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'Old Stones for Cash'. The Acquisition History of the Pitcairn Stone Tool Collection in Auckland Museum

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Abstract

Auckland Museum has approximately 20,000 stone tools from Pitcairn Island in the south east Pacific Ocean. Indisputably it is the largest collection from the island held in any museum. The history of the acquisitions in the 1930s–1940s from residents on the island will be explored and put in the context of the disruptions in the Pacific during World War II and the acquisitive aspirations of Auckland Museum. Correspondence in Museum archives provided a comprehensive record of the acquisitions, some of which have not been catalogued. The collection is an understudied assemblage from a technological, geological and functional perspective, just as the history of Polynesian occupation of the remote island is largely unknown. The assemblage is placed in the context of the known archaeology of the island.

Keywords

Pitcairn Island; museum collecting; Auckland Museum; basalt; archaeology; Polynesia.

INTRODUCTION

The remote Pitcairn Island is well known as the final destination of the mutineers from *HMS Bounty*. It was unoccupied in 1790 when the mutineers arrived, accompanied by Tahitian women and men, although there was evidence of former Polynesian occupation such as *marae*, standing *tiki* figures, rock carvings, adzes, cooking stones and plants such as taro, ti, and breadfruit that Polynesians transported during voyages of settlement (Erskine 2004: 37). Like other islands in the wider south eastern Pacific, the island was occupied by Polynesians by the 12th–13th century (Molle and Hermann 2008). When the island was abandoned by Polynesians is unknown, but it is believed that the small land area and limited resources, coupled with remoteness, meant that occupation could not be sustained long-term after inter-island sailing networks broke down (Weisler 1996).

This paper examines how Auckland Museum acquired the substantial collection of stone artefacts from Pitcairn. Director Gilbert Archey, and later ethnologist Victor (Vic.) Fisher and associate ethnologist Olwyn Turbott, corresponded with various residents on the island and these communications are held in the archives of Auckland Museum. While there was a small number of Pitcairn adzes gifted in 1911, the acquisitions relevant to this paper began in the 1930s, with most of the correspondence and exporting of artefacts occurring during the years of WWII (1939–45). The effects of the war, and the financial hardships experienced by

residents of Pitcairn, due to a diminished shipping traffic and tourist trade, was the likely motivation for the transactions with Auckland Museum. David Young, Nelson Dyett and Henry (Harry) and Honor Maude are associated with the majority of acquisitions either as sellers or donors.

The extensive and varied Pitcairn material in Auckland Museum is relatively unresearched. A descriptive analysis of the adzes and adze roughouts, from a technological perspective is the only in-depth examination of the collection (Turner 2010). This paper sets out the history of the Pitcairn acquisitions and the role Auckland Museum played in obtaining such a large and significant collection of stone tools in all stages of manufacture.

GEOGRAPHICAL SETTING

Pitcairn Island is situated 25° south of the Equator and is the southernmost of the four islands making up the isolated Pitcairn Group. Other islands are Henderson, a raised limestone island, and Oeno and Ducie which are coral atolls. Pitcairn is a young volcanic island approximately 5 sq. km in area, and is better resourced with fresh water, good quality fertile soils suitable for gardening and basaltic geology highly suitable for tool production. Henderson, the only other island in the group with evidence of Polynesian occupation (Weisler 1995), is approximately 170 km to the north east of Pitcairn. Nearest neighbours outside the Pitcairn Group are Mangareva (400 km) and

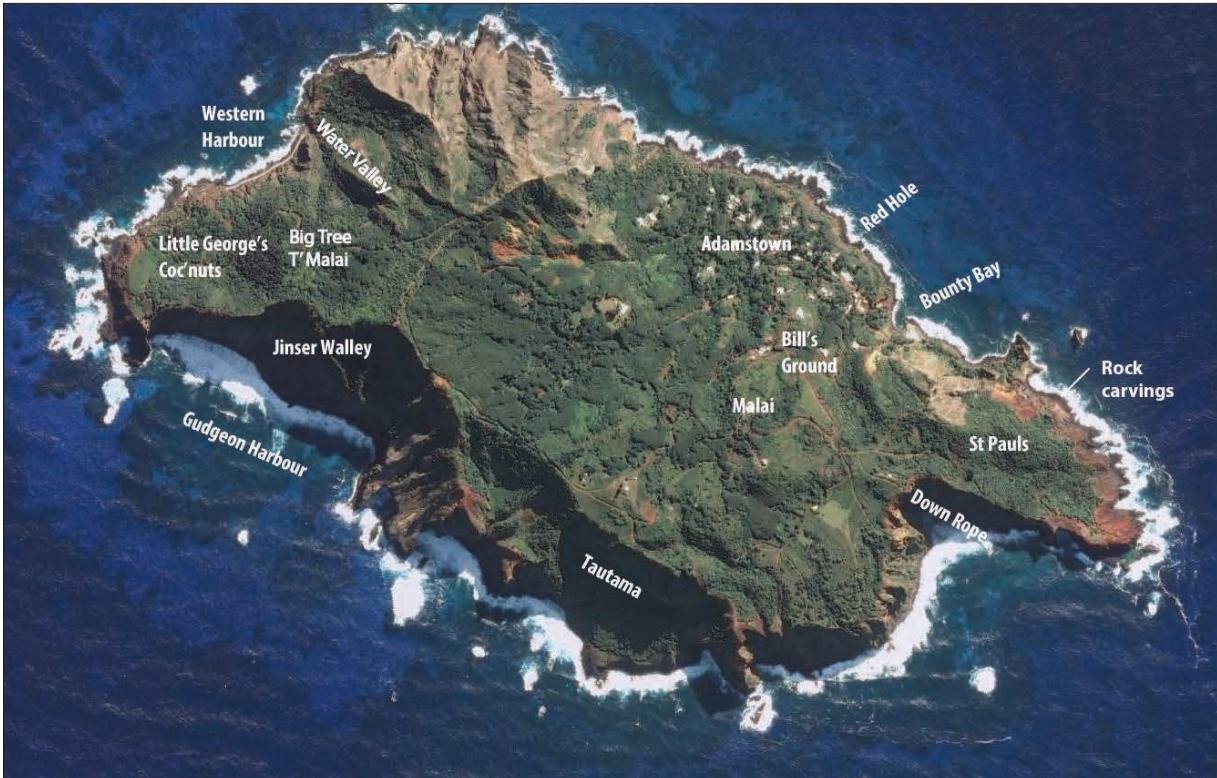


Figure 1. Pitcairn Island showing places mentioned in the text.



Figure 2. Bounty Bay in 1940. Maude Digital Archive, Part II, Series 4: Section 12. Courtesy of Rare Books and Manuscripts, The University of Adelaide Library.



Figure 3. Adamstown in 1940. Maude Digital Archive, Part II, Series 4: Section 12. Courtesy of Rare Books and Manuscripts, The University of Adelaide Library.

Rapanui Easter Island (1600 km). The nearest islands in the Society Island Group, and the Marquesas Group, are 1980 km and 2310 km respectively.

Pitcairn is a single volcano with the north side eroded away exposing the interior basin (Fig. 1). The highest elevation on the rim is about 360 m (Gathercole 1964). The coastal margins are steep, particularly on the south and western sides, and prone to erosion. There is no encircling reef, no harbour, and only two safe landing places for small boats in rough seas: Bounty Bay on the north coast (Fig. 2) and Gudgeon Harbour on the south west coast. In calm seas small boats can access nearly all of the coastline but access to the land is restricted by steep coastal cliffs (Gathercole 1964: 86). The island has undergone significant changes with land slips on the coastal cliffs and erosion of soils on the steep slopes. In some places cultural material is buried under up to one metre of recent sediment (Weisler 1996: 152). Flat land is restricted to only 8% of the land area, and 34% is steeply sloping (Cowell 1965). There is no permanent running water but there are three semi-permanent springs (Erskine 2004: 41). The north-facing basin, where Adamstown is situated (Fig. 3), has alternating ridges and valleys that in heavy rain become channels for runoff from the high slopes (Erskine 2004: 37).

GEOLOGICAL RESOURCES

There is a complex geology of interbedded tuffs and lava flows around the rim of the volcano (Gathercole 1964: 87). The rock within the crater is mainly vesicular basalt and is generally unsuitable for tool manufacture. High-quality basalt, found at Tautama, is chemically distinct from other basalt sources in south east Polynesia due to a low alkaline composition with enriched mid-Z elements (Weisler 1996: 156). It is also one of the best flaking quality basalts in Polynesia (Molle and Hermann 2008: 76). Blocks of basalt that fell from the cliff were worked into tools at the base of a talus slope, leaving piles of stone flakes up to 1 m in depth (Cowell 1965). Also present at Tautama were smooth beach boulders from a nearby coastal area used as hammer stones and anvils used as hammer stones and anvils (Gathercole 1969: 40). Mounds of flakes were near large vesicular blocks used as anvils, but there were few adze roughouts or broken fragments visible. The assumption was that the roughed out preform shapes were removed to settlement sites, with final shaping and finishing occurring at that location (Gathercole 1969). Turner (2010) alternatively suggested broken roughouts were repurposed into other tools. However the enthusiastic collecting activities of the Pitcairn Island residents in the 1940s cannot be discounted as being responsible for the apparent surface absence of roughouts. Analysis of Gathercole’s excavation material in Otago Museum may reveal whether the absence of roughouts is replicated in lower deposits.

A large part of the island is composed of tuff varying from lapilli to a finer pumiceous material. There are also tuffs with a distinctive red coloration derived from fragments of vesicular lava (Carter in Gathercole 1964) used for tool and statue manufacture. Red tuff

from Jinser Walley (Ginger Valley) Cave on a cliff was identified as the main source of abrading stones and described as ‘a red volcanic rock of gritty texture carrying small crystals of a black mineral, perhaps augite’ (Gathercole 1964). The tuff was mined from the cave walls by prising out blocks approximately 10 x 10 cm using flaked basalt tools with the appearance of broken adzes, examples of which were found on the floor of the cave (Gathercole 1964: 49–54; Heyerdahl and Skjölsvold 1965). Additional sources of red tuff include one at Red Hole near Bounty Bay and one to the east of Rope with similar characteristics to the fragment of statue in Otago Museum (Gathercole 1964: 92).

A volcanic glass, technically an ignimbrite, erodes as cobbles from the cliffs at the west end of Rope Beach (Down Rope) and has been found at various settlement sites on the island (Weisler 1996). The chemically distinctive glass also occurs in occupation sites on Henderson Island, suggesting that, despite its poor quality, it was a valuable resource in the region.

RESEARCH ON PITCAIRN

Little archaeological research has been carried out on Pitcairn and the history of Polynesian settlement is poorly understood. The island was abandoned prior to the 18th century, but settlement probably occurred around the 12th century, at the same time as island groups in the wider south east Pacific region (Molle and Hermann 2008; Sear *et. al.* 2020). Basalt, obsidian and oven stones were exported from Pitcairn and materials including coral and pearl shell imported through regional voyaging networks (Weisler 1997; Weisler *et. al.* 2004). These local networks, encompassing Henderson, Pitcairn and Mangareva, broke down around the mid-1400s (Molle and Hermann 2008; Weisler 1997: 167). Wider distribution of stone materials is evidenced by the presence of Pitcairn obsidian in the 14th century site of Atiahara on Tubuai in the Australs Group, and basalt in the Tuamotu group (Molle and Hermann 2008).

Although visitors to the island in the 19th century removed adzes as souvenirs, some of which found their way into museum collections, the Polynesian history of the island wasn’t explored until Katherine Routledge, English anthropologist and archaeologist, visited in 1915 following a year on Rapanui where her research included cataloguing *ahu* and excavating *moai* (statues). During her short five day visit to Pitcairn, Routledge described the location of three *marae* and the entire population of Pitcairn participated in digging them over (Heyerdahl and Skjölsvold 1965a: 5; Routledge 1919; van Tilburg 2003). The 72 adzes recovered are now in the Pitt Rivers Museum in Oxford, along with 25 tools donated by Pitcairners (Hamilton *et. al.* 2013). The British Museum has an unknown, but lesser, number of adzes and other tool types from the island attributed to Katherine’s husband, William Scorseby Routledge (Richards 2019). Adzes collected in 1897 by Lieutenant Gerald Pike of *HMS Comus* are described in Brown (1900), and some of these are now in the Pitt Rivers Museum (Hamilton *et. al.* 2013: 569). Emory (1928)

described 17 privately owned adzes collected in 1920. The small number of adzes and other tools in each institution makes the collection in Auckland Museum all the more significant.

Henri Lavachery (archaeologist) and Alfred Metraux (anthropologist), members of the Franco-Belgian expedition to Rapanui, also spent two days on Pitcairn in 1935 recording petroglyph sites, collecting information on the destroyed *marae* and interviewing islanders who recalled what they had looked like about 50 years prior. Adzes were also collected during their visit and are in Musées Royaux d'Art et d'Histoire in Brussels and the Musée de l'Homme in Paris (Gathercole 1964: 100). One of the *marae* statues, fashioned from red tuff, was subsequently acquired by Otago Museum (Heyerdahl and Skjölsvold 1965a: 5–6).

The Norwegian Archaeological Expedition in 1956, led by Thor Heyerdahl, conducted small excavations in two caves, and tools were acquired through surface collections or from islanders (Heyerdahl and Skjölsvold 1965a). The visit was brief, and results of the research not comprehensively written up, but the 75 adzes and 23 other described tools are in the Kon-Tiki Museum (Figuerola and Sanchez 1965; Heyerdahl and Skjölsvold 1965b).

Peter Gathercole's 1964 expedition was part of the wider Polynesian Culture History Programme organised from the Bernice P. Bishop Museum, Hawaii, supported by the National Science Foundation. Over three months the team of seven surveyed the visible archaeology, identified stone sources from which artefacts were made, and excavated 209m² across 10 locations (Gathercole 1964; Weisler 1997: 152). In addition, local place names and visible archaeological features were recorded. While Gathercole was aware of the stone material in Auckland Museum, it is evident he did not know of its quantity, referring only to the Maude collection which is a small part of the overall assemblage. Unfortunately, apart from a brief report, Gathercole's investigations have not been written up.

A small 5 m² excavation near Adamstown in 1971 with a pit and postholes, and over 5,000 flakes of Tautama basalt, adze roughouts, awls, abraders, scrapers and fish hooks was interpreted as an 'adze workshop' (Sinoto 1983: 61), and reinterpreted as an occupation site occupied in the 12th–13th centuries (Weisler 1995: 152). Other small excavations were conducted by Weisler (1995) at Water Valley and the Edge near Adamstown, and samples of Tautama basalt and volcanic glass collected for geochemical analysis. Pitcairn-derived stone material was present in the lowest layers of HEN-10 site on Henderson Island, dated around the 1100s, suggesting Pitcairn should have a similar, or even longer history of occupation (Weisler 1995: 389). Most significantly, adzes and other tools from Pitcairn, along with volcanic glass and oven stones, ceased being imported to Henderson around 1450 AD despite continued occupation of Henderson until the 17th century (Weisler 1995).

Technological aspects of the adzes in Auckland Museum have been discussed in Turner (2010). The ability to make adze types with predominantly thin

rectangular cross sections is possibly due to fracture lines in the stone. The slabs required little shaping and grinding, and polishing was minimal. Sourcing of adzes in the British Museum and Pitt Rivers Museum using X-ray Fluorescence produced some surprising results. While the adzes are predominantly from Pitcairn, the results suggest several of the adzes can be geochemically sourced to the Marquesas (Richards 2019). A larger sample of adzes needs to be assessed to determine if there is a significant presence of externally sourced stone on Pitcairn.

Pitcairn's pre-*Bounty* history has been inadequately addressed despite the investigations carried out, and the technological aspects of stone working in a Polynesian context is largely unknown. Pitcairn is widely acknowledged as having some of the best-quality basalt in Polynesia which is reflected in the shape of some of the objects made.

EUROPEAN HISTORY

Although first sighted and named in 1767 by crew of *HMS Swallow* under the command of Captain Carteret, landing on the apparently unoccupied Pitcairn was not possible due to the rough sea conditions. The plotting of the island's position was inaccurate, and while the latitude was correct, the 3° error in longitude (320 km) meant the island was not relocated by subsequent ships (Erskine 2004) using the Carteret map published in Hawksworth (1773). The isolation of the island and incorrect plotting was fortuitous for the *Bounty* mutineers, for although there were attempts to find them based on known locations of islands, they were not discovered and held to account for their actions.

The 1789 mutiny by Fletcher Christian (master's mate) and sailors on *HMS Bounty* who cast Captain Bligh and 18 of the crew adrift in a small boat is well known (Erskine 2004: 13, 24–26; Maude 1958). The mutineers sailed to Tubuai where they negotiated a place to settle. The *Bounty* then sailed to Tahiti for supplies, returning to Tubuai where there was a violent altercation. The mutineers abandoned the idea of settling there and returned to Tahiti where some of the mutineers left the ship. After travelling to the western Pacific including Tongatapu and the Lau Group, the *Bounty*, carrying the nine Englishmen (Fletcher Christian (leader), John Adams, William Brown, William McCoy, Isaac Martin, John Mills, Matthew Quintal, John Williams, Matthew Quintal and Edward Young); twelve Polynesian women including Teehuteatuaoroa (Jenny), Mauatua (Isabella), Teraura (Susannah) Toofaiti (Nancy) and Mareva (Prudence), Teio, Vahineatua and Tevarua; six Polynesian men (including Teirnua, Manarii, Tinatoruea and Taroamira); and a female child, eventually arrived at Pitcairn in 1790 more than 18 months after the mutiny (Maude 1958, 1959; Langdon 2000). The Polynesians had been kidnapped during the final trip to Tahiti, although one (Taroamiva) was from Tubuai and sailed voluntarily with the ship.

Conflicts soon arose and after a plot to kill the Englishmen was discovered, two of the Polynesian

men were killed. Six of the mutineers (Christian, Mills, Martin, Brown, McCoy and Williams) were murdered in 1793, and the remaining four Polynesian men killed in retaliation. McCoy committed suicide in 1799 after a heavy drinking session, and in the same year Adams and Young killed Quintal who, in a drunken state, threatened to kill them. Young died in 1800. The isolation of the community was broken in 1808 when the American whaler *Topaz* visited. After a visit by *HMS Briton* and *HMS Tagus* in 1814 it was reported that the island was inhabited by John Adams, the sole surviving mutineer, several Polynesian women and a lot of children. Adams by this time had undergone a religious conversion and was not charged for his crimes. He died in 1829.

The small island has been subjected to major weather events. In historic times a drought, and reduced crop yields in 1831 was the catalyst for the population to move to Tahiti, where the previously isolated Pitcairners' were exposed to illnesses, and after many fatalities the 65 survivors returned to the island the same year (Maude 1959). Several decades later, again after crop failure and loss of marine resources due to landslides after fierce storms, the entire population of 194 moved to Norfolk Island in 1856 (Erskine 2004: 242). Several families returned to Pitcairn between 1858–64 and the current population are their descendants.

ACQUISITION OF THE COLLECTION

Auckland Museum holds the most extensive collection of stone objects outside of Pitcairn Island. There are 11,703 catalogued and over 7,066 uncatalogued stone tools. Except for a few items clearly associated with the post-*Bounty* settlement, the majority are stone tools of Polynesian origin collected from unknown locations on the island. While there are large numbers of most tool types in various stages of manufacture, there are very few stone flakes indicating that the collectors were selectively choosing objects that Auckland Museum was prepared to pay for. The bulk of the museum's collection was amassed by individuals during the years of WWII with the large spike in acquisitions post-war (Fig. 4), attributable to the deposits by Dyett and Maude.

Acquisition records identify individuals who contributed to the Museum collection. Some were Pitcairners, with significant large collections attributed to non-Pitcairners. David Young (1876–1945) was the first to correspond directly with the museum and sent hundreds of stone tools. He actively encouraged others to collect and sell tools to the museum and names are listed in the appendix. Roy Clark (1893–1980), who had lived on the island for most of his life and held multiple roles including teacher and postmaster, also contributed.

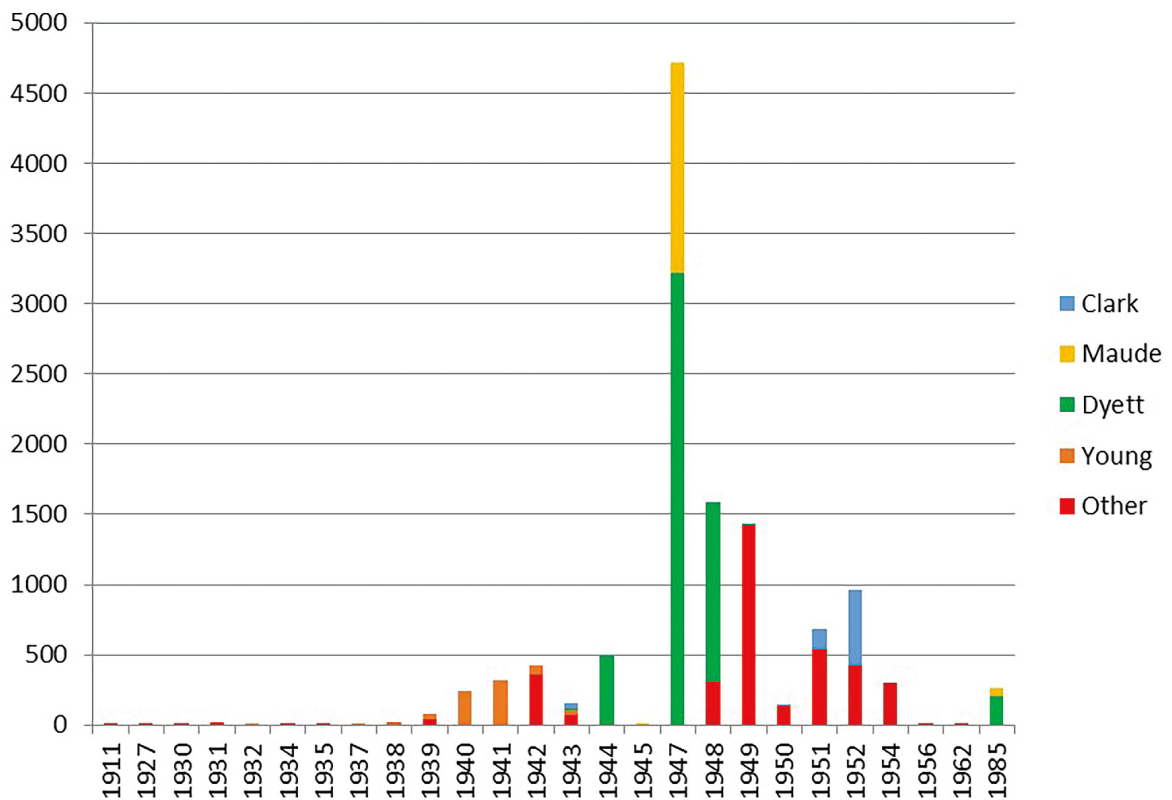


Figure 4. Acquisitions by year and donor.

Nelson Dalmain Dyett (1913–2011) was a New Zealander married to Pitcairner Maude (nee Young) and was living in Wellington when he volunteered in December 1939 to be a coastwatcher on the island (Gillespie 1952). He was later employed as a Government Wireless Operator for the duration of the war. Harry Maude (1906–2006), an administrator in the British Colonial Service, was seconded to the Western Pacific High Commission as Deputy Secretary in 1940 (Woodburn 2003). Maude and his wife Honor (1905–2001) collected stone tools during their relatively short official stay on the island. Their collection was initially deposited in Auckland Museum, then gifted some decades later.

Correspondence files in the archives of Auckland Museum are relatively comprehensive with letters over a period of 12 years from David Young on Pitcairn, Nelson Dyett during his time on the island and after he returned to Wellington, and from Roy Clark also resident on the island. Information derived from the Museum archives has been supplemented with letters from the archives of Canterbury Museum in relation to the eventual purchase of Dyett's collection.

Auckland Museum moved in 1929 from cramped inadequate accommodation in Princes St, Auckland, to the purpose-built neo-classical building in the Domain funded by the people of Auckland as a War Memorial. Gilbert Archey was the director of a small staff that increased in 1930 with the employment of Vic. Fisher as Assistant Ethnologist (promoted to Ethnologist in 1938). The museum at that time was in an acquisitive mode looking to expand the Māori collections and encouraged wealthy individuals to donate money for purchasing objects which would be attributed to them. Several major collections of Māori material came into the museum in the early 1930s, including Oruarangi (Furey 1996), with museum staff condoning the activities of curio hunters provided the museum was the recipient of the material, or staff participated in digging themselves. Archey was also identifying other opportunities for the Museum and he took the first steps to acquire more Pitcairn artefacts, perhaps inspired by Emory (1928).

David Young

Between 1911 and 1931 the museum obtained the first 20 objects from Pitcairn. Two were obtained from Captain Gaunt of the Royal Navy survey ship *HMS Challenger* that stopped at Pitcairn in 1911 (*The Sydney Morning Herald* 15 Feb 1911: 9), but the 1931 acquisition of the W.E. Cole Collection, containing 18 Pitcairn tools (Fig. 5), along with European and English archaeological material, was the catalyst for Gilbert Archey's approach to David Young:

We have recently received as a gift to the Museum a very fine collection of archaeological and ethnographical specimens from the late Mr. William M. Cole... and included among this collection is a splendid series of stone adzes and borers from Pitcairn Island. These are the ones which apparently you sent to him in 1928...

It has occurred to me that you may since have found other specimens, not only of adzes and borers but perhaps of pounders and other implements. You might also like to continue adding to the series which we now have in the Museum through your earlier collecting and Mr. Cole's bequest. (Archey to Young, 29 June 1931)

Young replied by return mail that he had not found any of the objects requested, and opened the negotiations in an off-hand way for what was to be a lengthy correspondence and shipping of a large number of items:

...and as for contributing to the museum it has not occurred [sic.] to me if I care to do so or not, it benefit me nothing and I do not suppose it will benefit me anything, but if I happen to find any of such articles I can forward it to you providing it does not cost too much as you know that the rate for parcels & letters now are so high, and it is hard to earn money from ships now. (Young to Archey, 24 July 1931)

The rapid turnaround of correspondence suggests both parties were keen to establish a working relationship. Pitcairn's isolation meant there was no regular postal delivery to the island, instead relying on passing ships travelling between New Zealand and the Panama Canal. Initially letters were exchanged on a monthly basis but the infrequency of ships stopping at the island sometimes led to lengthy periods of silence.

I am glad to know that you would favourably consider our request. Of course, we could not allow you to be put to any expense in connection with the matter, and, if you are able to send us any specimens, we should be very pleased not only to remit you the full cost of collection and forwarding the specimens, but also to send you articles from Auckland which might be of use to you. Would you be so kind as to let me know what we might send you: I had thought of some books for your library or some gramophone records; but you may be able to help us with other suggestions in this respect. (Archey to Young, 11 August 1931)

Although Young replied that he had nothing to send as he had only found a broken adze, and didn't want anything, Archey (letter, 25 September 1931) indicated that he was happy to receive even broken adzes, 'for a fragment very often tells us what we want to know...', and persisted with trying to establish an exchange that Young might find attractive. After Young sent him a couple of broken adzes (acquisition 1931.590), Archey provided further encouragement and urged Young to identify anything which could be gifted in return. At Young's request several musical records of a religious nature were sent.

They [adzes] are most interesting and I can assure you that anything of a like nature that you care to send to us will be very welcome. These crude



Figure 5. Pitcairn adzes acquired from W.E. Cole. Auckland War Memorial Museum 16515.3, 17016.4, 16514.1, 16515.5.

apparently valueless articles are often of greater importance than the well made ones, and, as I said in my previous letter, anything at all that has been worked by the unknown previous inhabitants of Pitcairn Island would be gratefully accepted by us. (Archey to Young, 29 December 1931)

Young did not respond for several months but then sent a box of nine ‘stones’ in the care of the ship’s purser, which required Archey to collect them from the wharf on arrival (1932.167). Archey sent a positive and encouraging reply:

I was very pleased indeed to get... the very fine set of adzes which you so kindly sent to us. These are very acceptable, particularly, of course, the very fine one you mentioned in your letter. I do hope that you will be able to get some more of them so that your collection in the Auckland Museum will be a really fine one. The ones you have sent will be placed on exhibition and marked as having been presented by you...It has occurred to me, however, that you should not be put to any expense with regard to postage. So long as you can send them in care of the Purser it will be no expense either to you or to the Museum and all will be well, but if you have to post them I would notice that there were stamps on the

parcel and would refund the stamps to you. (Archey to Young, 14 May 1932)

Each time Young sent tools, whether complete or broken, Archey responded that each item was ‘exactly what we want’, and requested more. Further religious records and needles for a gramophone were sent, as requested by Young, and when some records arrived in a damaged state, Young sent them back for replacement. There is little mention of individual objects, although Archey referred to a ‘four-sided piece of stone which seems to have been for winding a fishing line (Fig. 6). From its general appearance I should imagine that it was made shortly after the arrival of the “Bounty”.’ (Archey to Young, 28 September 1932)

Of the four acquisitions of 1931 and 1932, Young gifted 15 objects and the museum purchased two. Communication ceased from the end of 1932 to 1936 when Young contacted Archey again after hearing from a ship’s purser that Auckland Museum was now willing to pay for items sent. Young speculated that there were no more tools on the island although he would continue to look (Young to Archey, 21 January 1937). The museum provided further enticement:

I am sorry that no more adzes have been found...we would be very glad indeed to reward them [islanders]



Figure 6. Ground and flaked item Archey likened to a fishing line holder. There are several similar-sized ground or flaked blanks present in the Pitcairn collection, and are undoubtedly of pre-Bounty origin and probably used in wood-working. Auckland War Memorial Museum 18810.

for their hunting, and if you would be so kind as to act for us, we should be very glad to pay what might be regarded as a suitable amount. The Museum Ethnologist, Mr Fisher, who during the coming year will continue our correspondence, considers that half a crown for a broken piece, and say, 7/6 for a perfect adze with perhaps 10/- for an exceptionally large and well finished one might be a fair thing, and I should like to have your opinion of this. I think it simpler for us if we were to buy them, as it were, direct from you and you could arrange whatever you liked with the young people who happened to find the adzes. It would be quite proper for you to give the finder less than you received from us, because after all an agent should receive a commission and in any case it might not be advisable to let the young people have too many shillings all at once. (Archey to Young, 11 February 1937)

Young found this arrangement very satisfactory and all following correspondence from Fisher includes accounts of objects received and value assigned. For a time Young corresponded with Fisher, and to ensure full accountability of the money, Young was required to sign and return a receipt for the postal notes received. Under Fisher's authorship the tone of the correspondence shifted from strictly transactional to more personal, with enquiries after the health of Young and his family, and conversational sharing of information about the weather,

so that when Archey resumed the communication in 1939 (due to Fisher's absence on study leave) he also continued in the same vein. The frequent response from Young was that there were not many objects to be found, but in 1939 Young enlisted his wife Mrs Edna Young (Fig. 7) and son Vernon, and the acquisitions became more frequent.

Young's letter to Archey on 19 May 1939 reported that there had been a storm on 7th May resulting in 10–12 landslips, one of which damaged fishing boats at Bounty Bay, and the alternative landing on the western side of the island was covered with large rocks and earth. A positive outcome, according to Young, was that many artefacts were exposed.

From 1940 the number of items received from Young increased substantially in number. There were 234 in that year compared to 61 in 1939 and 23 in 1938. Children and adults, many of whom were related to Young (https://www.library.puc.edu/pitcairn/pitcairn/Pitcairners_Young.shtml), were collecting objects and delivering to Young under whose name the acquisition was recorded, but transaction receipts were issued to Master Douglas Warren, Jenny Warren, Lyndon Warren, Burley Warren, Kate Young, Andrew Young, Joy Charles and Burley Butler. Young complained to Olwyn Turbott, assistant ethnologist, that several Pitcairners were grouping their objects to get around having to pay him the 2/6 packing fee, but the number of objects he was sending from himself, and on behalf of others, increased significantly in quantity although few were complete. In contrast to earlier purchases where paperwork is clear, for the later transactions it is difficult to match the receipted items to the acquisition information.

After the November 1940 sinking of the New Zealand Shipping Company passenger liner *Rangitane* by a German vessel (<https://nzhistory.govt.nz/page/liner-sunk-german-raiders>), the shipping schedules in the south east Pacific became more erratic. With few vessels passing the island incomes from selling souvenirs were substantially reduced and Young began asking Fisher to purchase particular items (e.g., a case of Hellaby's corned beef, tins of milk and rubber sheeting), arrange shipping and deduct the sum from the amount owed to him from the previous sale (letter, 15 June 1940). Increasingly Young commented on the fact that the post office had little cash to convert the postal notes sent from Auckland. Pitcairners were still travelling to New Zealand, and instructions were given to send postal notes to local addresses, to place the money in bank accounts in New Zealand, or to settle invoices from businesses engaged in exporting goods to Pitcairn. The transactions became even more complex for the Museum when Young requested that the 2/6 packing fee be deducted from the balance owed to the finders and credited to Young.

There were increasingly long intervals between ships from New Zealand stopping at Pitcairn, possibly because of a route change due to war activities. Instead, a faster and more efficient way of sending mail and money to Pitcairn was to send it to the British Consul at Panama, awaiting more frequent ships travelling across



Figure 7. From left: Harry Maude, David and Edna Young, Edith (Young's sister) and husband Thornton Christian, Arthur Fuller (Western Pacific High Commission) at cave below Cathedral Rock (to east of Bounty Bay). Note the rock carvings in the wall behind Fuller. Maude Digital Archive, Part II, Series 4: Section 12. Courtesy of Rare Books and Manuscripts, The University of Adelaide Library.

the Pacific in the direction of the island (Young, 11 Sept 1942). The United States had not entered the war at this stage and ships flying the American flag were considered neutral and could travel safely (Woodburn 2003).

From 1932–1943 Young was central to the transactions with Auckland Museum, either on his own account or through encouraging other islanders to collect items which he sent to Auckland and took a commission as well as a packing fee. Catalogued items attributed to Young number 942, although at least 420 other objects were transacted through him.

Nelson Dyett

In late 1942 the collector scene changed when Nelson Dyett, the wireless operator, contacted Auckland Museum.

Mr H.E. Maude who is known to yourself and whose acquaintance I made when he was on official business at the island last year explained that at any time I found any of these “stones” they could be forwarded to your museum for sale...

If you have any special requirements in the types of stone required to complete your collection you might state them and if possible I will keep a watchful eye open to get the specimens desired – a sketch will help. (Dyett to Fisher, 14 September 1942)

Young was upset at the potential competition from Nelson Dyett. Although he blamed Dyett directly, other

correspondence from Dyett and Maude made it clear that Maude made the introduction to Auckland Museum.

You will see that another man will be sending stones to you, he saw the address on the last case I sent to you and copy it off now he is collecting stones and telling some of the people that Mr H.E. Maude gave him your address when he was here...

I think that you should tell him if he want to send any stones to you, to save [...] he must do like the rest of the people, send it through D.A. Young. Mr Nelson Dyatt [*sic*] is the wireless operator for the Navy boards from Wellington, and if he could get his hold on anything, he will try to get you out of it and let him come in, that is what he is trying to do with my business with you, trying to get you to do business with him instead of me. (Young to Turbott, 4 October 1942)

Young sent no more letters or objects after 1943, although acquisitions continued from other Pitcairners. Dyett advised the Museum of Young's death in 1945.

While Fisher was absent on active war service in the Pacific (Auckland Museum Annual Report 1942–43) Olwyn Turbott continued the correspondence. The first acquisition of 11 items from Dyett was purchased, and a pounder [1943.43, 26528] attracted special mention due to its rarity in the collection. Turbott requested any examples of particular types of artefacts (Fig. 8) including:



Figure 8. The 'pencil like' tools referred to by Turbott are chisels or gouges of circular cross section but different diameters. Auckland War Memorial Museum 30141.9, 28398.1, 23873.1.

thin, flat ones ... or any with small "horns" on the back at the top; also for any pieces about 1/3" diameter of 8 sided or cylindrical shape like pieces of pencil perfectly symmetrical and carefully polished. We have from time to time received sections of such pieces but [sic] have never seen them complete, so I cannot give you much idea what the objects originally looked like. Even the fragments might one day give us the clue when we have them in sufficient numbers.

As you probably know the people have been sending us specimens from the island for some time and regard the sale of them as a kind of home industry, although they are really of very small monetary value. With their help we are gradually completing our collection. (Turbott to Dyett, 25 November 1942)

There was in some cases a delay of some months or even a year between the arrival at Auckland Museum and the date the material was given an acquisition number. The processing of new acquisitions slowed down with Fisher away on war duties, and there were more pressing priorities within the museum. Fearing an invasion or aerial strike by Japanese, staff time was diverted to packing objects away and sandbagging key items such as the waka taua 'Te Toki-a-Tapiri' for safe keeping (Auckland Museum Annual Report 1941–42). The shortage of staff at the time, and the lack of formal documentation undoubtedly contributed to the legacy of uncatalogued items from Pitcairn.

Dyett, in addition to providing stone objects, was also sending sought-after Pitcairn stamps which Turbott passed on to a collector, possibly in England, and credited the converted NZ pounds to Dyett's bank account. He also corresponded with A.W.B. Powell (assistant director and malacologist at Auckland Museum) and sent land snails. However, between 1943 and 1946 only the one transaction of 11 objects was purchased and catalogued under Dyett's name. In a letter dated 24 February 1944, Olwyn Turbott alluded to his intention to retain his collection, but expressed a desire that in the future Auckland Museum may be the final repository. Several months later, he again corresponded:

Just recently I went through my collection and after a lot of work and debating decided to classify it under three headings – complete specimens, "heads and tails" and mid-sections bracketed with hopelessly broken specimens. The latter I have thrown out and you may or may not be pleased to learn that I have forwarded by the same ship as this letter two cases of "heads and tails" which include 100 complete specimens which for the sake of a name I call awls. I have retained approximately eight hundred good specimens in my collection and as I have stated before these will probably be placed on deposit with you upon my return to N.Z. (Dyett to Olwyn Turbott, 23 May 1944)

Fisher on his return to the Museum assessed the two cases of objects as being worth £63.13.0. The financial inventory lists 491 objects, of which 120 were 'reamers' costing at 2/6 each (Fig. 9). The Ethnology Register attributes the objects to J.C. Entrican, an Auckland merchant and elected member of the Auckland City Council (<http://nzetc.victoria.ac.nz/tm/scholarly/tei-Cyc02Cyclt1-body1-d1-d52-d7.html>), although Dyett is identified as the source in the acquisition records (1944.130). Several noteworthy objects included a side hafted adze (Fig. 10).

Up until this date there were 502 purchased items attributed to Dyett. An additional £62.2.0, for 615 objects, was paid on 23 April 1946 but there is no record of this acquisition being processed. Subsequent letters by Dyett referred to the finding of more objects, with the observation that they were now scarce and that the Pitcairners were also not finding any in their cultivations.

In 1945 Roger Duff, ethnologist (and later director) of Canterbury Museum, entered the Pitcairn collecting scene that, up until then, was exclusively the domain of Auckland Museum. Dyett advised of his interest in a letter to Powell (12 October 1945):

Somehow or other the Christchurch Museum has learned of the existence of my collection of stone implements [sic] and Mr Roger Duff has been hot on my trail for the privilege of classifying it/purchase same for Christchurch Museum. I have written explaining that it was my intention to deposit it with Auckland... By the way Duff is talking of coming up here first chance but I'm [sic] afraid he will work very hard to dig out very many more good specimens.



Figure 9 (above). Stone point/awls. Auckland War Memorial Museum 28968.2, 28326.4, 30155.

Figure 10 (right). Side hafted adze. Auckland War Memorial Museum 28359.

Duff had, on one or more occasions, visited Auckland Museum and seen Pitcairn material. He proposed an exchange of items in 1943 so Canterbury Museum could have Pitcairn adzes of a particular shape. Turbott (letter, 15 March 1944) responded the museum could only exchange two Pitcairn adzes (and one Tahitian adze), and no 'rimers' '[for] ...we do not feel we can part with any more of the Pitcairn material'. Although on the surface all the museums in New Zealand acted collegially, there was intense rivalry to position their institutions as having the best collections in New Zealand (Furey 1996).

The Annual Report of Canterbury Museum (1945: 21) reported that Duff, at very short notice, had been able to sail from Auckland to Pitcairn where he spent only 24 hours before returning. He 'completed arrangements with Mr Nelson Dyett for a share with Auckland Museum of a large and important collection of stone implements which have now been received on deposit.' The distance and time spent travelling across the Pacific in order to meet Dyett for such a short time indicates how keen Duff was to obtain Pitcairn material.

While Duff was on the island, Dyett wrote to Fisher (17 November 1945) advised that 16 cases of his collection (the result of five years' work) had been dispatched:

I have instructed [Duff] to deliver them to you on the understanding that the collection is to be shared out equally between Auckland and Canterbury Museums where in each case it is to remain as a deposit in my name. I feel that the collection is sufficiently large to justify this division and I leave it to you and Roger Duff with full confidence to decide the division as you see fit. ...

I naturally claim the complete liberty to withdraw the collection on demand which I understand is the implication of a museum loan or deposit.

I trust that the collection which has been forwarded in the trust of Roger Duff will be the means of helping to establish cooperation between N.Z. Museums.

Although Powell sent a neutral response to Dyett, the attitude of Auckland Museum to the attempt by Duff to interfere is clear:

If, however, at some future time you desire to realise upon the collection, I should like to know if your previous promise to give the Auckland Museum first refusal still holds good. We are not seeking to spoil Canterbury's chances of acquiring a representative collection by coveting the lot, and I am sure that they are not endeavouring to cut us out. (Powell to Dyett, 14 December 1945)

However only 15 of the 16 promised cases arrived in Auckland, which Fisher and Duff shared out for each institution. Powell advised Dyett that one case was missing, and he replied in his next letter that a case had been lost during transfer from the longboat to the ship, but had been salvaged and sent to Auckland on a later ship. Duff had paid Dyett £6 towards the salvage costs, so although the original intention was for all the objects to be shared between the two museums, Duff had effectively acquired exclusive rights to that case, and Dyett had left it to Duff to decide whether it should also be shared.

There is no surviving correspondence from Fisher to Duff on the matter. However, Duff belatedly provided an explanation:

It was lost in 90 feet of water when we were loading the schooner, and I did not discover its loss in time to check up on its number. As it might well have been valuable (and I had no means of knowing

before reaching Auckland) I asked Nelson to offer a reward of £1 for the discovery of the box and £5 for its recovery. Apparently the reward worked, and the box has been forwarded to me c/o Auckland Museum ... I will leave it to you to decide whether it is worth splitting its contents (and the reward) or whether we [Canterbury Museum] should take it over and the reward. (Duff to Fisher, 1 February 1946)

Fisher was adamant that Auckland Museum would share the contents, and contributed half the cost of salvage (letter, Fisher to Duff, 7 March 1946). Canterbury's share of the 16 cases amounted to over 1,800 objects (figure collated from pers. comm. Emma Brooks, Canterbury Museum; Moira White, Otago Museum; and notes supplied by Roger Fyfe, Canterbury Museum 2016). Auckland's share was 1,854 objects (1947.50) (letter, Fisher to Dyett, 23 December 1946). A further four cases for deposit, numbering 1,308 items (1947.51), arrived later in 1946 (letter, Fisher to Dyett, 23 December 1946) and were retained at Auckland Museum. Up until that time Dyett had sold 1,126 stone tools valued at £125/15/-. The additional deposits (3,162) took the total objects which can be accounted for in Auckland Museum records to 4,288.

In a letter to Powell (20 August 1946), Dyett noted that Duff had not corresponded with him since leaving the island, and that Otago Museum had also contacted him requesting a share '...but I don't intend at the present time to alter the arrangement as it now stands'.

When Dyett left Pitcairn in 1948 he personally delivered the remainder of his collection to Auckland Museum. The deposit of 1,273 tools (1948.154) were valued by Fisher and itemised lists sent to Dyett. These included finished and unfinished adzes, broken fragments, finished objects of unusual shape (usually tanged), reamers (stone points and awls) stone fish hooks, rasps, grind stones, spheroid and flattened stones (hammerstones), and stone flakes. An undated report (likely to be 1953), written by Fisher for the Auckland Museum Trust Board to authorise final purchase of Dyett's collection, numbers the deposited items at 7,009. The catalogued items fall short of the accounted for number by several thousand and it is likely the remainder are in the unaccessioned or uncatalogued backlog.

There is little correspondence from Dyett between 1948 and 1953. He wrote to Duff in May of 1953 advising that overseas museums were interested in his entire collection and he wished to sell it for £1,800. Duff commented to H.D. Skinner, director of Otago Museum, (letter, August 1953) that the price was inflated, and considerably more than the valuations provided by Auckland and Canterbury Museums. He went on to suggest that the four metropolitan museums (Auckland, Wellington, Christchurch and Dunedin) jointly purchase the collection, or alternatively that the Government purchase it and distribute it to the four museums. There is no correspondence in Auckland Museum files related to this suggestion, but Duff, in a letter to Fisher, requested that he (Duff) be consulted before Auckland negotiated to purchase the Dyett collection. Fisher responded that

he would '...follow this course if you agree that we establish the principle that our respective museums do not compete for collections already held on deposit.' (Fisher to Duff, 4 December 1946). The tone suggests that Fisher was suspicious that Duff would try to reach a deal favourable to Canterbury Museum at Auckland's expense, and may reference Duff's actions in originally obtaining Pitcairn material from Dyett.

Duff revised the offer for Canterbury's share from the £600 Dyett requested to £300. He pleaded with Dyett to take pity on the poor South Island museum, after acknowledging that Auckland Museum was prepared to pay more than their original valuation. An alternative option to retain a selection of 28 objects for £100 was also proposed. He concluded, 'well, I can do no more but leave you to consider these propositions and trust that, by adopting one or the other of them, you will seal the initial act of generosity when I stepped ashore at Pitcairn in December 1945.' (Duff to Dyett, 27 October 1953)

Agreement between Canterbury Museum and Dyett was reached in July 1954 for £300, with the condition that a small representative sample was to be returned to Dyett. Duff was reminded over a year later in October 1955 of the condition, and the 29 objects were finally selected by Duff in November 1955. He wrote: "It is certainly small, but if you realised how little of the first rank material remains with us after Auckland's 2/3 and Skinner's 1/6, you will appreciate it is the best I can do." It is not clear whether H.D. (Harry) Skinner, Curator at Otago Museum, approached Duff to obtain a selection of the Pitcairn material, or vice versa, but Otago contributed £125 of the £300 Canterbury Museum had negotiated with Dyett (file notes from Fyfe, 2016) and obtained over 400 objects (Moira White, pers. comm. 2019).

Meanwhile, after some face to face negotiation, Dyett sold to Auckland Museum the full number of deposited objects in November 1953. Fisher had travelled to Wellington by overnight train, visited with Dyett, who was then living in Wellington, and returned to Auckland on the train the same day. The following month the Council of Auckland Museum finalised the purchase of 7,009 items for £900 (Fisher, n.d.).

Harry and Honor Maude

Harry and Honor Maude's large collection of 1,497 items was deposited between 1945–47 (1945.82, 1947.54) and subsequently gifted (1985.46). Maude was at the time seconded to the Western Pacific High Commission and was sent to Pitcairn in 1940–41. His role was to overhaul the system of government on Pitcairn and to establish a post office with its own stamp issue to raise revenue. In addition to rules around how the island was to be governed, and day to day activities, there were provisions for the protection of historic relics including *Bounty*-related items (for which there was a lucrative trade) and fencing around the petroglyphs to protect them (Maude 1941). All adult Pitcairnians were signatories to the regulations.

Maude was a long-time correspondent of Gilbert Archey, and Kenneth Emory of the Bernice P. Bishop

Museum in Hawaii, and Emory's (1928) paper on Pitcairn adzes was familiar to Maude. The Maudes' posting to Kiribati (Gilbert Islands) between 1929–39 allowed regular visits to New Zealand for leave, and they deposited Kiribati material with Auckland Museum on several occasions (Woodburn 2003).

Although sent to Pitcairn for three months on official duty in 1940, the enforced stay of eight months enabled Maude to collect valuable information on the island and the residents. Their extended visit was due to reduced shipping passing the island, and because of the perceived danger from enemy vessels, none were prepared to carry Honor Maude and their young son Aleric (Woodburn 2003: 167).

In a letter to Miss Titcomb (Emory's secretary) on 20 January 1941, Maude described how he obtained stone tools:

I have been spending all my spare time studying the archaeology of the island, which interests me far more than the history of the present inhabitants. You ought to see our collection of adzes and other stone material -- Dr Emory would be particularly interested in them. Many of the islanders had been collecting the old stones they pick up when working in their gardens for years and I have purchased every private collection for spot cash. On top of that practically the whole island has been digging frantically for six months to earn good money while it lasts. As a result some good caches have been unearthed and we have now a collection of about 1,500 implements or worked stones of various kinds. Of course much of this is what we call junk - bits and pieces of all shapes and sizes - but among the lot are over 100 complete, or nearly complete, adzes of a great variety of types. I have hopes that this in many ways unique collection of Polynesian material will result in settling several questions with regard to the former Inhabitants of south eastern Polynesia. [https://digital.library.adelaide.edu.au/dspace/handle/2240/105816.Part1_SeriesJ_Section14_1941\(6\).pdf](https://digital.library.adelaide.edu.au/dspace/handle/2240/105816.Part1_SeriesJ_Section14_1941(6).pdf)

Maude's purchases, and the implication that some islanders had been amassing material for some time, can be examined against the activities of Young and Dyett. David Young was encouraging Pitcairners to look for stone material, with him taking a commission on the transactions, but there are a limited number of individuals referenced in the museum registers and many of these are related to Young (https://www.library.puc.edu/pitcairn/pitcairn/Pitcairners_Young.shtml). Dyett collected objects himself (Gathercole 1964) but also purchased from Pitcairners (letter, Clark to Fisher, 14 July 1948).

Maude on the other hand was a neutral outsider and his official role may have been advantageous in acquiring objects. He observed that there were factions and rivalries amongst the islanders ([https://digital.library.adelaide.edu.au/dspace/handle/2240/105816.Part1_SeriesJ_Section14_1941\(6\).pdf](https://digital.library.adelaide.edu.au/dspace/handle/2240/105816.Part1_SeriesJ_Section14_1941(6).pdf)) and the trade

in cultural material may have been influenced by this as Young and Dyett operated within their own social and familial spheres.

Maude, who had read anthropology at Cambridge University before joining the Colonial Service, believed the artefacts were evidence of temporary occupation by Tuamotuans, who visited Pitcairn specifically to fell trees for canoes (Maude 1964; Woodburn 2003: 165). There was no substance to this interpretation, although he may have been influenced by Buck (1938) who held similar views. However Maude may have inadvertently identified the function of the tools as Turner (2010) concluded that many were used for construction and maintenance of canoes for local use.

Other individuals

Between 1948 and 1956 there were an additional 31 acquisitions of Pitcairn material. All 2,203 objects were purchased from Pitcairners, and Roy Clark the postmaster. Some of these were delayed acquisitions due to the war disruptions at Auckland Museum, but new material continued to arrive. Clark, who first sent stone material in 1943 had been selling objects through Dyett, then began trading on his own account between 1948–1952, and sold 758 objects. Acquisitions between 1948 and 1952 were funded from the E.E. Vaile Trust Fund and the Sir Cecil Leys Bequest, recognised in the Auckland Museum Annual Reports, but the Pitcairn Island individuals are named in the documentation (see appendix). An acquisition in 1950 [1950.37] was belated paperwork for objects received in 1940 from 'Pitcairn Islanders' possibly through David Young. There is no correspondence with any of the individuals.

Many of the names on acquisition records are associated with David Young and his wider family, but the presence of other names reinforces the interpretation that collecting of stone tools was a local past time providing an income. In total there are 55 names associated with the wider collection (see appendix).

There are also thousands of uncatalogued Pitcairn stone items in the Museum. This can be explained by the bulk of the material arriving during the war years when Auckland Museum was short staffed, but also, the time-consuming task to process such a large number of objects may have been overwhelming. Many boxes have retained the original documentation providing clues to source (Fig. 11), or accession number. Familiar names such as Young, Dyett and Maude are identified, along with the names of Pitcairn Islanders who appear in earlier acquisitions. The uncatalogued material is mostly represented by broken roughouts, stone points, undiagnostic flaked tools and a small amount of historic material. Objects that were considered interesting at the time were separated out and catalogued.

The uncatalogued backlog makes it difficult to ascertain accurate numbers of objects from each of the main contributors and this research has gone some way to reconciling the paperwork with actual object numbers. Fisher's final numbers for the Dyett collection differ in each document, which may be accounted for by



Figure 11. Label in box of uncatalogued objects identifying them as being from Albert Young, delivered 'Per favour Carpenter H.M.S. "Rangitiki"', and receipted as 'Albert Young Paid' by Vic. Fisher (V.F.F.).

the catalogued items, plus the additional uncatalogued objects. The Maude collection suffers from similar inconsistencies and final numbers from Turner's (2010) analysis differ again. A recent inventory of all catalogued objects in the museum's collection database has provided a more accurate number for each individual, and a standard terminology of object names has been applied. Further, the uncatalogued material has been sorted into object type and source where known with an accurate box count.

Collectors' letters provide little information on where the items were obtained. Maude refers to items found while gardening, narrowing the locations down to the flatter or gently sloping land in the Adamstown Basin. Roy Clark collected at Malai, and on the outskirts of Adamstown. He also collected numerous awls from Little Georges Coc'nuts (Gathercole 1964: 17,70). The stone fish hooks (based on where Clark was collecting) may have been obtained from Bills Ground III, where the Gathercole expedition also uncovered the only pearl shell fish hook found on the island. An analysis of the entire collection may also provide information on where tools were collected: in addition to the dark grey basalt tools there are many with a reddish-brown weathered rind with dark grey interior. The localised material from the Gathercole expedition may be useful in narrowing down where these tools came from. Maude purchased items from Pitcairners, but also the hunt for stone tools provided a pastime for the family while waiting for a ship to take them from the island. The ease with which the residents recovered stone material from their gardens and Gathercole's observation that there was evidence of occupation everywhere supports his statement that the whole island could be considered a site.

CONCLUSION

The extensive collection of Pitcairn objects in the museum comprising adzes, roughout, chisels and gouges, fish hooks, hand-held tools, points, abraders, pounders, flaked edge tools, hammerstones and some flakes, primarily relate to the Polynesian, pre-*Bounty* inhabitants. Rectangular-shaped abrading tools known as *yolla* stones (coconut graters), (Fig. 12) have been identified from similar stones taken to Norfolk Island when Pitcairn was evacuated in 1856 (Janelle Blucher, Norfolk Island Museum, pers. comm. 2016) and may relate to post-1790 occupation. Other tool types equate with those characterised in Gathercole (1964) and Heyerdahl and Skojosvold (1965). It is a biased collection in the sense that collectors were deliberately selecting items of sale value and avoiding flakes without additional modification, but Auckland Museum was willing to pay for broken items in all stages of manufacture. The large range of tools, some of which are not known elsewhere in Polynesia, makes this collection unique.

The exchange of correspondence is interesting from the perspective of the changing tone of the letters with Young in particular, and he, Maude, Dyett and Clark each made visits to Auckland Museum when they were in New Zealand. The museum treated the relationships as more than just transactions of money for artefacts by also providing additional services for the Pitcairners such as purchasing requested goods or paying money to suppliers on their behalf. This level of cooperation is not evident in correspondence relating to other large acquisitions in the museum. Collectively a large sum of money was paid. At any stage the museum could have changed its policy of collecting and declined



Figure 12. *Yolla* stone made from vesicular basalt. Examples in Norfolk Island Museum show the stone was attached to a wooden stool in a similar way to pearl shell coconut graters (<http://www.norfolkonlinenews.com/non-heritej-nyuus-heritage-news/yolla-stone-by>). Auckland War Memorial Museum 28593.

payment for broken adze roughouts and worked flakes, yet incrementally it acquired well over 20,000 items, and even in the 1950s Fisher was sending sketches of types of tools he wanted. There may have been several reasons for this: possibly the hope that something unusual would be found and sent to the museum, or the desire to acquire the largest collection of Pitcairn material in the world, but it wouldn't need 20,000 items to achieve that status. Another possibility relates to the fact that collectors were by and large resident on an isolated island in the Pacific Ocean with few resources and little opportunity to earn money, and there may have been an element of museum benevolence in helping out during the war years when few other sources of income were available. Young (letter, 19 May 1939) wrote thanking the museum for providing financial assistance "as I find it [life] very hard in regard to cash". Young, in particular, could be interpreted as having a more personal relationship with Fisher and wrote even when he was not on Pitcairn.

Although the collection has little information on where individual items were found, the overall size and representation of object types make it a highly valuable assemblage. Turner described the majority of the adzes as being flaked, or ground only on the blade, and fully ground adzes rare. Many of the items are discarded roughouts, either because of breakage across the body or the flaking resulted in an irregular shape which could not be rectified by further flaking. Overall complete examples represent 8% of the total adzes (n=207). These range in size from 40–305 mm in length, with a mean length of 120 (Turner 2010: 136). The indiscriminately collected assemblage from the island can be viewed against Pitcairn adzes collected during Heyerdahl's expedition, which are mainly large, ground all over and unusually shaped, suggesting that there may have been a degree of collector bias. This is further indicated by the unusually large Types 3 and 4 (300–500 mm range), which Molle and Hermann (2008: 77) interpreted as ceremonial adzes, contrasting with the same adze types in Auckland Museum's collection with 97–283 mm and 142–302 mm length respectively (Turner 2010: 141).

Artefacts in all stages of manufacture, use, condition and size are present in Auckland Museum and analysis of such a large sample of any one type of artefact opens avenues for research on technological adaptation, use, breakage patterns, stone properties, geochemistry, and mobility of Polynesians between island groups at the centre of Polynesia and those at the margins. There are however few stone flakes. There is no correspondence to the effect that flakes were not wanted, and islanders must have recognised that some of the points were made on flakes. Locals may have recognised the flakes had little value and were not worth collecting, but some unmodified stones with no value were being sent to Auckland and were discarded. Many object shapes are unique to Pitcairn and demonstrate the high level of skill of the stone workers, coupled with what is technologically possible with fine-grained basalt. What is intriguing is that so many artefacts were made on the

island yet so few Pitcairn basalt tools have been found elsewhere. This suggests Pitcairn basalt, because of the geographic isolation, was not a major source of stone distributed widely and regularly through the south eastern Pacific.

The collecting history is an example of past museum practices. The continual encouragement to find and sell objects indicates a belief that the best place for them was in a museum, albeit far from the island. The discipline of archaeology did not reach East Polynesia in the 1940s, and in New Zealand was very different to what it is now: it was still primarily a hunt for artefacts masquerading as archaeology. Islanders were unaware of what could be learned from context, and with no connection to the Polynesian past of Pitcairn there was no emotional or spiritual relationship to the sites. This is best illustrated by the willingness to dig over the marae sites for Routledge. Despite its collecting history and lack of context it is still a remarkable collection of artefacts with huge potential to contribute to understanding Polynesian stone working technology.

ENDNOTES

1. Defined as born on the island and descended from the *Bounty* mutineers.
2. H.E. and Honor Maude also donated a large collection of ethnographic material from Kiribati (formerly Gilbert and Ellis Islands) accumulated during his career in island administration from the late 1920s.
3. It was the practice of the museum to use wealthy benefactors (Entrican in this case) to purchase objects on the museum's behalf. Among other philanthropists were E. Earle Vaile who also paid for Pitcairn acquisitions, presenting 3,006 Pitcairn items in 23 acquisitions from various Pitcairners between 1948–56, and the Sir Cecil Leys Bequest paid for acquisitions from five Pitcairners in 1952 (158 items, 1952.92,114–118).
4. Although Duff delivered the cases to Auckland Museum and spent probably several days with staff sorting and dividing the objects in the 15 cases, he neglected to mention that one case had been lost overboard and that by paying salvage costs Canterbury Museum had rights over the contents.
5. A precedent was set in 1948 of the purchase of the Oldman Collection by the New Zealand Government for £44,000 and objects distributed among the four major and some smaller provincial museums (Neich and Davidson 2004).

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APPENDIX 1: Names recorded in Auckland Museum Pitcairn acquisitions

Pitcairners or significant collection sources

Brown, Len

Charles, Joyce

Christian, Clement

Christian, Angela

Christian, Caroline (Mrs)

Christian, Ivan

Christian, John

Christian, Lucy

Christian, Mabel (Mrs)

Christian, Myrtle

Christian, Thomas C.

Christian, Verna

Christian, Virgil

Clark, Hyacinth

Clark, Norma

Clark, Roy

Dyett, Nelson

Grant, Edward

Jacobsen, Norma

Maude, Harry

Maude, Honor

Neil, Norma

Warren, A.G.

Warren, Burley

Warren, Douglas

Warren, Jennie

Warren, Lucy

Warren, Lyndon

Warren, Mima (Mrs)

Warren, R. (Mrs)

Warren, Wilis

Young, Albert

Young, Bruce

Young, Caroline

Young, David

Young, David (Mrs) (Edna)

Young, Edna

Young, Henry

Young, Hilda (Mrs)

Young, Kate

Young, Leona

Young, Lillian

Young, Norma

Young, Ralph

Young, Robert

Young, Vernon

Other sources

Cole, W. Collection

Commish, J.D. (Captain)

Gaunt, Captain

Holden, Charles

Milwaukee Museum

Ross, Harriet

Saunders, E.

Tyrell's Ltd

Watt, A.H.

Māori Archaeological Textiles: A Structural Analysis of Māori Raranga ‘Woven’ Basketry from the Waitakere Ranges in Auckland Museum

Lisa Mckendry University of Otago

Abstract

Māori wove a diverse array of textiles including a wide range of basketry. There has been little examination of the Māori pre-contact woven textiles from archaeological contexts in the collections of Auckland Museum, particularly those manufactured using the technique Māori call *raranga*. The key structural attributes of woven bags and baskets, and woven fragments from Te Wao Nui a Tiriwa (Waitakere Ranges), Tāmaki Makaurau were identified. These attributes included the raw material, weave form, strand width, pattern, and edge types, along with the type of commencement and finishing structures. Examination revealed diverse materials and manufacturing processes to create bags and baskets. Comparison with other Māori archaeological textiles from Aotearoa confirmed the value of a structure-based investigation to contribute to known customary and ethnographic knowledge bases. In addition, the presence of distinctive structural combinations has extended our understanding of *raranga* technology, revealing the continuity, and diversity, of Maori textile manufacturing processes in the past.

Keywords

archaeological textiles; Māori weaving; kete; Waitakere Ranges

INTRODUCTION

Archaeological textiles encompass a broad range of objects, including *kupenga* (fishing nets), *kete*, *whāriki*, *kākahu* and cordage for building and waka lashings. Manufactured from organic materials, archaeological textiles rarely survive unless in very arid or wet conditions (Cameron 2012). Plant material responds in different ways to variations in depositional contexts and this is reflected in an artefact’s condition (Kronkright 1990; Cameron 2012). For example, the *para* ‘epidermis’ of harakeke (NZ flax, *Phormium tenax*) is water resistant and will survive in wet deposits while the *muka* ‘inner fibre’ disintegrates. In contrast, the *muka* will be preserved in dry deposits while the *para* disintegrates. The visibility of the inner structure of the leaf on fragments allows an assessment of how an object was constructed and reveals diverse techniques such as knotting, twisting, plaiting, twining, weaving, and sewing.

This article concentrates on bag and basket fragments manufactured in *raranga*, i.e., woven using leaf strips. Two sets of elements (groups of leaf strips) are interlaced at an oblique angle, are functionally undifferentiated and have a common starting point (Emery 1966: 60). The sets are further distinguished by their direction, the dextral whenu ‘leaf strips’ lean to the right and the sinistral whenu lean to the left (Hiroa 1950: 145). In addition, the weave can be open or closed (Figs 1 and 2).

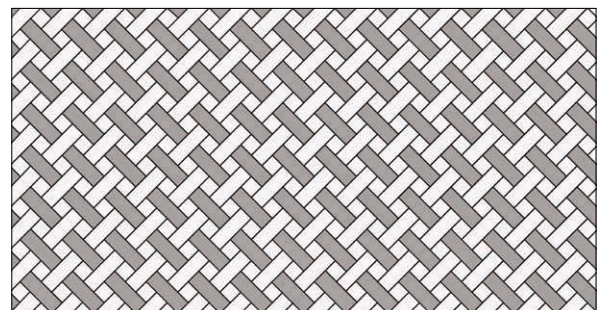


Figure 1. *Takitahi* (check pattern), open weave, sinistral whenu are grey and dextral whenu are white.

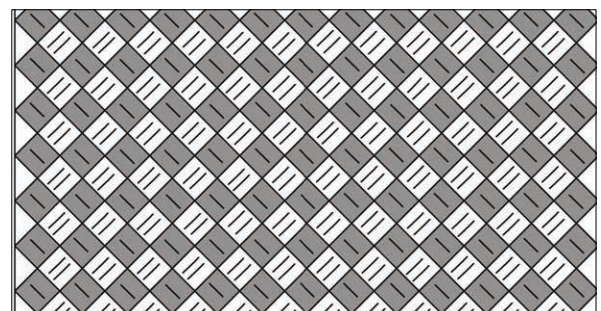


Figure 2. *Takitahi* (check pattern), closed weave, sinistral whenu are grey and dextral whenu are white.

MĀORI WOVEN TEXTILES

A wide variety of fibre objects such as fishing equipment, clothing, general purpose baskets and cordage were essential to survival for pre-contact Māori. However customary Māori weaving technologies were in serious decline by the early 20th century due to the rapid uptake of European materials (Mead 1969). Elsdon Best (1856–1931) and Rangi Hiroa (1877–1951), believing they were documenting a dying art, recorded Māori textile construction methods, techniques and protocols. Their in-depth studies included the detailed drawings of techniques together with Māori terminology by Hiroa (1923, 1926, 1950), and important tikanga ‘protocols’ and weaving *whakapapa* ‘connections’ from Best (1898). These publications provide a rich resource for identifying and understanding *raranga* technological practices.

Māori wove a diverse range of woven *kete* ‘bags/baskets’ using many raw materials, construction methods and patterns for everyday activities and special occasions. *Kete* were usually woven for distinct purposes and ‘named accordingly’ (Puketapu-Hetet 1999:47). There were many types of utilitarian containers, known generally as *kete tātahi* ‘open weave/general purpose baskets’ (Hiroa 1923). They were woven for everyday use and include the *rourou* and *kono* ‘small food baskets’, *kete* ‘bag’, *kete kāwhiu* ‘shellfish bag’ and *kete kumara* ‘kumara bag’ (Puketapu-Hetet 1999). As Hiroa (1923: 732) commented, ‘woven baskets were used for so many purposes that it is difficult to imagine Maori being without them’. These expedient baskets were for resource gathering and storage. In contrast, the class of finer woven textiles took longer to weave and required a high skill level. The *kete pūputu* ‘close weave’ group includes the *kete pūtea* ‘finely woven bag’ and *kete whakairo* ‘patterned bag’. These bags were highly valued for storing significant *taonga* such as cloaks, or for tools and materials required for fibre work (Hamilton 1896; Puketapu-Hetet 1999: 50). In addition, *kete pure* ‘ceremonial bags’ were manufactured for ritual purposes (Hiroa 1923: 725; Puketapu-Hetet 1999: 49).

MANUFACTURING PROCESSES

Māori arrived in Aotearoa with the necessary skills to manufacture a full suite of textiles specific to their requirements (McCrae-Tarei 2013; Smith 2015). The importance of textile-related plants to Māori is demonstrated by the *tapu* ‘sacredness’ that surround all aspects of their lifecycle; planting, harvesting, processing, and weaving (Puketapu-Hetet 1999; Te Kanawa 2006). In Aotearoa, weavers followed strict protocols for all aspects of *raranga* manufacture that display respect for the environment, the people, and the object. These processes were important during the manufacture of simple and complex textiles (McCallum and Carr 2012). To assess the significance of the objects and various structural attributes, an understanding of the relevant harvesting, processing and manufacturing strategies used by Māori is required. The following provides a summary of the materials and construction methods used by Māori to weave *raranga* textiles, based on traditional, ethnohistorical and practical knowledge.

Raw Materials

There were many suitable raw materials available, including harakeke (New Zealand flax, *Phormium tenax*), kiekie (*Freycinetia banksii*), tī kōuka (cabbage tree, *Cordyline* spp.), nikau (*Rhopalostylis sapida*), pīngao (golden sand sedge, *Ficinia spiralis*) and houī (lacebark, *Hoheria* spp.) (Hiroa 1923; McCallum and Carr 2012; Puketapu-Hetet 1999). The importance of weaving materials is illustrated by their inclusion as a *taonga* species in the Ngāi Tahu Claims Settlement Act 1998 (McCallum and Carr 2012: 183). Plants were selected based on various factors, including abundance, ease of preparation, leaf width, flexibility and strength.

Harakeke was the preferred weaving material across Aotearoa as it was plentiful and had long, strong leaves (Hiroa 1923; Puketapu-Hetet 1999; Scheele 2005). The tī kōuka were also readily available and favoured for their strength and durability (Hiroa 1923; McCallum and Carr 2012; Smith 2015). These species were particularly suited for everyday open weave textiles, as illustrated by the large number of *kete tātahi* in museum collections woven from harakeke and tī kōuka. Given the superior nature of harakeke it was also used, along with kiekie, in the manufacture of closely woven items such as the *kete pūtea* and *kete pure*.

Preparation and Processing Methods

The various raw materials used in textile manufacture require different harvesting and processing techniques depending on the intended textile (Puketapu-Hetet 1999). The first process after harvesting harakeke is to strip the leaves into the required width. The broad harakeke leaves allow for a range of strip widths to be produced making it suitable for weaving a variety of object types and sizes. In comparison, plants such as pīngao and kiekie have narrower leaves yet they are very strong and durable.

The leaves from harakeke, tī kōuka and nikau could be used without any further processing (Best 1941; Hiroa 1923; McCallum and Carr 2012). Unprocessed plant strips shrink as they dry, leaving gaps between each strip and creating an open weave structure. This natural drying process was exploited by Māori who wove many open weave *kete* of this form for particular purposes such as drainage of liquids, or where air circulation was required e.g., the loose weave of *kete kumara* allows soil to drop through the gaps. When using harakeke, the strips were often removed from the base of the leaf using the tākirikiri technique (Hiroa 1923). This involved separating the *whenu* from the base with a ‘quick, sharp pull’ (Hiroa 1923: 710) to leave fibrous rather than cut distal ends, which were then plaited together. The most valued textiles were manufactured with leaf strips that had undergone further processing such as softening or boiling.

The *hāro*¹ or *hapine* ‘softening’ process for harakeke removes moisture from the leaf without breaking the surface layers (McCallum and Carr 2012). The leaf strip is pulled firmly along its length against the back of a shell (Puketapu-Hetet 1999). This results in less shrinkage and more flexible strips ensuring a close weave

1. *Hāro* is a common term for extracting *muka* fibres.

structure. Harakeke leaf strips could be further processed by boiling the strips in a *kumete* or *oko* ‘wooden bowl’ with hot stones to make the strips whiter (Hiroa 1923: 711; Maori Dictionary 2020). The water-resistant upper surface layer of the flax leaf makes it difficult to absorb dye. However, black colouration was achievable using iron-rich *paru* ‘mud’ (Puketapu-Hetet 1999: 16).

Manufacturing Techniques

Starting Structure

General purpose bags were often woven from unprepared *whenu* with a two corner, four corner or three-ply plait start. For example, the *kono* ‘small food baskets’ and everyday *kete* had a flat four corner base. However, both *kete tātahi* and *kete pūputu* could begin with a *whiriwhiri* ‘three-ply plait’ (Hiroa 1923). In contrast, special bags were mainly woven from processed leaves, with the same start as a *whāriki* ‘floor mat’ (Hiroa 1923: 732). This uses narrow strips still attached to the butt end of the leaf to ensure a secure starting structure.

Patterns

Patterns are created by varying the number of *whenu raranga* ‘weaving strip’ each strip passes over or under. The two simplest and most used weaving patterns are *takitahi* ‘plain or check weave’ (Figs 1 and 2) and *takirua* ‘twill weave’ (Hiroa 1923: 733; Connor 1983: 197). The *takitahi* pattern has both *whenu* (dextral and sinistrals) go over one strip, then under one strip, to create an even check pattern (Connor 1983: 197). The *takirua* weave has both the dextrals and sinistrals carried over two strips, with Māori distinguishing between two types: *torua whakatu* ‘vertical twill’, and *torua whakatakoto* ‘horizontal twill’ (Pendergrast 2005). Other more intricate pattern arrangements were created for special items include *kete whakairo*, for which the patterns could be *papakirango*, *rau kumara* and *hai tamana*, which are usually *rohe* ‘region’ specific (Pendergrast 1991; Te Kanawa 2006). The pattern is not overlaid after manufacture but created during construction, with the first row or *whakapapa* setting out the pattern by using the variation in colour of the upper and lower leaf, or by combining natural and dyed strips. The patterns represent the natural and cultural environment, for example, *hapu* living near rivers used the *niho taniwha* ‘monster teeth’ pattern (Puketapu-Hetet 1999).

Finishing Structures

The presence of a start and finish edge is informative of the original size when examining fragmented textiles. The primary method to finish a simple bag was with a *whiri kawē* ‘three-ply plait’ started directly from the *raranga* structure (Hiroa 1923: 735). This is recognisable by the loop effect from the strips as they wrap around the back of the plait. There are many examples of this structure in collections at Auckland Museum, Tāmaki Paenga Hira (Pendergrast 1984, 1995), though seldom seen in contemporary practitioners’ work. Another common finish for mats and bags was *tāpiki* or *kopetipeti* (Hiroa 1923: 718), a selvedge edge where both the sinistrals and dextrals are folded back along the body of the work. Often a *whiri* ‘plait’ was added around the rim to create a firm edge for attaching the handles.

MUSEUM COLLECTION

This raranga textile assemblage is from various coastal locations: Anawhata, Piha (Whakāri Pā, Te Ahuahu Point and Takatu Point) and Karekare. The find places include overhangs and shelters on cliffs and exposed coastal sites, small in size and not suitable for long term occupation (Lawrence 1989). In the wider area is a range of Māori occupation evidence such as pā, terraces, pits and midden. The forest, river valleys and coastline of Te Wao Nui a Tiriwa have been actively occupied by small tribal groups for about 600–800 years, who managed the marine and terrestrial resources (Taua 2009). Unfortunately, conflict over land during the early 1800s decimated many people, leaving only a few small groups to maintain *ahi kā* ‘burning fires of occupation’ (Taua 2009: 51).

The fibre remains discussed below were collected by Sir F. Mappin, A.T. Pycroft, G. Fairfield and W.E. Browne, and accessioned into Auckland Museum Tāmaki Paenga Hira collections between 1928 and 1951. The complete textile assemblage consists of cordage, fishing nets, cloak fragments, belts, mats and discard fibres. In depth discussion of the entire collection is beyond the scope of this paper (see Mckendry (2017a) for discussion of the cordage, Mckendry (2017b) for details on the cloaks from Whakāri Pā and Lawrence (1989) for the remaining stone, wood and bone artefacts).

THE RARANGA TEXTILES

The rāranga textiles were recorded using particular attributes, including the material type, weave form, strand width, pattern type, and the start, finishing and edge techniques. The raw materials were identified by Jean Goulding using comparative textile and plant samples, although techniques for scientifically identifying archaeological fibres have since improved dramatically with micro-computed tomography, SEM and polarized light microscopy (Smith *et al.* 2018). One *kōnae*, six *kete tātahi*, four *kete pūputu* and one *kete pure* (Table 1) were identified and examined.

Anawhata

The two fragments (23887.2 and 23887.3) are woven in the *takitahi* pattern from tī kōuka and nikau, respectively (Goulding 1971). Textile 23887.2 (Fig. 3) has a variation in the *raranga* structure with groups of eight *whenu* woven with a selvedge edge to make separate bands of weaving and a *whiri kawē* rim. These two pieces may be from a *kete tātahi*.

Piha, Whakāri Pā

The two *kete* from this site are partially intact and identified as *kete pūputu*. They are both closely woven from harakeke with *whiriwhiri* starts, differentiated by their strip widths and pattern types. *Kete* 26447.3 (Fig. 4) is woven in the *torua whakatakoto* pattern with medium strips (7 mm) and *kete* 26447.4 is in the *takitahi* pattern (15 mm wide strips), with only the fibres remaining.

Table 1. The attributes of the bags and fragments; material type, weave form, strip width, pattern, start, finish, object type and condition.

Bags, Baskets	Material	Weave Form	Strip Width mm	Pattern	Start	Finish	Object	Condition
Anawhata								
23887.2	Ti kōuka	Open	3	<i>Takitahi</i>		three-ply plait	<i>Kete tātahi</i> rim	Frag.
23887.3	Nikau	Open	5	<i>Takitahi</i>		three-ply plait	<i>Kete tātahi</i> rim	Frag.
Piha, Whakāri Pa								
26447.3	Harakeke	Close	7	<i>Torua whaka-takoto</i>	three-ply plait		<i>Kete pūputu</i>	Partial
26447.4	Harakeke	Close	15	<i>Takitahi</i>	three-ply plait		<i>Kete pūputu</i>	Partial
Piha, Te Ahuahu Shelter								
43127.1	Kiekie	Open	5	<i>Takitahi</i>	four-corner	three-ply plait	<i>Kete tātahi</i>	Complete
43127.2	Harakeke	Open	5	<i>Takitahi</i>	four-corner		<i>Kete tātahi</i>	Complete
Piha								
19773	Kiekie	Open	4	<i>Torua whaka-takoto</i>	knot		<i>Kete pure</i>	Complete
19775.1	Astelia	Open	18	<i>Takitahi</i>	two-corner	three-ply plait	<i>Konae</i>	Complete
2012.x.217.2	Kiekie	Open	5	<i>Takitahi</i>	three-ply plait		<i>Kete tātahi</i>	Partial
26448.3	Toetoe	Open	8	<i>Takitahi</i>	four-corner	three-ply plait	<i>Kete tātahi</i>	Complete
Karekare								
33011.7	Harakeke	Open	4	<i>Takitahi</i>	three-ply plait		<i>Kete tātahi</i> base	Frag.
33011.11	Harakeke	Open	4	<i>Takitahi</i>		three-ply plait	<i>Kete tātahi</i> handle	Frag

Piha, Te Ahuahu Shelter

The two complete *kete tātahi*, 43127.1 and 43127.2 (Figs 5 and 6), have an open weave in the *takitahi* pattern, a flat base with a four-corner start, medium strip widths, plaited handles and *whiri kawae* rim. They are made from kiekie and harakeke, respectively. Both have an irregular structure, with the degraded base of *kete* 43127.1 possibly the result of use-wear, and *kete* 43127.2 having the appearance of basketry weaving. These may be expedient baskets such as *kete kumara*.

Piha

A complete *kōnae* ‘purse’ (19775.1, Fig. 7) is made from astelia in an open weave, with two corners in the *takitahi* pattern, wide *whenu* and a three-ply plait rim (18 mm). An unfinished *kete pure*, 19773, encloses a small lock of *makawe* ‘human hair’. It is made from kiekie in the *takirua* pattern with 4 mm strands and the commencement has four leaf strips knotted together in pairs, with two becoming sinistrals and two dextrals.

This site produced one complete and one partial *kete* which appear to be general use baskets. The complete *kete*

tātahi (26448.3, Fig. 8) is made from toetoe with an open weave in the *takitahi* pattern, a flat base with a four-corner start, medium strand widths (5–8 mm), a *whiri kawae* rim and three-ply plait handles. The total degradation of the epidermis layer indicates this *kete* has been exposed to very dry conditions. The partial *kete* (2012.x.217.2, Fig. 9) is made from kiekie with an open weave in the *takitahi* pattern and a *whiriwhiri* start with medium strips. The dextrals lie at right angles and the sinistrals flat against the plait, contributing to an unbalanced weave.

Karekare

The two small open weave fragments are made from harakeke in the *takitahi* pattern with 4 mm strips and with their lower leaf surface front facing. One, 33011.7 (Fig. 10), is a rim fragment which retains a three-ply plait handle where the *whenu* goes directly into the *whiri kawae*, and the other fragment 33011.11 (Fig. 11) has the *whiriwhiri* start.



Figure 3. Plaited rim with band of weaving, fragment. Auckland War Memorial Museum 23887.2. Photo by Tim Mackrell.



Figure 4. *Kete pūputu*, partial. Inside view of the *whiriwhiri* start and *torua whakatakoto* pattern. Auckland War Memorial Museum 26447.3. Photo by author.



Figure 5. *Kete tātahi*, complete; open *takitahi* weave, plaited rim and handles, degraded base. Auckland War Memorial Museum 43127.1. Photo by Tim Mackrell.



Figure 6. *Kete tātahi*, complete; uneven open *takitahi* weave, *whiri kawe* rim and plaited handles. Auckland War Memorial Museum 43127.2. Photo by Tim Mackrell.

DISCUSSION

There is a long history of settlement, mobility and seasonal expeditions in the resource rich forests and coastline of Te Wao Nui a Tiriwa (Tuaa 2009; Hayward and Diamond 1978). The *raranga* textiles reflect this complex history and retain sufficient structural variables to reveal common object types and diverse manufacturing processes. The majority were identified as *kete tātahi* 'general use bags'. The distribution of these utilitarian *kete* across all the sites reflects their essential use for everyday activities. Open weave baskets were ideal for large scale collection of cockles, pipi, scallops and mussels, and the harvesting and storing of kumara. The shaping of the band on the open weave fragment 23887.2 (Fig. 3) is a technique which allows the bag to close around a form, such as a gourd' used to store water or preserved foods. The close weave *kete* at Whakāri Pā also provide evidence of the care of special items and demonstrate the work of skilled weavers. In general, the

attribute variability of the *kete* were as expected, with evidence of a range of weaving and plaiting techniques, using multiple raw materials.

Materials

There is a reliance on harakeke for everyday use *kete*. The identification of plants, such as toetoe, nikau and astelia, which are rarely seen in collections, supports Māori and ethnohistorical narratives of widespread use of many fibre plants (Goulding 1971; Hiroa 1923; Puketapu-Hetet 1999; Tregear 1904). These materials were easily available, growing in lowland forests and swamps and well suited for general baskets due to their ease of harvesting and processing (Best 1977; Puketapu-Hetet 1999). In addition, tī kōuka and toetoe are recorded as being particularly suitable for cooking baskets due to their water-resistant qualities (Pendergrast 1996; Puketapu-Hetet 1999). These plants have thick, strong and durable leaves that are valuable for the making of utilitarian baskets. The use of toetoe at Karekare, nikau



Figure 7. *Kōnae*; open *takitahi* weave and three-ply plait rim. Auckland War Memorial Museum 19775.1. Photo by Tim Mackrell.



Figure 8. *Kete tātahi*, complete; open *takitahi* weave, *whiri kawe* rim and plaited handles. Inner fibre only remaining. Auckland War Memorial Museum 26448.3. Photo by Tim Mackrell.



Figure 9. *Kete tātahi*, partial; inside view of *whiriwhiri* start and unbalanced weave (the dextrals lie at right angles and the sinistrals flat against the plait). Auckland War Memorial Museum 2012.x.217.2. Photo by Tim Mackrell.



Figure 10. *Kete*, rim and handle fragment; *whiri kawe* rim and plaited handle. Auckland War Memorial Museum 33011.7. Photo by Tim Mackrell.

and *tī kōuka* at Anawhata and *astelia* from Takatu Point, alongside the ubiquitous *harakeke*, demonstrates the utilisation of local resources for everyday use objects.

Structural Attributes

Many archaeological textiles are degraded fragments without start or finishing structures, constraining their identification as specific objects. However, the detailed recording of textile structures based on standard attributes and raw material has provided clues. The diverse array of structural attributes identified supports known customary Māori weaving knowledge. Further, various structural combinations yielded some interesting results. Due to the nature of the material, it was expected that *harakeke* or *kiekie* strips would be narrower than other materials. However, the item with the narrowest *whenu* was manufactured from *tī kōuka* (23887.2, Fig. 3). In contrast, the complete *konae* from Takatu Point (19775.1, Fig. 5), woven in *astelia* has unusually wide strands measuring



Figure 10. *Kete*, base fragment; inside view of the *whiriwhiri* base. Auckland War Memorial Museum 33011.11. Photo by Tim Mackrell.

18 mm, and more than double the width seen in other objects. It has a typical flat two-corner start for a small *konaē*; however, the wide strips, open weave and *whiri kawē* rim are more common on larger *kete*. In this case, an examination of the leaf strips identified the mid-rib of the leaf in each strip, indicating a whole *astelia* leaf was used to create each element or strip. The expected range of start and finish weaving techniques and weave variation are represented in this collection. The five complete *kete* all have *whiri kawē* finishing edges, four have an open weave in the *takitahi* pattern with three starting methods; two-corner, flat four-corner and *whiriwhiri*. The partial closely woven *kete*, and other open weave fragments, also have *whiriwhiri* starts, and all finish edges are *whiri kawē* suggesting widespread knowledge of these particular techniques. The *kete* from Whakaari Pa (26447.3, Fig. 4) is the only textile with a twill weave pattern. This could be further identified as *torua whakatakoto* ‘horizontal twill’ due to the presence of the starting plait, and alongside the very close weave, warranted the title *kete pūputu*.

Another variation in structural combinations was evident in textile 19773 from Takatu Point. This unique *kete* was begun by knotting four strands of *kiekie* together, a technique more typically found on a *rourou*, using *harakeke* or *tī kōuka*. The faster, but more difficult pattern *torua whakatakoto* is unfinished. The textile wraps around a bundle of *makawē* ‘human hair’. The sacredness of human hair to Māori, considered to contain the spirit of the person, is well recorded within oral traditions and ethnohistoric accounts (see Cowan 1930; Shortland 1856; Salmond 1985; Taylor 1855). Best (1924: 533) states ‘cut hair was carefully deposited at the tapu place, or on a tree, or secreted in some way’. Wrapping the textile around the hair demonstrates the importance of covering the hair prior to deposition, and the expedient manufacturing techniques used suggests some urgency in this process. These examples illustrate the variability in textile objects and structures, influenced not only by raw material availability but also the intended purpose.

Archaeological Comparisons

A few complete and fragmented *kete*, largely in poor condition, have been excavated or collected from caves near Taupo; a wetland pa site at Kohika in the eastern Bay of Plenty (Aranui 2006); Raupa near Paeroa (Lander 1992); a coastal site at Kaitorete Spit (Smith 2015); and other pieces from various locations held at Southland Museum and Art Gallery (Smith 2015). As with the Waitakere collection the primary material is *harakeke*, with the addition of *tī kōuka*, *kiekie*, and *astelia*. This confirms the superiority of *harakeke* as a strong durable material which is readily available and easy to harvest and process. There were also similar anomalies in construction, such as the use of *kiekie* for an open weave form and *tī kōuka* for a closely woven bag. In this case, the *kiekie* *kete* is very degraded, with a lot of fibre visible as the epidermis has deteriorated, which may explain why the weave form appears open. Alternatively, it may

have been constructed by a less experienced weaver and the *tī kōuka kete* by a skilled practitioner. Further, the type of plant species does not appear to have any influence on the width of the strips. They were uniform across all materials, weave forms and object types, and across all collections, with the majority being of medium width (5–10 mm). This suggests the strip width, though constrained by the plant morphology, is also determined by the weaver and intended textile.

The general use *kete* had the expected attributes; a *whiriwhiri* (usually a three-ply plait) start, an open weave, wide and narrow strips, *takitahi* and *takirua* patterns, and a *whiri kawē* rim. This includes two complete *kete tātahi* from Southland Museum and Art Gallery, three from Taupo in Auckland Museum, and two from Kohika, Bay of Plenty. Like the Waitakere textiles, these bags vary in overall shape and size. A key difference is in the starting method for the *kete tātahi* from the Waitakere Ranges where the complete bags have a flat four-corner start, not a *whiriwhiri* ‘three-ply plait start’. This could indicate different functions, the length of the plant material available (as a four-corner start requires longer strips) or it may simply be the preference of this area. In addition, it reflects the versatility of basic weaving techniques, giving a weaver the ability to adapt to the required function of the object.

As previously mentioned, many archaeological textiles are very small fragmented pieces. Smith (2015: 277) comments that most Kaitorete Spit *raranga* specimens ‘were such small fragments that only a few had recognisable structures’, and only nine of the 64 textile fragments are quantifiable and recognisable. The charred *raranga* remains from the Raupa site near Paeroa are also considered too small to assign to a specific object (Lander 1992), although in spite of poor preservation they are all still identifiable as *raranga* textiles by their interlaced structure and flat leaf strips. In the main these fragments have recognisable attributes such as variations of a plain weave and narrow to wide strips. For example, the Raupa fragments have a *takirua* weave and 3–6 mm wide flax strips (Lander 1992), and the Kohika fragments have the four basic pattern types; *takitahi* and *takirua* variations (Aranui 2006). However, it is the presence of intact finishing edge structures that can be particularly enlightening.

A small open weave fragment from Kohika woven in *takitahi*, with wide strips of unprocessed flax, has a folded rim edge reminiscent of a *rourou* or *kono* (McAra 2004: 157). *Rourou* were containers made expediently from raw flax leaves for everyday and often single-use occasions. In contrast, two fragments from Kaitorete Spit, closely woven from medium width flax strips, are *whakakitaratara* ‘triangular edge’ fragments (Smith 2015: 258–345). This finish along the rim of a *kete*, of a series of triangles, represents a very high skill level and is solely a decorative finish. Hiroa (1923: 738) states this was a recent innovation, even though his informant maintained this finish is ‘ancient’, and it is a common Pacific technique. An exquisite *kete whakairo* discovered at Puketoi Station (see Hamilton

1896, Smith 2015), complete with a range of weaving resources, provides an insight into the type of *kete* the *whakakitaratara* fragments may belong to. This closely woven *kete* has a complex pattern from narrow strips and is coated in *kōkōwai*, indicating it was a prized possession. In addition, this *kete* was so finely woven and used for squeezing the juice of beaten tutu kernels and is known as a pukoro, or pututu. Given the nature of organic materials, the lack of similar high-quality textiles at other sites doesn't mean they were not used there but demonstrates the difficulty of making robust interpretations about past activities based solely on surviving evidence. Despite this, many of the limitations present in the analysis of archaeological textile collections are counteracted by a structural analysis.

CONCLUSION

Several raranga textiles presented here share structural components which aid in identification of their object type. Examination revealed a diverse use of materials and manufacturing processes to create a wide variety of bags and baskets, including every-day and potentially ritual textiles. In addition, the distinctive structural combinations of certain textiles reflect the diversity of past Māori textile manufacturing processes and demonstrate the flexibility of weavers to respond to the available plant material and required purpose. Future analyses, with broader data sets, could help identify regional and individual techniques, as well as contributing to the continuity of customary fibre-working practices.

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John Buchanan's pre-1880 Records and Illustrations of New Zealand Fungi

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Abstract

John Buchanan illustrated a range of non-lichenised fungi while botanising around Wellington. In 1874 he recorded the names of 52 fungi as an addition to a list of plants of Wellington province, based on his collections and illustrations of fungal specimens. All but one of Buchanan's known fungal illustrations, dating mostly from 1871 to 1877, are unpublished and are collated along with botanical illustrations in a bound volume labelled MS-41 in the Manuscript Collection, Documentary Heritage, Auckland War Memorial Museum. Several illustrations are historically significant as they predate formal description of the species depicted. Buchanan's only mycological paper was the illustrated description of a new species *Cyttaria purdiei*, a name that will separately be epitypified and applied to a misidentified New Zealand species.

Keywords

mycology; mycota; new historical records; manuscript.

INTRODUCTION

John Buchanan FLS (1819–1898) was born in Dunbartonshire, Scotland and apprenticed as a pattern designer in the calico printing trade (Adams 1990, 2002). He emigrated to Dunedin in 1852 (the 5th year of the Scottish settlement) and, following brief work in the Australian goldfields in Victoria during 1852, worked as a survey assistant and gold prospector in Otago. Through his friendship with botanist John Ross (Busby, Glasgow) to whom he sent plant specimens, and subsequent recommendation from Joseph D. Hooker, Buchanan was employed in 1862 as botanist and draughtsman for Sir James Hector's geological survey of Otago and West Coast. During his work, he collected plant specimens, and prepared maps, colour paintings of lakes and sounds and botanical illustrations (Tyler 2012). In 1865, Hector was appointed Director of the Colonial Museum in Wellington, employing Buchanan along with his other Dunedin staff. Buchanan lived in Thorndon for the next 20 years and contributed significantly to the Museum and the Wellington Botanic Garden. The latter was referred to by some as the 'Buchanan Garden' (Ridley 2016) or the 'Buchanical' gardens (Nathan 2019). His work involved botanical and geological trips throughout New Zealand, recording his collections in field-books, letters and reports (parts cited by Adams 1990), and writing 36 scientific papers and a folio treatment of NZ native grasses (Adams 1990). He became a Fellow of the Linnean Society of London (FLS) in 1876.

As an astute botanical observer, Buchanan also noticed fungal fruiting bodies during his many surveying trips, but to our knowledge his illustrations and records of fungi relate almost entirely to his botanising near Wellington. Fungi were mentioned in just two of his publications; one a list of species from Wellington (Buchanan 1874), the other a description of a new species (Buchanan 1886). With the exception of lichens, no fungal voucher specimens by Buchanan are known, with the authors having checked holdings of the New Zealand Fungarium (Landcare Research, Auckland) and of Kew Fungarium, London (Begoña Aguirre-Hudson, pers. comm.). Buchanan sent specimens of flowering plants, lichens, and other cryptogams to Ross and other professional contacts in Glasgow. Apparently lacking a mycological colleague in Glasgow, Buchanan sent few if any fungal specimens to Scotland for determination.

FUNGI OF THE WELLINGTON REGION

The main published evidence of his interest in fungi is his list of 52 species found during his botanising in and around Wellington (Buchanan 1874). He noted the unrecorded diversity of the cryptogams: '...The alpine forms [of cryptogams] are little known, and the whole, especially Fungi, still offer a rich field for further research in Wellington'. Having illustrated some of the fungi he was motivated to include a list of identified species: '... The Fungi I had intended to have left entirely out, but having drawings of some easily recognized species, they have, with a few others, been added'.

The illustrations that support Buchanan's 1874 list, however, were not published and were overlooked until Adams (2002) investigated the contents of an Auckland War Memorial Museum Manuscript Collection, Documentary Heritage volume MS-41, bearing handwriting by T.F. Cheeseman (L. Tyler, pers. comm.) including the wording 'J. Buchanan's Notes'. This volume of over 230 pages includes mostly pencil sketches with occasional colour paintings of plants and fungi. The 114 illustrations of fungi begin on p. 161 and extend over about 40 pages, occasionally interspersed with botanical illustrations. Beyond p. 201, the pages of MS-41 are not numbered; most illustrations are on odd-numbered pages. Those fungal illustrations that are dated are mainly from the period 1871–1877 (with two dated 1884 and 1885) when Buchanan was based in Wellington. While mushrooms dominate, he also drew other macrofungi (e.g., bracket, coral and gasteroid species), and an occasional smaller ascomycete and rust fungus; the latter is one of a few coloured illustrations. Voucher specimens were apparently not preserved, although an unnamed fungus illustrated on p. 177 is annotated, along with two lichen specimens on p. 175, as 'Sent to Scotland'.

We assume that Buchanan himself identified the fungi included in his Wellington list. Where others had

assisted him with identifications, e.g., James Stirton for the lichens, he gave due acknowledgment (Buchanan 1874). Hooker's (1867) collation of 217 species of fungi, as New Zealand's first mycota, was likely the main source of locally relevant information available to Buchanan.

Specimens illustrated in MS-41 are from his familiar, botanical-collecting locations around Wellington, which included the Botanic Gardens, Kaiwarra (now Kaiwharawhara), Porirua, Tinakori Hills, Dr Hector's garden (likely at Korokoro and later known as Percy Scenic Reserve – Hector's Family Album, 1903) and Mantell's garden (likely at Thorndon – National Library 1868). Outside Wellington, there is an illustration of an earthstar fungus from Taurangahika in the Whanganui region. For several species (e.g., *Ileodictyon cibarium* Tul. & C.Tul., basket fungus, kōpura whetū, Fig. 1), different growth stages are illustrated as habit drawings and in transverse section. This species was among the earliest newly described New Zealand fungi (Raoul 1844) with Buchanan's illustrations improving on the more superficial earlier images by Rev. Richard Taylor (Taylor 1855, pl. V, #6). Notes accompanying Buchanan's fungal illustrations, however, are sometimes rudimentary in comparison with his plants notes, but may include colour and habitat details, and sometimes location and date.

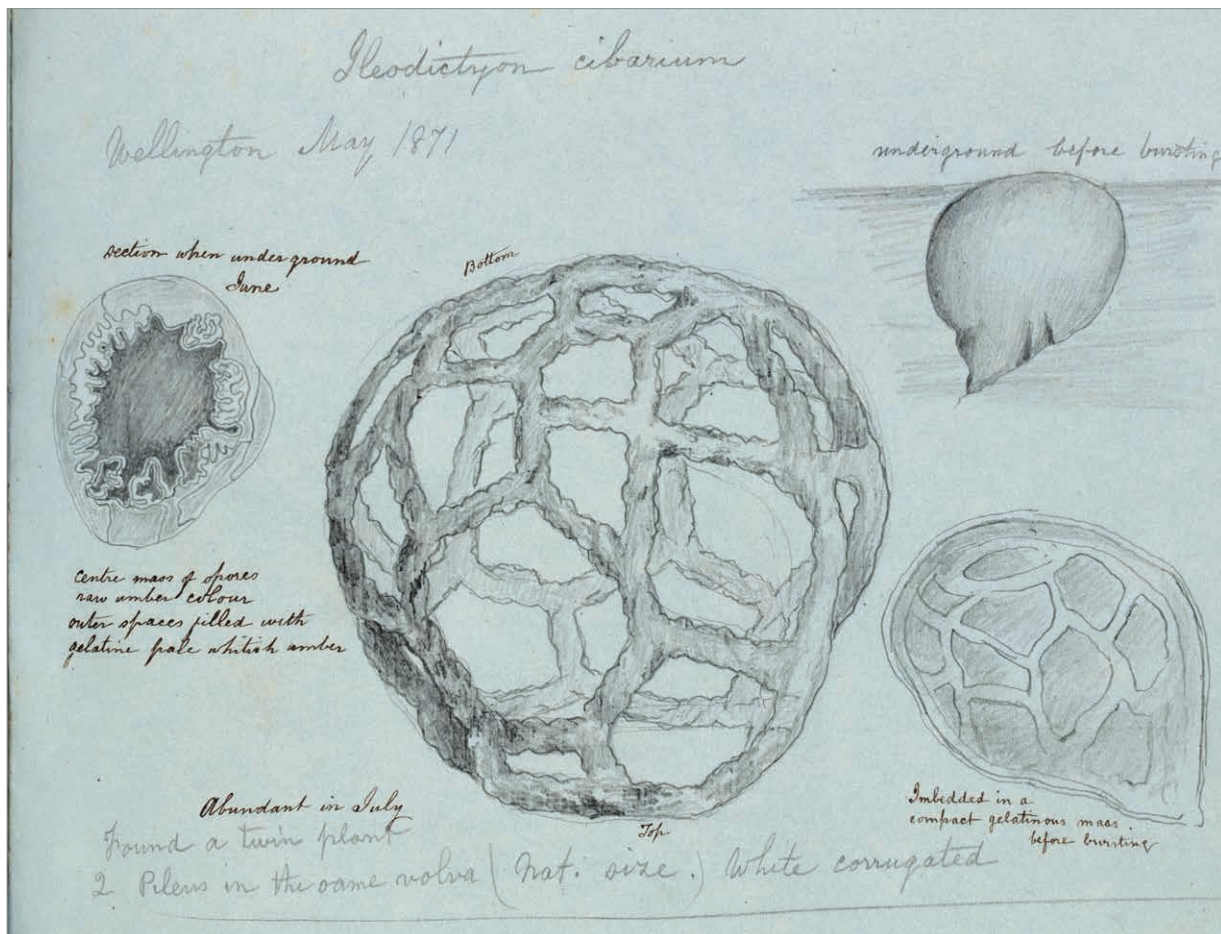


Figure 1. *Ileodictyon cibarium* – basket fungus, kōpura whetū. John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: 161.

For some species, microscopic features are illustrated. MS-41 includes tracings by Buchanan of drawings of microscopic features from Berkeley (1845), suggesting he used Berkeley's drawings to assist his own interpretation of spores, basidia, and asci. We note that some of Buchanan's drawings of spores have misinterpreted large contaminant spores for those of the target species (e.g., a multiseptate spore in Fig. 2).

Coloured illustrations were prepared for two fungi. *Puccinia otagense* (Linds.) McKenzie & Padamsee

(Fig. 3, as *Aecidium tragopogonis*), is a native pathogenic rust fungus that causes deformation of *Clematis* spp., earlier described and illustrated by Lindsay (1867) and later found to be conspecific with three other named native rust fungi each recorded on different host plants (Padamsee & McKenzie 2017). *Gyromitra tasmanica* Berk. & Cooke (Fig. 4) was collected in 'Dr Hector's Garden' and possibly illustrated in colour as a tribute to his mentor. To our knowledge, neither illustration was published by Buchanan or his associates.

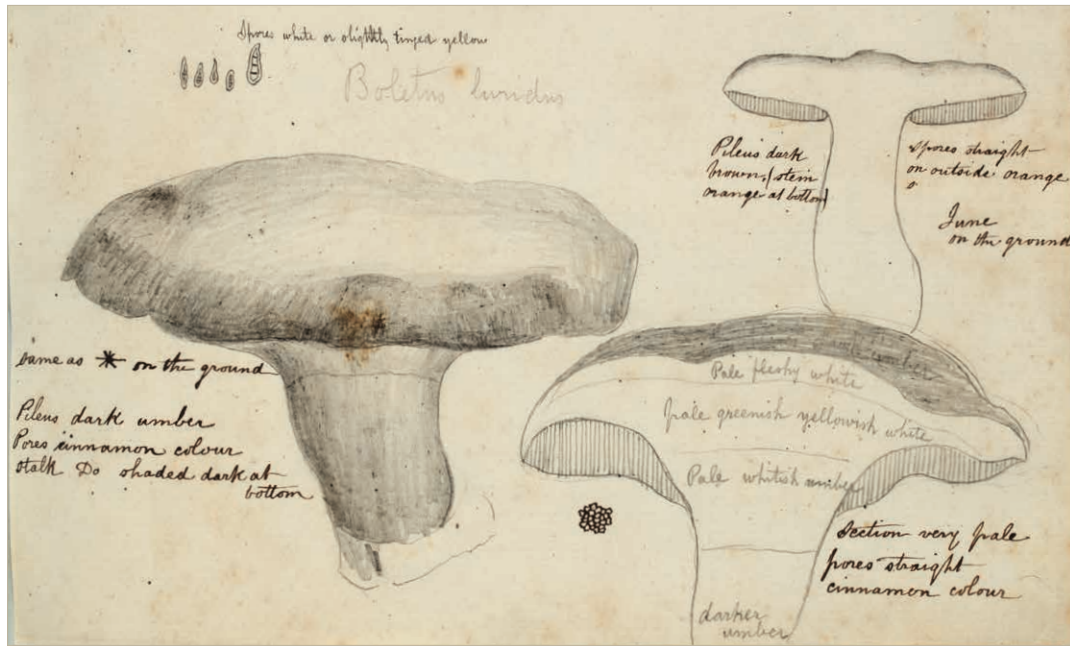


Figure 2. *Suillus quiescens* – suggested identification. Note also contaminant multiseptate spore (upper left). John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: 197.



Figure 3. *Puccinia otagense*. Padamsee & McKenzie (2017) suggested that this illustration dates from c. 1875, and shows distortion of the host *Clematis* stem, and reproductive stages of the fungus – aecia, spermatogonia and aeciospores (protospores). John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: s.n. 213.



Figure 4. *Gyromitra tasmanica*. John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: s.n. 227.

HISTORICAL SIGNIFICANCE OF BUCHANAN'S ILLUSTRATIONS

The illustrations in MS-41 are historically important as few pre-1900 illustrations of New Zealand fungi are known, even of common species; the drawings are also of artistic merit. Sometimes Buchanan's illustrations cannot be identified with confidence as diagnostic features and associated collection data are lacking or confused. Having attempted reassessment of identity where possible, we find that Buchanan's illustrations in MS-41 provide the first records of 20 species that were not formally named until several years to decades later (Table 1). *Cyclocybe parasitica* (G. Stev.) Vizzini (Fig. 5), for example, is a common indigenous mushroom of large size with a characteristic hanging veil, parasitic on a range of native and introduced hardwood trees. It is edible and was known to Māori as tawaka (Fuller *et al.* 2004; Buchanan *et al.* 2017). Colenso (1891) and following authors referred to tawaka as the exotic *Agaricus pudicus*, and it was not until Stevenson (1982) compared New Zealand and Australian material with related species of *Agrocybe* that the Australasian species was recognized as new, as *Agrocybe parasitica* G. Stev. *Amanita australis* G. Stev. (Fig. 6), *Russula acrolamellata* McNabb (Fig. 7), and *Crinipellis novae-zelandiae* G. Stev. (\equiv *Lentinula novae-zelandiae* (G. Stev.) Pegler; Fig. 8) are three other examples where Buchanan's illustrations were almost a century ahead of the species descriptions.

Fungal material sent for identification to Kew by early New Zealand collectors was often misinterpreted

(e.g., by J.D. Hooker, M.C. Cooke) as widespread species known already from the Northern Hemisphere. Colenso (1885), quoting Joseph Hooker's response to his fungal specimens, wrote: '...While many of them are already well-known to science from other countries; on the other hand, almost all the species you have now sent are new to the islands of New Zealand, and thus give an idea how vast a number of widely distributed forms remain to be collected.', and in Colenso (1887):



Figure 5. *Cyclocybe parasitica* – tawaka. Conspicuous veil not evident on this specimen, but rough sketch on p. 222 shows an expansive veil. John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: s.n. 219.

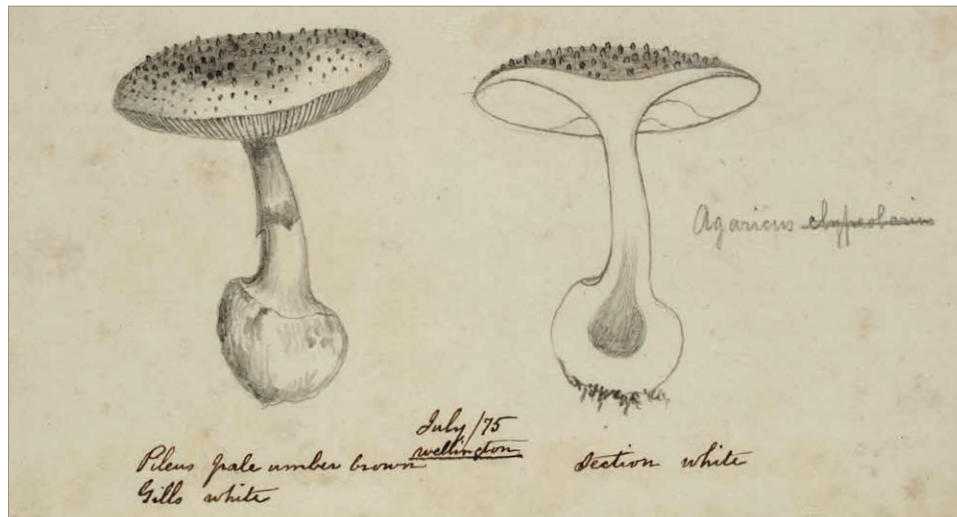


Figure 6. *Amanita australis*. John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: 195.

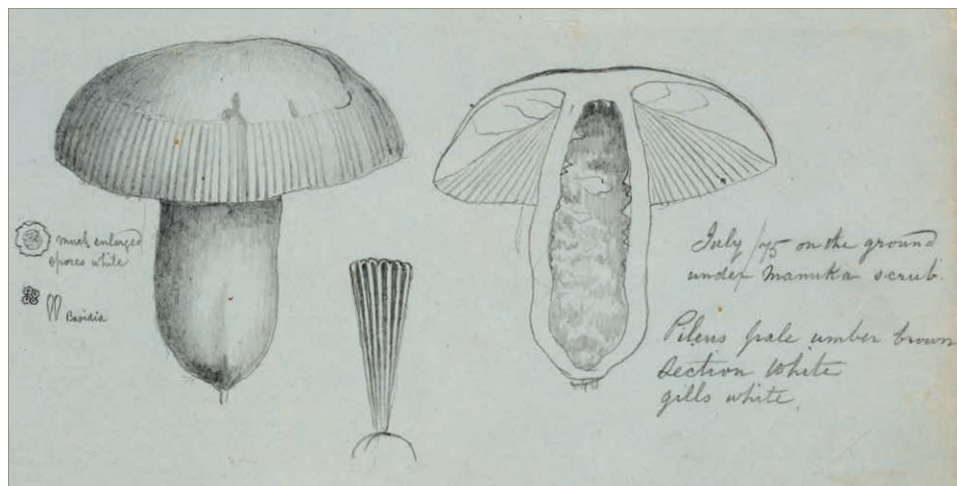


Figure 7. *Russula acrolamellata*. John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: s.n. 203.

'...a total of 179 species [of fungi] are new to the New Zealand flora; and of these only 18 species have been determined as new to science'. Subsequently, it has become evident from more detailed studies that many New Zealand fungi are endemic and only superficially similar to their northern relatives.

Early illustrations of ectomycorrhizal fungi that are obligate associates of particular host tree species can contribute new knowledge about the timing of host-fungus associations. Buchanan's illustration of *Thelephora terrestris* Ehrh. (Fig. 9) under exotic pines in the Botanic Gardens indicates early recognition of this introduced fungus accompanying its Northern Hemisphere host. His drawing of a bolete that we suggest could be the introduced *Suillus quiescens* T.D. Bruns & Vellinga (Fig. 2) if also collected under pines, would predate its description in its North American homeland

by over 120 years. An especially large and conspicuous bolete illustrated by Buchanan as a full page (Fig. 10) lacks host data but was first formally recorded from New Zealand in the 1960s as *Phaeogyroporus portentosus* (Berk. & Broome) McNabb (McNabb 1968); it is now considered to belong in the genus *Phlebopus* but is phylogenetically distinct from named species. On the other hand, the lack of an illustration in MS-41 of *Amanita muscaria* (L.) Lam., the conspicuous mushroom with red caps and white spots so common today under pines and oaks, correlates with the later introduction to New Zealand of this ectomycorrhizal species, first reported here in 1937 (McKenzie 2004).

Other items of interest in MS-41 include an occasional new host record, as in Buchanan's data on the edible wood decay fungus *Auricularia cornea* Ehrenb. (wood ear, Taranaki wool, hakeka, Fig. 11). Noting its

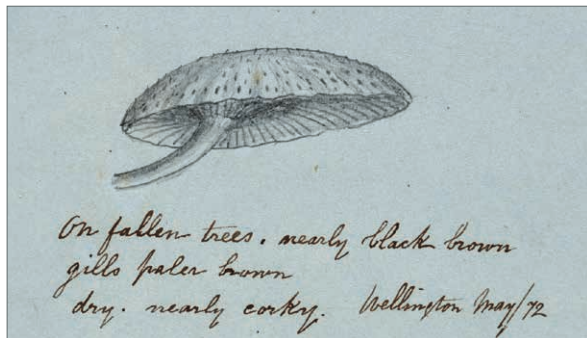


Figure 8. *Lentinula novae-zelandiae* (= *Crinipellis novae-zelandiae*) – New Zealand ‘shiitake’. John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: 175.



Figure 9. *Thelephora terrestris*. John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: s.n. 224.

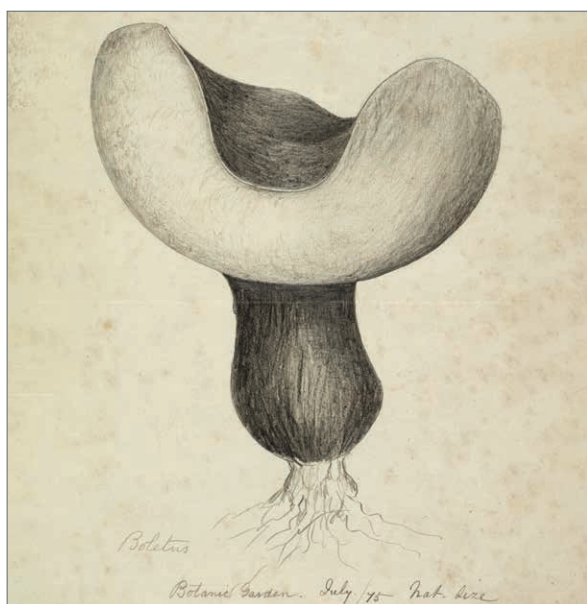


Figure 10. *Phlebopus* sp. (= *Phaeogyroporus portentosus*). John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: s.n. 209.

commercial harvest and export trade to China (see also Drabble 1996; McKenzie 2004), Buchanan illustrated a specimen collected from whale bone; to our knowledge this is the only New Zealand record of a non-plant substrate for this species.

As an artist at the Colonial Museum, Buchanan illustrated many papers in the first 19 volumes of the journal *Transactions and Proceedings of the New Zealand Institute* (Sampson 1985) and is credited as New Zealand’s first scientific illustrator (Nathan 2019). Colenso’s papers in the *Transactions* (e.g., Colenso 1885, 1887) reported new fungal records for New Zealand based on Colenso’s collections sent to J.D. Hooker at Kew and identified by M.C. Cooke. Colenso’s papers may have stimulated Buchanan’s interest in describing fungi himself. The last illustration in MS-41, dating from about 1885, is annotated: “... This should be called *Agaricus adhaerans* N. Sp. J.B.” although Buchanan did not publish this. In 1886 Buchanan published his sole mycological paper on a new species of *Cyttaria*.

Cyttaria purdiei Buchanan

Buchanan (1886) described and illustrated *Cyttaria purdiei* Buchanan, naming it in honour of his Dunedin botanical friend Alexander Callander Purdie (1824–1899) (Scholefield 1940: Vol. 2, 189). The species can be separated by its pear-shaped fruitbodies and lack of the enlarged supporting galls of host tissue associated with *C. nigra* Rawlings and *C. pallida* Rawlings, two other NZ species. It was also described and illustrated as having red beech *Fuscospora fusca* (as *Fagus fusca*) as host, whereas the other three species, including New Zealand material labelled *C. gunnii* Berk. occur on silver beech *Lophozonia menziesii* (Rawlings 1956; McKenzie *et al.* 2000; Peterson *et al.* 2010). Authenticated specimens of *C. purdiei* were not indicated by Buchanan (1886).

Since publication, the name *C. purdiei* has been mostly ignored or cited as a synonym of *C. gunnii*. The latter was considered an Australasian species until Peterson & Pfister (2010) differentiated Australian and New Zealand material of *C. gunnii* as separate non-sister clades. Since *C. gunnii* was first described from Tasmania, the name has been misapplied for the New Zealand taxon and a new name is needed. Peterson & Pfister (2010) judged that *C. purdiei* could not be a candidate for the New Zealand ‘*C. gunnii*’ due to inadequacies in Buchanan’s description and illustration, and the lack of type material. There is little doubt, however, that Buchanan’s illustration refers to the species misidentified as *C. gunnii* in New Zealand, despite the erroneous host. In a future publication we will designate Buchanan’s illustration as a lectotype for *C. purdiei* and nominate an epitype.

ACKNOWLEDGEMENTS

We appreciate the opportunity provided by the Auckland War Memorial Museum to reproduce and publicise the contents of MS-41, since so few illustrations of fungi are available from this era of early European history in New Zealand. We also thank Linda Tyler (University

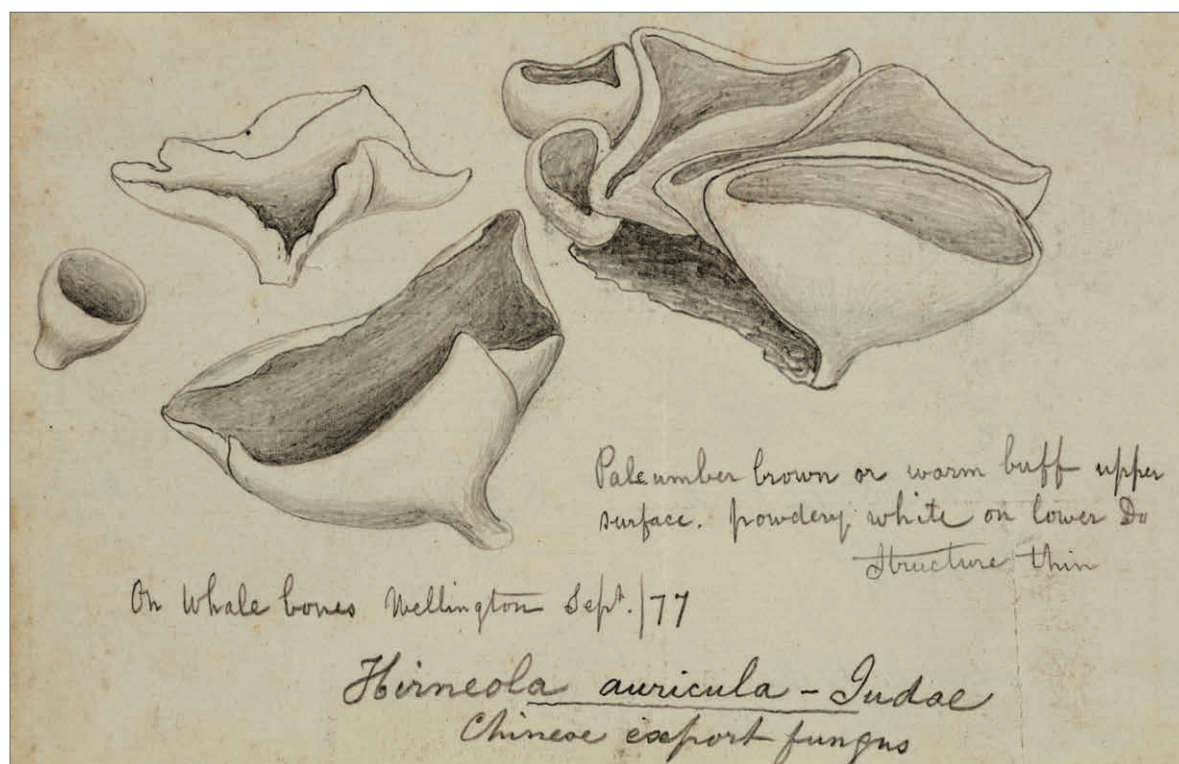


Figure 11. *Auricularia cornea* – wood ear, hakeka, reported from whale bones. John Buchanan Botanical Notebook, 1866–1886. Auckland War Memorial Museum Tāmaki Paenga Hira. MS-41: s.n. 220.

Table 1. List of fungal basionyms and dates of publication for those identifiable species illustrated in Buchanan's MS-41 that predate, by years to decades, their description as new species. Current names or other nomenclatural comments are indicated, and some of Buchanan's illustrations have been reproduced.

- Agrocybe parasitica* G. Stev. 1982 – current name: *Cyclocybe parasitica* (G. Stev.) Vizzini 2014, see Fig. 5
Amanita australis G. Stev. 1962 – see Fig. 6
Armillariella limonea G. Stev. 1964 – current name: *Armillaria limonea* (G. Stev.) Boesew. 1977
Ascobolus raripilus W. Phillips 1878 – current name: *Cheilymenia raripila* (W. Phillips) Dennis 1960
Clavulina brunneocinerea R.H. Petersen 1988
Clavulinopsis sulcata Overeem 1923
Crinipellis novae-zelandiae G. Stev. 1964 – current name: *Lentinula novae-zelandiae* (G. Stev.) Pegler 1983, see Fig. 8
Galerina patagonica Singer 1954
Gyromitra tasmanica Berk. & Cooke 1878 – see Fig. 4
Hydnum crocidens var. *badium* McNabb 1971
Laccaria fibrillosa McNabb 1972
Lycoperdon compactum G. Cunn. 1926 – current name: *Morganella compacta* (G. Cunn.) Kreisel & Dring 1967
Lycoperdon perlatum sensu G. Cunn. 1944 – current name: *Lycoperdon* sp., requires re-evaluation
Mycena roseoflava G. Stev. 1964
Phaeogyroporus portentosus sensu (Berk. & Broome) McNabb 1968 – current name: *Phlebopus* sp., requires re-evaluation
Psilocybe asperospora Cleland 1934 – current name: *Lacrymaria asperospora* (Cleland) Watling 1979, requires re-evaluation
Russula acrolamellata McNabb 1973 – see Fig. 7
Secotium porphyreum G. Cunn. 1924 – current name: *Cortinarius porphyroideus* Peintner & M.M. Moser 2002 *sensu lato*
Secotium virescens Masee 1890 – current name: *Clavogaster virescens* (Masee) J.A. Cooper 2015
Suillus quiescens T.D. Bruns & Vellinga 2010 – suggested identification, see Fig. 2

of Auckland) and the late David Galloway (Dunedin) for recognizing the significance of MS-41 and inviting this paper as part of their November 2012 symposium in Dunedin on the life of John Buchanan. This paper was initially contributed for the proceedings of that symposium, but those were not published.

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The flora and vegetation of Dayrell Island, Herald Islets, northern Kermadec Island group

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Abstract

The flora, avifauna, lichenised mycobiota and vegetation of Dayrell I, northern Kermadec Is, is described based on a four-hour visit made there on 18 May 2011. Dayrell I has a flora and lichenised mycobiota of 80 taxa (one unidentified cyanobacterium, 10 marine algae, 21 lichens, four mosses, four ferns, and 40 flowering plants). Five vegetation associations are described including the first documented record of makatea from the Kermadec Is. The vegetation of Dayrell I was at the time of the visit recovering from the impact of Cyclone Bune which traversed the Kermadecs on 28 March 2011.

Keywords

Kermadec Is; Dayrell I; makatea; biota; vegetation associations; Cyclone Bune.

INTRODUCTION

Dayrell I (58 m a.s.l., 6.07 ha, 29°14'43.10"S, 177°51'26.14"W, Figs 1, 2) located 3.8 km NNE of Turtle Bay, Raoul I., is the northern most of the Herald Islets (the others of which are North, South and West Chanter, and in some accounts also Napier and Nugent (see Sykes 1977)). Although Dayrell I is briefly discussed (as part of the Herald Islets) by Sykes (1977) there has not been a specific account of its flora and vegetation published.

Whilst participating in the 2011 Auckland Museum Kermadec Biodiscovery expedition (Trnski & de Lange 2015) the senior author visited Dayrell I on 18 May 2011 in the company of two marine biologists. During that visit, lichenised mycobiota, flora and marine invertebrate specimens were collected, observations on the avifauna made, and rock samples, notes and images taken. Dayrell I, and nearby Napier I., Nugent, and the Chanters (which were also visited on the expedition), were found to support 3.54 ha of makatea, a hitherto unrecognised karst landform and ecosystem for the Kermadec Is and new to geopolitical New Zealand (de Lange 2011a). Prior to that visit the flora, fauna and vegetation of Dayrell I were investigated over two short visits in 1966 and 1984 by W.R. Sykes (pers. comm., December 2014). However, Sykes's notes from those visits were never published, though he did provide a summary listing of the vascular flora of that island (Sykes 1977). Aside from that listing it seems that nothing further has been published about the vegetation and flora of Dayrell I. Therefore, this paper provides an account of the flora, lichenised mycobiota, avifauna and vegetation of Dayrell I, as well as a description of the makatea.

GEOLOGY AND PHYSIOGRAPHY

The geology of Dayrell I has been described in detail by Brook (1998) who placed it and the nearby Chanters within his early Pleistocene-aged Herald Group, as two distinct formations, the Chanter and Dayrell Formations. The basal Chanter Formation Brook (1998) described as a submarine volcanogenic unit (comprising submarine lava flows, tephra and vent lithofacies on Dayrell), while the overlying Dayrell Formation he defined as a sedimentary, fossil-rich unit. Both units are exposed on Dayrell I, with the basal volcanogenic Chanter Formation forming roughly the bottom third of the island, and the Dayrell Formation the remainder (Fig. 3). It is the Dayrell Formation that includes *in situ* coral and limestone. The limestone is initially manifest on the lower slopes of the island as sporadic *in situ* coral heads and patch reefs perched on the underlying volcanogenic Chanter Formation. Further up the island the coral aggregates into a continuous encircling limestone composed of a coarse calcarenite comprising shells, eroded coral blocks and coral fragments. About a third of the limestone is buried by a cap of mantle-bedded airfall tephra that covers the upper 20 m or so of the island forming the summit cap (58 m a.s.l.).

The physiography of the island is precipitous. Aside from a small portion of the northern coastline Dayrell I is cliff girt. The cliffs of the southern, western and eastern sides of the island rise from the sea directly up to the summit. However, on the northern coastline the encircling cliffs are lower (30–35 m) and, due to erosion of the summit capping tephra, the limestone that forms the upper portion of the cliffs is exposed to the elements

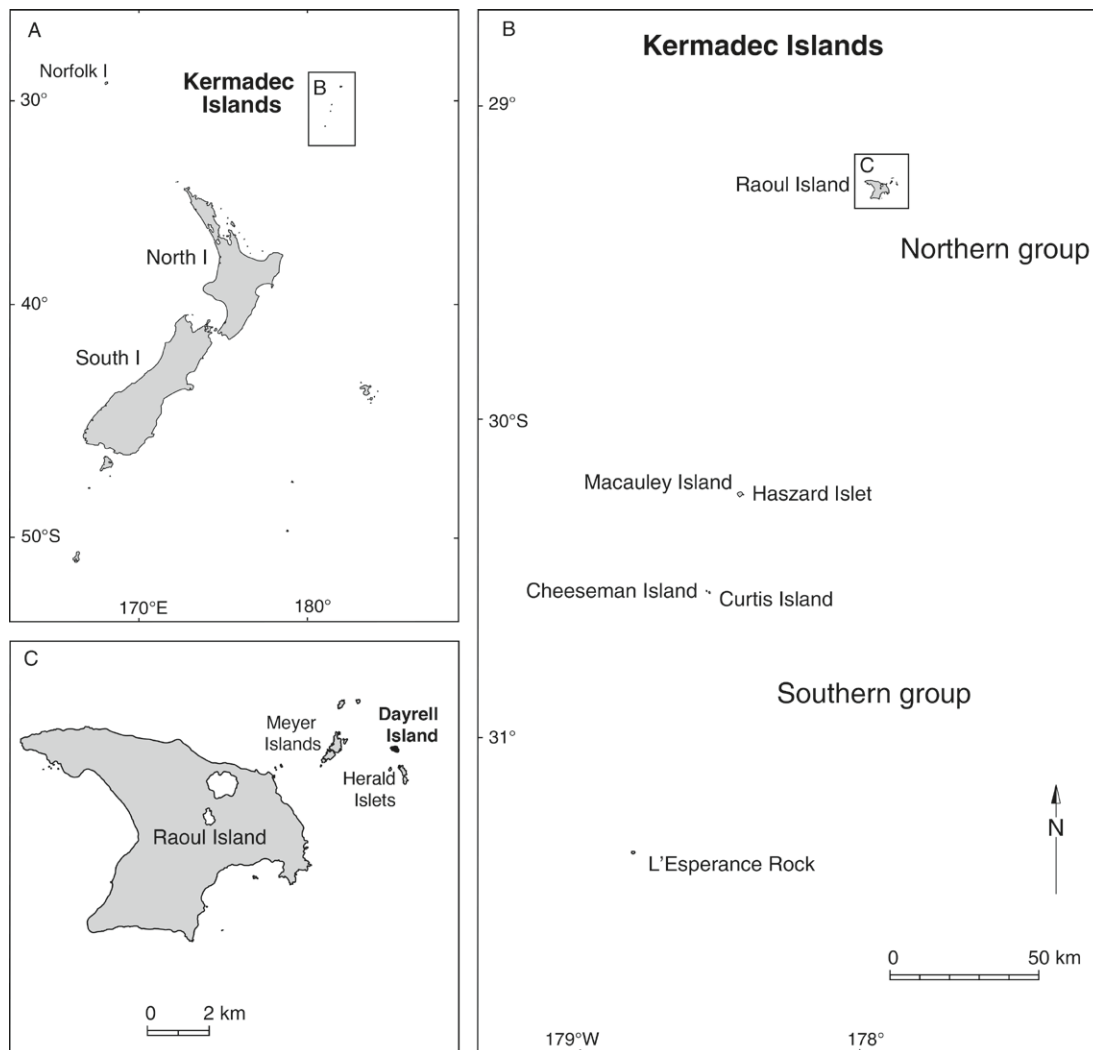


Figure 1. Location of Dayrell I within the Kermadec Islands group. A, location of the Kermadec Islands (B) with respect to New Zealand and Norfolk Island; B, the Kermadec Island group showing the Northern and Southern groups and location of Dayrell I (C); C, the location of Dayrell I in relation to Raoul I and adjacent smaller islands of the northern Kermadec group.

(Fig. 4); it is here that the karst landscape on which a distinct vegetation association known in the Pacific as ‘makatea’ (Mueller-Dombois & Fosberg 1998; Sykes 2016) has developed.

Makatea is described as a deeply dissected, pitted (in places razor sharp), porous, drought-prone, karst landscape (Mueller-Dombois & Fosberg 1998; Sykes 2016), which is often sparsely vegetated with low growing shrubs, vines, scrambling plants and herbs. On Dayrell I makatea occupies an area of 0.76 ha and is confined to the central northern two-thirds of the island. Here it is manifest as a miniature karst landscape, complete with sinkholes, and solution karren whose tops have often weathered into narrow razor-sharp turrets (Figs 5, 6). Makatea occupying a total area of 2.78 ha is also present on nearby Napier I (0.4 ha), Nugent (768 m²) and the Chanters (North Chanter (1.4 ha), South Chanter (0.86 ha) and West Chanter (384 m²) (de Lange 2011b,c). That makatea has not been reported previously for the Kermadec Is probably reflects that few ecologists have visited the Kermadec Is, and of

those that have, they either did not make landfall on the islands supporting this landform, or if they had they did not seem to recognise it by this name. This omission is perhaps all the more understandable because the extent of makatea on the Kermadecs is minuscule (3.54 ha, 0.1% of the Kermadec Is total area), and all of it is confined to islands and islets that are very rarely visited by people. Nevertheless W.R. Sykes (pers. comm., December 2014) stated that he did recognise makatea on these islands but for various reasons failed to document it.

PREVIOUS BOTANICAL SURVEYS

Whilst it is likely that W.R.B. Oliver visited Dayrell I during his 10 month stay on the Kermadec Is (W.R. Sykes, pers. comm. December 2014) we can find no written account or herbarium specimens to prove this. The first known record of plants collected from Dayrell I that we could locate are those collections made by W.R. Sykes during his 1966 and 1984 visits. Although Sykes



Figure 2. Dayrell I aerial image courtesy of the New Zealand Department of Conservation.



Figure 3. Dayrell as viewed from the north-eastern side of the island near the landing made on 18 May 2011. In this image the three main geological formations of the island (Brook 1998) can be seen; the shore platform and lower cliffs of the Chanter Formation and the limestone of the Dayrell Formation whose surface expression forms the makatea, which is partially overlaid by a cap of mantle-bedded airfall tephra on which the summit forest can be seen.



Figure 4. Dayrell I north-eastern cliffs composed of limestone, showing their bedding and pitted karstic surface which forms the makatea.



Figure 5. Makatea vegetation still recovering from the passage of Cyclone Bune - note the fronds of *Asplenium decurrens* growing in small sinkholes and dead *Cyperus insularis* and *Disphyma australe* subsp. *stricticaule*.



Figure 6. Makatea vegetation still recovering from the passage of Cyclone Bune showing masses of *Disphyma australe* subsp. *stricticaule* with numerous seedlings of *Senecio kermadecensis*, *Solanum americanum*, *S. nigrum* and *S. opacum*, and resprouting *Cyperus insularis*. Note nesting Kermadec petrels (*Pterodroma neglecta*).

collected only four species from Dayrell I he recorded a total of 17 indigenous taxa (Sykes 1977). While he did not formally report any naturalised taxa from the islands in his Kermadec Bulletin, Sykes (pers. comm. December 2014) observed six naturalised plants: five (*Erigeron bonariense*, *Dactylis glomerata*, *Lepidium didymum*, *Paspalum dilatatum* and *Symphyotrichum subulatum*) are accepted here as naturalised, while the sixth he noted, a grass *Digitaria setigera*, is treated here as indigenous. Aside from these vascular plants Sykes did not record or collect any algae, lichens or mosses from the island.

Other than Sykes's collections, notes and tabulation of the indigenous flora of Dayrell I (Sykes 1977, Table 8) there seem to have been no other published accounts of the flora or vegetation.

METHODS

On the morning of May 18, 2011, the senior author spent four hours on Dayrell I. The landing was made on the northern side of the island where a series of small ledges and a narrow cleft exists within the central encircling cliffs, so enabling easy access to the central vegetated portion of the island.

Marine algae were collected into a solution of 1% formalin in seawater, and samples were retained in this preservative until they could be air dried back in New Zealand. Mycobiota and bryophytes were collected into paper bags and envelopes, and air dried in transit to New Zealand on the *RV Braveheart* (de Lange 2011a).

Vascular plants were lightly pressed in newspaper, wedged between cardboard, then lightly bound, placed in stout plastic bags, and preserved by pouring a solution of one-part ethanol to two parts acetic acid over them. In this way, they could be stored wet until they were able to be air dried back in New Zealand. These precautions were undertaken both to reduce biosecurity risks to New Zealand and to prevent specimens rotting in the humid weather conditions experienced during fieldwork on the Kermadec Is (de Lange 2011a-d).

Field observations on the avifauna, mycobiota, flora, vegetation associations and geology were recorded in a notebook and digital images taken to aid in later ecological interpretation. As time was limited qualitative rather than quantitative data were used to compile the vegetation associations recognised here, using the system described by Atkinson (1985).

Voucher specimens collected during the visit to the island are lodged in Auckland Museum (AK) and Unitec Institute of Technology Herbarium (UNITEC). Older voucher specimens in the Allan Herbarium, Landcare Research (CHR) were also examined. Herbarium acronyms follow Thiers (2020).

RESULTS

Mycobiota and Flora

A total of 80 taxa were recorded for Dayrell I (Appendix 1) and 75 of these are supported by herbarium vouchers in AK, CHR and UNITEC. The collections comprised:

one unidentified cyanobacterium, ten marine algae, 21 lichens, four mosses, four ferns, and 40 flowering plants. The collected specimens were lodged in the Auckland Museum Herbarium (AK) and the lichens at UNITECH. Only the cyanobacterium remain undetermined to family or lower rank, while of the ten marine algae collected (representing six taxa) two specimens were tentatively placed within *Porphyra sens.lat.* (at genus rank only) and *Clymene* (as *C. ?coleana*), while two more represent undetermined species of *Sargassum* and *Ulva* respectively.

Lichens, although widespread and common, were poorly sampled due to time constraints. Of the saxicolous lichens, determinations of several genera, particularly *Buellia*, proved especially difficult. In the case of *Buellia*, specimens collected while mostly approaching the descriptions and names available in Galloway (2007), often differed in spore length and width or thallus colour and it is quite likely that they represent other species from neighbouring island groups in the South Pacific or even new species (see Elix & de Lange 2017). Nevertheless, it is hoped that by documenting the presence of this genus on the island (and indeed the Kermadec Is), this may encourage further study of the collections made by those engaged in worldwide revisions of these lichens. The canopy branches of the island's summit forest of Kermadec pōhutukawa (*Metrosideros kermadecensis*) mostly supported a range of Parmeliaceae taxa. Of these, *Parmotrema cetratum* and *P. reticulatum* were

especially conspicuous. Also noted on these trees were *Halegrapha mucronata*, *Heterodermia tremulans*, *H. speciosa*, *Ramalina celsa*, *R. leiodea*, *R. exiguella*, *R. pacifica*. Although a full assessment of the lichens present on the limestone outcrops of the makatea was not possible due to time constraints, *Ramalina microspora* was locally common on some exposures of this rock (for a full account of the Kermadec Is *Ramalina* see de Lange & Blanchon 2015).

Avifauna

The most commonly encountered bird was the Kermadec petrel (*Pterodroma neglecta*), numerous individuals of which were seen roosting in trees or on the ground (Figs 6, 7), or attending their nests (usually a slight scrape or hollowed out portion of vegetation (and then most often *Cyperus insularis*) in which a solitary egg had been deposited). Although Kermadec petrels were found throughout the makatea and forested portion of the island they were most common in the makatea. Less frequently seen were wedge-tailed shearwaters (*Puffinus pacificus pacificus*); mostly mature adults roosting on the ground within the forest, but also sparingly down-covered, moulting juvenile fledglings. Several adult red-tailed tropic birds (*Phaethon rubricauda*) were noted in shaded limestone overhangs, while a pair of Tasman boobies (*Sula dactylatra tasmani*) were seen roosting on the jagged limestone. Within the makatea and forest occasional Kermadec kākārīki (*Cyanoramphus*



Figure 7. Dayrell I summit forest ground cover dominated by purslane (*Portulaca oleracea*) through which grew *Cotula australis*, *Digitaria setigera*, *Lachnagrostis littoralis* subsp. *littoralis*, *Lepturus repens* *Senecio kermadecensis* and *Solanum* spp. The green algae on the rocks is a species of *Prasiola*. Note nesting Kermadec petrels (*Pterodroma neglecta*).

novaezelandiae cyanurus) were seen, notably a pair scavenging the carcass of a Kermadec petrel. Similar feeding observations were also made from North Meyer a few days earlier (de Lange 2011b). Within the summit forest a pair of spotless crakes (*Porzana tabuensis*) were also encountered. These birds are now abundant on Raoul I. As the habitat on Dayrell I is limited it is likely that these birds have a transitory presence there rather than a permanent one. Also observed was a solitary great frigate bird (*Fregata minor*) circling the island summit forest. This was possibly the same bird that was noted on 17 May 2011 circling the summit of nearby Napier I.

Cyclone Damage

As with elsewhere in the Kermadec Is the vegetation cover of Dayrell I had been severely impacted by the passage of Cyclone Bune on the 28 March 2011 (de Lange 2011c, d, e; de Lange 2015a, b). At the time of the 18 May 2011 visit to Dayrell I 44 days had elapsed since the cyclone, so storm damage was still very evident, the cyclone leaving large areas of exposed, loose, eroding

soil, wind blasted, defoliated (or nearly so) shrubs and trees and wind thrown Kermadec ngaio (*Myoporum rapense* subsp. *kermadecense*) and pōhutukawa (*Metrosideros kermadecensis*). Recovery from this destruction was evident by the numerous seedlings (mostly at the cotyledon stage) of *Cotula australis*, *Disphyma australe* subsp. *stricticaule*, *Chenopodium* spp. (cotyledon stage), *Gamochaeta* (cotyledon stage), *Parietaria debilis*, *Senecio kermadecensis*, *Solanum* spp. (cotyledon stage), and various grasses (*Digitaria setigera* and *Lachnagrostis littoralis* especially), while both ngaio and pōhutukawa were covered in epicormic growth. No cyclone damage was evident in the *Cyperus insularis* but many of the scrambling plants, such as *Canavalia rosea*, *Chenopodium trigonon* and *Disphyma* were >80% dead.

Vegetation Associations

The vegetation of Dayrell I appears to be naturally restricted to the upper portion of the island (Fig. 8). The area occupied roughly corresponds to the surface expression of the Dayrell Formation (Brook 1998). It

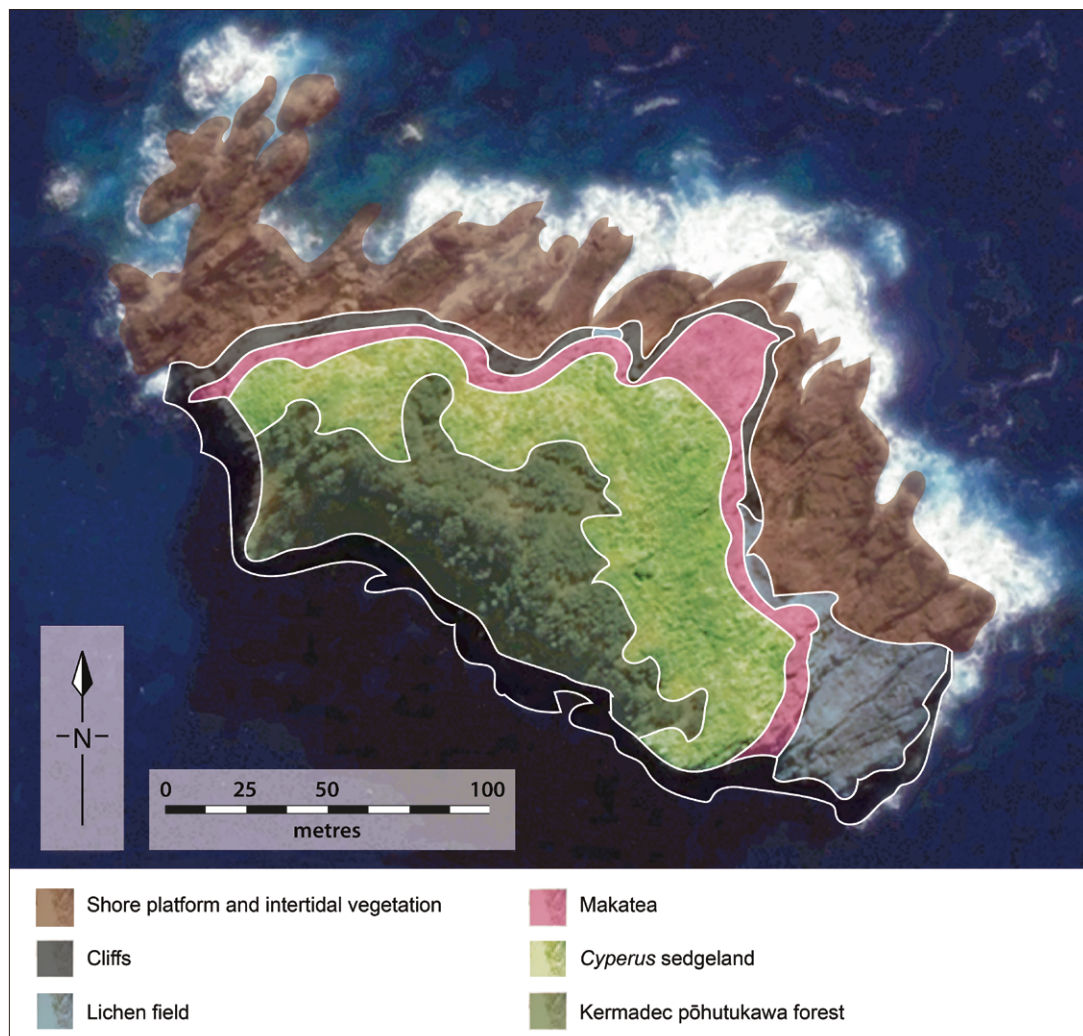


Figure 8. Vegetation associations of Dayrell I as discussed in text. Base image (see Fig. 2) courtesy of the New Zealand Department of Conservation.

is also likely that the extent of the vegetated area seen during the visit had been affected and reduced by the passage of Cyclone Bune. Six vegetation associations (Fig. 8) were observed in the field using the vegetation classification system of Atkinson (1985).

1. Shore Platform and Intertidal Vegetation

Because of strong surges experienced during the landing on Dayrell I a thorough study of the intertidal vegetation was impractical. Nevertheless a few collections and observations were made. The most commonly encountered seaweed was a species of *Sargassum* that formed yellow-brown, pliant, leathery tufts up to 60 mm tall and as much wide. This *Sargassum* is commonly seen on the exposed shores of the Kermadec Is, but it has yet to be identified below genus rank (W.A. Nelson, pers. comm. August 2011). The only associates of the *Sargassum* noted were a few minute thalli of a purple-pink seaweed (possibly a species of *Porphyra*), what may be *Clymene coleana* and in one place *Osmundaria colensoi*. Here too on the tops of Kermadec limpet (*Scutellastra kermadecensis*) exposed along the surge zone grew tufts of *Cladophora prolifera*. Within this zone where water was sweeping across the rocks and/or where pools had formed within a series of depressions and collapsed tunnels in the exposed lava, grew a sparse algal flora of three species: *Pterocladia capillacea*, *Martensia fragilis* and *Caulerpa racemosa*. Higher up the island, in a series of shallow, brackish pools grew two filamentous 'algae', a species of *Ulva* and an undetermined cyanobacterium (W.A. Nelson, pers. comm. August 2011).

2. Cliffs

The cliff faces of Dayrell, particularly those on the southern side of the island, supported a distinct vegetation dominated by *Cyperus insularis*, *Lachnagrostis littoralis*, *Disphyma australe* subsp. *stricticaule*, *Chenopodium* spp. (which species could not be determined safely), augmented by occasional specimens of *Wahlenbergia vernicosa*, *Sonchus kirkii* and, especially in sites used as roosts by red-tailed tropicbird, *Digitaria setigera*, *Senecio kermadecensis* and *Polycarpon tetraphyllum*. Nearer the summit forest on the west and south-western facing cliffs occasional tufts of *Poa polyphylla* were also noted. This species, though common on Raoul I and present on Macauley I (de Lange 2015a), was otherwise only seen in these outer islands on the Meyers.

3. Lichenfield

On the north-eastern and eastern side of the island, where the Dayrell Formation overlies the volcanogenic Chanter Formation, the contact is delineated by a limestone cliff of some 2–6 m high. Here a diverse lichenfield was noted, however due to time constraints few specimens were collected. Of those seen, the most visually conspicuous on account of its bright orange-yellow colour was the foliose *Dufourea ligulata*, through which crustose 'dustings' of dark orange-red and yellow *Caloplaca* species (mostly *C. acheila*, *C. cf. lutea*, and *C. cf. sublobulata*) were commonly seen. In these same sites grew silvery-grey 'scabs' of

Buellia cf. stellulata, and *Ramalina microspora*, while on the underlying igneous rock occasional specimens of *Buellia cranwelliae* and numerous patches of *B. cf. stellulata* were noted.

4. Makatea

Although much of the vegetation covering the makatea of Dayrell I (Figs 5, 6, 9, 10) had been severely damaged by Cyclone Bune it was evident that the usual vegetation covering this karst landscape would have been one dominated by the scramblers *Disphyma australe* subsp. *stricticaule*, *Canavalia rosea*, *Chenopodium triandrum*, *C. trigonon* subsp. *trigonon*, *Tetragonia tetragonoides*, and the vine *Sicyos mawhai*. Scarce associates of this 'scrambler' vegetation also included *Ficinia nodosa*, *Hypolepis dicksonioides*, *Scaevola gracilis* and *Ipomoea pes-caprae* subsp. *brasiliense*. Shrubby plants within this vegetation included occasional *Coprosma petiolata* and numerous Kermadec ngaio. On the razorbacks and solution karren the fern *Asplenium decurrens* was the dominant vascular plant, reaching its greatest dominance on the sides of the solution flutes and runnels formed within the karrenfeld, and also at their bases where dark red-black rendzina soil has accumulated. Also growing on the limestone, though rather uncommonly, was the moss *Syntrichia phaea* whose colonies appeared as small black balls on the exposed limestone. In the runnels and miniature dolines, and on the associated rendzina the sedge *Cyperus insularis* was locally common. The most commonly encountered herb on the makatea, particularly in the limestone runnels and around petrel nests, was *Senecio kermadecensis* (though mostly seen during the visit as 10–30 mm tall seedlings) followed by *Cotula australis*. Less commonly seen, though their abundance was undoubtedly affected by the season and cyclone damage, was *Lepidium didymum*, *L. oleraceum*, purslane (*Portulaca oleracea*), *Solanum americanum*, *S. nigrum*, *S. opacum* and a single *Symphyotrichum subulatum*. Seedlings of *Parietaria debilis*, *Erigeron bonariensis* and an unidentified species of *Gamochaeta* were also occasionally observed on areas of eroded rendzina. The makatea also supported grasses of which the most commonly encountered were *Digitaria setigera*, *Eleusine indica*, *Lachnagrostis littoralis* subsp. *littoralis*, *Lepturus repens* and *Paspalum dilatatum*. The *Digitaria* and *Paspalum* were especially common where petrels and red-tailed tropic birds (*Phaethon rubricauda*) had been or were nesting.

5. *Cyperus insularis* sedgeland

Upslope of the makatea, where soil erosion and colluvium from the upper summit forest has covered the limestone (Fig. 10), *Cyperus insularis* is the dominant plant forming its own vegetation association. At the time of the field survey associated species were still in recovery from Cyclone Bune and so undoubtedly under-represented; those seen included occasional Kermadec ngaio and *Coprosma petiolata*, *Sicyos mawhai*, *Senecio kermadecensis* and *Solanum* spp. Much of this area was also occupied by nesting Kermadec petrels, whose nesting activities left patches of dead *Cyperus* or bare earth.



Figure 9. Makatea vegetation recovering from Cyclone Bune. It comprises *Cyperus insularis*, *Disphyma australe* subsp. *stricticaule* and occasional shrubs of Kermadec ngaio (*Myoporum rapense* subsp. *kermadecense*) and *Coprosma petiolata* in places where rendzina soil has accumulated to depths of up to 1 metre and the vegetation is sheltered by rock towers, sink holes and dolines. The shrubs were often festooned with *Canavalia rosea*, *Scaevola gracilis* and *Sicyos mawhai*.



Figure 10. View from summit slopes of Dayrell I looking north across *Cyperus* sedgeland that has developed on the colluvium that has crept down slope from the summit forest, and into the makatea vegetation.

6. Kermadec pōhutukawa forest

Above the makatea is a broad cap of mantle-bedded airfall tephra (Brook 1998). This area is entirely covered by an open, windshorn Kermadec pōhutukawa ‘forest’ (in places up to 6 m tall) (Figs 11, 12), through which occasional Kermadec ngaio and a single *Melicope ternata* were encountered. The understorey of this forest was sparse, comprising mainly scattered shrubs of *Coprosma petiolata* and, in one place, a single *C. repens*. Much of the ground cover was bare earth, a condition attributed in part to the effects of Cyclone Bune, but mostly to the ground nesting Kermadec petrels which dominated this area and whose nesting habits keep the vegetation sparse. Nevertheless, the most commonly encountered herbs and grasses in this area were purslane (Fig. 7), *Solanum* spp. (mostly cotyledon stage), *Digitaria setigera*, *Lachnagrostis littoralis* subsp. *littoralis*, *Lepturus repens*, and occasional tufts of *Poa polyphylla*. *Senecio kermadecensis* though present, was mostly found on the exposed south-eastern portion of this vegetation association, particularly along the contact between limestone and airfall tephra. A few mostly spent seeding plants of *Lepidium oleraceum* were also present in this vegetation, growing amongst

purslane within an active Kermadec petrel nesting ground. Another uncommon associate of the purslane ground cover was the fern *Nephrolepis brownii*. In places, the bare earth was covered in patches of *Bryum dichotomum*. Here too grew *Fissidens leptocladus* and, in shaded places, patches of an unidentified filamentous green alga and another minute, fruticose one, possibly a species of *Prasiola*. This latter entity was especially common in areas where guano had accumulated. On the Kermadec pōhutukawa trunks and branch undersides the moss *Syrrhopodon armatus* was also common, and in one place a small patch of *Pyrrosia serpens*, a new fern record for the Kermadec Is grew (Brownsey *et al.* 2020).

DISCUSSION

Overall the indigenous vascular flora of Dayrell has grown from the 18 taxa recognised by Sykes to 43, an increase of 139% in the 34 years that have elapsed since Sykes’s publication (Sykes 1977). As he did not give a complete listing of the exotic naturalised taxa a detailed analysis of the changes in the vascular flora between his visits and this one is difficult. Nevertheless, using his unpublished notebooks detailing visits made to the island



Figure 11. Interior of summit forest of Dayrell I. The dominant tree here, Kermadec pōhutukawa (*Metrosideros kermadecensis*) is in the process of recovering from the effects of Cyclone Bune.



Figure 12. Interior of summit forest of Dayrell I looking west toward Raoul I. The dominant tree here is Kermadec pōhutukawa (*Metrosideros kermadecensis*). The forest is just starting to recover from the passage of Cyclone Bune. Note the numerous seedlings covering the exposed soil, mostly *Cotula australis* and *Senecio kermadecensis*; the mosses covering the exposed rocks are *Bryum dichotomum* and *Fissidens leptocladus*.

in 1966 and 1984 the following naturalised plants were recorded: *Digitaria setigera*, *Eleusine indica*, *Lepidium didymum* (as *Coronopus didymum*), *Polycarpon tetraphyllum* and *Symphytotrichum subulatum* (as *Aster subulatus*). All of these taxa were found in 2011, though of them we now regard *Digitaria setigera* as indigenous (see de Lange *et al.* 2013a; de Lange *et al.* 2018).

With respect to the naturalised vascular flora, in 2011, a further seven taxa were recorded, and, allowing for the change in biostatus for *Digitaria setigera* discussed below, these additions represent a 175% increase within the naturalised vascular flora of the island. Of the new additions to the flora, Sykes (1977) considered *Dactylis* to be very scarce on Raoul I, as indeed it still is, whilst *Paspalum dilatatum* was then noted only from Raoul and The Meyer Is. The spread of *Paspalum*, whose sticky fruits are so readily moved by birds, to Dayrell I is not surprising. The spread of *Dactylis* may also be bird assisted, possibly via movement of Kermadec kākārīki between Raoul and the Herald Islets.

Only seedlings of *Gamochaeta* were seen in 2011, and these failed to survive cultivation back in New Zealand. Vegetatively, the young plants most closely resembled *Gamochaeta pensylvanica* and *G. subfalcata*, which are the two most likely species to occur on Dayrell I, as both are common on nearby Raoul I (Sykes 1977, as *Gnaphalium pensylvanicum* Wild. and *G. subfalcatum* Cabrera).

The presence of purslane is interesting. Sykes (1977) considered that this species was still in an active expansion phase on the Kermadec Is, being reported by him only from Raoul I and North Meyer in the northern Kermadec Is. By May 2011 this species was now present on both Meyers, Napier, Egeria Rock (de Lange 2014), the other Herald Islets visited and Cheeseman I (de Lange 2015b), testimony to its ease of dispersion as was hinted at by Sykes (1977: 131).

Of the remaining naturalised plants, Sykes (1977) noted that *Erigeron bonariensis* and *Sonchus oleraceus* were present on all the Herald Islets he visited, yet neither species was recorded during his 1966 and 1984 visits to Dayrell I. He did not record *Solanum nigrum* from the northern Kermadec group at all (Sykes, 1977).

Of the indigenous vascular plants recorded here, a few are either: new records for the Herald Islets and/or the northern Kermadec Islands group; confirmations of historically collected taxa (often with vague location details) that were accepted by Sykes (1977); or represent significant range extensions. Further, the naturalised status of one species, *Digitaria setigera*, awarded by Edgar & Connor (2010) is here questioned - see below.

Probably the most important of these indigenous plant records is *Lepturus repens*. This widespread tropical grass, which reaches its world southern limit on the Kermadec Is (Edgar & Connor 2010; Murray & de Lange 2013), was initially recorded from most of the Herald Islets and The Meyers in Table 8, by Sykes (1977: 191, Table 8) despite the implication (Sykes 1977: 171) that it was only recorded from one site on North Chanter. This error was later addressed by Sykes & West (1996) who confined this species to North Chanter and noted

that those plants matched var. *cinereus* (Burcham) Fosberg, because 'the Kermadec plant is semi-prostrate'. Subsequent study by the senior author in Auckland of live plants collected from North Chanter found that the 'semi-prostrate' growth habit was soon lost in cultivation. Additional 2011 collections of this species from North Chanter, Dayrell and Napier Is were of plants that had an erect, tufted growth habit. Therefore, Murray & de Lange (2013) suggested that New Zealand plants are better referred to *L. repens sens. lat.* The discovery of *Lepturus* on the other islands and islets where Sykes had initially reported it in (Sykes 1977: 191, Table 8) suggests that his original observations, subsequently refuted in Sykes & West (1996), were probably correct.

Lepidium oleraceum, treated as *L. oleraceum* var. *frondosum* Kirk, was noted by Sykes (1977) as only present in the southern Kermadec Island group (Curtis and Cheeseman Is). *Lepidium* was subsequently reported from Macauley I and Hazard Islet (Barkla *et al.* 2008; de Lange 2015a; de Lange *et al.* 2013b). Recently de Lange *et al.* (2013b) referred most of the southern Kermadec Islands group *Lepidium* to a new, Kermadec endemic species *L. castellanum* de Lange et Heenan. In the same publication, they also treated *L. oleraceum* var. *frondosum* as a synonym of *L. oleraceum*, a species that they also accepted from the Kermadec Is, recording it from Dayrell and Napier Is in the northern Kermadec Islands group, and from Curtis I and L'Esperance Rock in the southern Kermadec Islands group.

In this paper, we follow de Lange *et al.* (2013a) and treat *Digitaria setigera* as indigenous. As the basis for that change in biostatus was not elaborated by de Lange *et al.* (2013b) the reasoning is given here. *Digitaria setigera* was initially treated as indigenous to the Kermadec Is by Cheeseman (1888, 1906, 1925) and Oliver (1910). It was Sykes (1977: 166–167, as *D. pruriens* (Trin.) Büse) who first treated this grass as naturalised. However, his comments about it being suited to long distance avian dispersal, its close association on the Kermadec Is with sea bird nesting sites and other general comments about its indigenous status in the Tropical Pacific implies that he may also have considered it indigenous to the Kermadecs. In this respect it is notable that Veldkamp (1973), who synonymised *D. pruriens* with *D. setigera*, included the Kermadec Is in this species' natural distribution without further comment. Irrespective, Edgar & Connor (2010) followed Sykes (1977) and Edgar & Shand (1987) in treating this grass as naturalised though without providing any justification for their decision. Beyond the speculation by Whistler (1995) that *D. setigera* might possibly be an ancient Polynesian introduction to the Pacific, he and others (Green 1994; Whistler 1995; Edgar & Connor 2010; R.O. Gardner, W.R. Sykes & W.A. Whistler, pers. comms. December 2013) all regard this grass as indigenous to tropical Asia, Malesia, the Pacific Islands and northern Australia. With respect to the Kermadec Is, the presence of this species on the nearby Norfolk I group, where Green (1994) considered it indigenous, strengthens the argument that *D. setigera* is also indigenous to the Kermadecs. Outside the Kermadecs within the New Zealand Botanical Region (Trnski & de Lange 2015), Edgar & Connor

(2010) noted that *D. setigera* had been collected in 1840 from the Bay of Islands by members of the U.S Exploring Expedition. This record was accepted by Edgar & Connor (2010) as further evidence of the naturalised status of this grass to the New Zealand Botanical Region. Gardner (2020) however, has suggested that this record, the sole one reported from New Zealand, is the result of a labelling error, noting that such errors on specimens collected during that expedition are ‘all too common’. The only anomaly in the South Pacific occurrences of this grass seems to be Lord Howe I from where *D. setigera* is believed absent (Green 1994). Whilst its absence from there is unexpected this does not preclude an indigenous status in the adjacent island groups. Further, grasses are notoriously under collected and/or overlooked, so its apparent absence from Lord Howe may simply reflect that no one has yet found it there. Regarding decisions on biostatus, Heenan *et al.* (2009) noted the general failure of New Zealand botanists to fully explain their biostatus decisions, which they argue has resulted in the inappropriate relegation of a number of indigenous ‘weedy’ plants to ‘naturalised’ status. In this respect Sykes’s observations of *D. setigera* on the Kermadecs, notably that it is ‘associated with bird colonies’ of the more remote outer islands in the northern Kermadecs, and that its exact distribution on Raoul I was unclear due to field confusion there with the more common and undeniably naturalised *D. ciliaris* (Retz.) Koel (Sykes 1977: 167) tend to argue for an indigenous status. In fact, nothing concrete was ever offered by Sykes (1977) to justify the subsequent naturalised status he suggested and which was then allotted to this species by Edgar & Connor (2010).

Coprosma repens and *Tetragonia implexicoma* (as *T. trigyna* Banks et Solander) were accepted for the Kermadecs by Sykes (1977) based on earlier historical records only. During 2011 both species were subsequently collected from the southern Kermadec Islands group (de Lange 2015a, b). In the northern Kermadec Islands group *C. repens* was previously known only from one collection made from the ‘east coast of Raoul’ by Cheeseman (Sykes 1977: 138). The discovery of this species on Dayrell, albeit as a single individual, supports the statement made by Sykes (1977) that Cheeseman’s record was valid, and it also suggests that this species is probably present elsewhere in the northern Kermadec Islands group where it may have been overlooked through field confusion with the superficially similar *C. petiolata* (see comments by Sykes 1977). Similarly, Sykes (1977: 75) noted that *T. implexicoma* (as *T. trigyna*) had been collected from the ‘north coast of Raoul’ by Thomas Cheeseman but that he had not seen it there himself. While there seem to be no further records of that species from Raoul I, its discovery on Dayrell I suggests that it may be elsewhere in the northern Kermadec Island group.

Chenopodium triandrum is a new record for the Kermadec Is. As *Rhagodia triandra* (G. Forst.) Aellen this species had been recorded from the Kermadec Is by Sykes (1977). Later Sykes & West (1996) attributed the seed record of *C. allanii* Aellen and collections of *C. triandrum* (as *Rhagodia triandra*) accepted by Sykes

(1977) to *Einadia trigonos* (Schult.) Paul.G. Wilson subsp. *trigonos*, which is here treated as *C. trigonon* Schult. subsp. *trigonon*. While *C. trigonon* subsp. *trigonon* is very common on most of the Kermadec Is (Sykes & West 1996), it is now evident that *C. triandrum* is also present, though only it would seem, on the Herald Islets, and Napier and Nugent. On none of these islands is it common, though as it often grows with the superficially similar *C. trigonon*, it may be more abundant, because without careful inspection it is easily mistaken for the other species.

The discovery of the fern *Pyrrosia serpens* on Dayrell I is also noteworthy. The presence of this species on the Kermadec Is was documented in detail by Brownsey *et al.* (2020). This is the first record from the Kermadec Is; all other *Pyrrosia* herbarium specimens seen from there to date are *P. elaeagnifolia*. On Dayrell I *Pyrrosia serpens* was collected as a low epiphyte on the basal portion of the trunk of a *Metrosideros kermadecensis* within the summit forest. Its discovery on the Kermadec Is extends its southward range from its previous reported southern limit of Pitcairn I (25° 04’ S) to 29° 15’ S on Dayrell I

Sykes (1977) did not provide a detailed account of the distribution of the bryophyte and lichen taxa he reported from the Kermadec Is, and they are missing from his Table 8. Therefore, we cannot determine any changes in the diversity and distribution of bryophytes and lichens between Sykes’s visits to Dayrell I and the results reported here.

Of the mosses recorded from Dayrell I, two of these (the *Bryum* and *Fissidens*) are also found on the larger Meyer Is where they are common (de Lange & Beever 2015). It is surprising that *Syrrhopodon armatus*, so common on Dayrell, was not located on the Meyers (de Lange & Beever 2015). On Raoul I this species is very common in mid-slope, dense Kermadec pōhutukawa forest, so why it should be absent from the more extensive and denser forest cover of The Meyers yet present in the smaller, more open forest of Dayrell is unclear. The most plausible explanation is that *Syrrhopodon* is more likely overlooked on The Meyers rather than genuinely absent. Although *Syntrichia phaea* was erroneously recorded from the Kermadec Islands by Sykes (1977) and Beever *et al.* (1996), it was subsequently discovered on the islands (de Lange & Beever 2015), with records from Macauley and Dayrell Is. Interestingly this basicolous species was not recorded in 2011 from the makatea of the adjacent Chanters and Napier I. It may be genuinely absent from those islands, though it seems more likely that it was overlooked.

At present 91 lichenized fungi have been recorded for the Kermadecs Is (Sykes 1977; Galloway 2007; de Lange & Galloway 2015; de Lange 2014; de Lange 2015c, de Lange & Blanchon 2015; Elix & de Lange 2017). Of the 21 species recorded here from Dayrell I, seven (*Buellia cranwelliae*, *Caloplaca* cf. *lutea*, *Halegrapha mucronata*, *Lecidiella elaeochroma*, *Parmotrema austrocetratum*, *P. cetratum*, *P. tinctorum* and *Teloschistes flavicans*) are additions to the documented lichens of the Kermadec Is (see above references). Even with these additions it

should be stressed that the lichen mycobiota of Dayrell I remains poorly investigated. As with New Zealand (see Marshall *et al.* 2020 and references therein), the future focus of lichen collecting on the Kermadecs should be with crustose taxa, as these remain poorly collected from that island group and are where the greatest worldwide lichen diversity is anticipated to occur (Sipman & Aptroot 2001).

Finally, this paper, based as it is on four hours of dedicated collecting on a rarely visited island within the Kermadec Island group, highlights the importance of undertaking regular inspections of the outer islands, islets and rock stacks of the Kermadec archipelago. Prior to this visit there had been only two confirmed specialist botanical visits to Dayrell I in 1966 and 1984. Considering the importance of Dayrell I as a key site for such threatened plants as *Lepidium oleraceum* and *Senecio kermadecensis* and the ongoing risk of weed invasion from the nearby Meyers, this is insufficient. Further, as this paper has shown, the biota of Dayrell I is constantly changing. Therefore, to enable relevant management of the islands regular visits are needed to ensure that data available for the island are not antiquated.

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APPENDIX 1: Algae, vascular plants and lichenised mycobiota recorded from Dayrell Island

* denotes taxa naturalised to the Kermadec Islands
 AK Auckland War Memorial Museum Herbarium
 CHR Allan Herbarium, Landcare Research
 UNITEC Unitec Herbarium

	Noted by Sykes (1977)	Family	Abundance	Voucher
Rhodophyta (5)				
<i>Clymene coleana</i> (W.A.Nelson) W.A.Nelson	No	Bangiaceae	uncommon	AK 327418
<i>Martensia fragilis</i> Harv.	No	Delesseriaceae	uncommon	AK 356856
<i>Osmundaria colensoi</i> (Hook.f. et Harv.) R.E.Norris	No	Rhodomelaceae	uncommon	AK 356523
? <i>Porphyra</i> sp.	No	Bangiaceae	uncommon	AK 327420
<i>Pterocladia capillacea</i> (S.G. Gmel.) Santel et Hommers.	No	Gelidaceae	uncommon	AK 356522

	Noted by Sykes (1977)	Family	Abundance	Voucher
Chlorophyta (4)				
<i>Caulerpa racemosa</i> (Forssk.) J. Agardh	No	Caulerpaceae	uncommon	
<i>Cladophora prolifera</i> (Roth) Kuetz.	No	Cladophoraceae	common	AK 356536
<i>Prasiola</i> sp.	No	Prasiolaceae	common	AK 356606
<i>Ulva</i> sp.	No	Ulvaceae	abundant	AK 327416
Bryophytes (4)				
<i>Bryum dichotomum</i> Hedw.	No	Bryaceae	abundant	AK 326902
<i>Fissidens leptocladus</i> Rodway	No	Fissidentaceae	uncommon	AK 356604
<i>Syntrichia phaea</i> (Hook. f. et Wilson) R.H. Zander	No	Pottiaceae	uncommon	AK 326906
<i>Syrrhopodon armatus</i> Mitt.	No	Calymperaceae	abundant	AK 326907
Pteridophytes (4)				
<i>Asplenium decurrens</i> Wild.	Yes	Aspleniaceae	common	AK 356560
<i>Hypolepis dicksonioides</i> (Endl.) Hook.	No	Dennstaedtiaceae	one plant	AK 356403
<i>Nephrolepis brownii</i> (Desv.) Hovenkamp et Miyam.	No	Nephrolepidaceae	uncommon	AK 326587
<i>Pyrrosia serpens</i> (G. Forst.) Ching	No	Polypodiaceae	uncommon	AK 356559
Spermatophytes (40)				
Monocots II – Commelinids (9)				
<i>Cyperus insularis</i> Heenan et de Lange	Yes	Cyperaceae	abundant	AK 356857
<i>Ficinia nodosa</i> (Rottb.) Goetgh., Muasya et D. Simpson	Yes	Cyperaceae	uncommon	AK 356307
* <i>Dactylis glomerata</i> L.	No	Poaceae	one plant	AK 356525
<i>Digitaria setigera</i> Roem. et Schult.	No	Poaceae	abundant	AK 326642
* <i>Eleusine indica</i> (L.) Gaertn.	No	Poaceae	common	AK 326640
<i>Lachnagrostis littoralis</i> (Hack.) Edgar subsp. <i>littoralis</i>	Yes	Poaceae	common	AK 356557
<i>Lepturus repens</i> (G. Forst.) R.Br.	No	Poaceae	uncommon	AK 326590
<i>Poa polyphylla</i> Hack	Yes	Poaceae	uncommon	AK 356561
* <i>Paspalum dilatatum</i> Poir.	No	Poaceae	uncommon	AK 356526
Core Eudicots (31)				
* <i>Conyza bonariensis</i> (L.) Cronq.	No	Asteraceae	uncommon	AK 356528
<i>Cotula australis</i> (Spreng.) Hook. f.	Yes	Asteraceae	abundant	AK 356521
* <i>Gamochaeta</i> sp.	No	Asteraceae	uncommon	
<i>Senecio kermadecensis</i> Belcher	Yes	Asteraceae	abundant	AK 326645
<i>Sonchus kirkii</i> Hamlin	No	Asteraceae	uncommon	AK 356520
* <i>Sonchus oleraceus</i> L.	No	Asteraceae	uncommon	AK 356527
* <i>Symphotrichum subulatum</i> (Michx.) G.L. Nesom	No	Asteraceae	one plant	AK 326647
<i>Disphyma australe</i> subsp. <i>stricticaule</i> Chinnock	Yes	Aizoaceae	abundant	
<i>Tetragonia implexicoma</i> (Miq.) Hook. f.	No	Aizoaceae	uncommon	AK 356309
<i>Tetragonia tetragonoides</i> (Pall.) Kuntze	Yes	Aizoaceae	abundant	AK 326641
<i>Chenopodium triandrum</i> G. Forst.	No	Amaranthaceae	uncommon	AK 356407
<i>Chenopodium trigonon</i> Schult. subsp. <i>trigonon</i>	Yes	Amaranthaceae	common	AK 326644
* <i>Lepidium didymum</i> L.	No	Brassicaceae	uncommon	AK 326646
<i>Lepidium oleraceum</i> G. Forst. ex Sparrm.	No	Brassicaceae	one plant	AK 326586
<i>Wahlenbergia vernicosa</i> J.A. Petterson	No	Campanulaceae	uncommon	AK 356558
* <i>Polycarpon tetraphyllum</i> (L.) L.	No	Caryophyllaceae	abundant	AK 356537

	Noted by Sykes (1977)	Family	Abundance	Voucher
<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i> (L.) Ooststr.	No	Convolvulaceae	one plant	AK 326638
<i>Sicyos mawhai</i> I.Telford et P. Sebastian	Yes	Cucurbitaceae	common	AK 326639
<i>Canavalia rosea</i> (Sw.) DC.	No	Fabaceae	common	AK 356831
<i>Scaevola gracilis</i> Hook.f.	No	Goodeniaceae	one plant seen	AK 326637
<i>Metrosideros kermadecensis</i> W.R.B.Oliv.	Yes	Myrtaceae	abundant	AK 326643
* <i>Portulaca oleracea</i> L.	No	Portulacaceae	abundant	AK 326648
<i>Samolus repens</i> var. <i>strictus</i> Cockayne	Yes	Primulaceae	uncommon	AK 356306
<i>Coprosma petiolata</i> Hook.f.	Yes	Rubiaceae	uncommon	CHR 193461
<i>Coprosma repens</i> A.Rich.	No	Rubiaceae	one plant	AK 326588
<i>Melicope ternata</i> J.R. Forst. et G.Forst.	No	Rutaceae	one tree	AK 356605
<i>Myoporum rapense</i> subsp. <i>kermadecense</i> (Sykes) Chinnock	Yes	Scrophulariaceae	abundant	AK 326643
<i>Solanum americanum</i> Mill.	Yes	Solanaceae	uncommon	AK 356308
* <i>Solanum nigrum</i> L.	No	Solanaceae	common	AK 357088
* <i>Solanum opacum</i> A.Braun et C.D.Bouché	No	Solanaceae	uncommon	AK 357089
<i>Parietaria debilis</i> G.Forst.	Yes	Urticaceae	common	AK 356529
Chromista – Ochrophyta (Phaeophyceae) (1)				
<i>Sargassum</i> sp.	No	Sargassaceae	common	AK 356405
Cyanobacteria (1)				
Indet.	No	Unknown	abundant	AK 327422
Mycobiota				
Lichens (21)				
<i>Buellia cranwelliae</i> Zahlbr.	No	Physciaceae	uncommon	UNITEC 6967
<i>Buellia</i> cf. <i>stellulata</i> (Taylor) Mudd	No	Physciaceae	common	UNITEC 6968
<i>Caloplaca acheila</i> Zahlbr.	No	Teloschistaceae	common	UNITEC 6965
<i>Caloplaca</i> cf. <i>lutea</i> (J.R.Laundon) D.J.Galloway	No	Teloschistaceae	common	
<i>Caloplaca</i> cf. <i>subtobulata</i> (Nyl.) Zahlbr.	No	Teloschistaceae	common	
<i>Dufourea ligulata</i> (Körb.) P.James	No	Teloschistaceae	common	UNITEC 6962
<i>Halegrapha mucronata</i> (Stirt.) Lücking	No	Graphidaceae	common	UNITEC 7033
<i>Heterodermia speciosa</i> (Wulfen) Trevis.	No	Physciaceae	common	AK 356830
<i>Heterodermia tremulans</i> (Müll.Arg.) W.L.Culb.	No	Physciaceae	common	AK 357571
<i>Lecidella elaeochroma</i> (Ach.) Hazsl.	No	Lecanoraceae	common	UNITEC 7012
<i>Parmotrema austrocetratum</i> Elix et J.Johnst.	No	Parmeliaceae	uncommon	UNITEC 6958
<i>Parmotrema cetratum</i> (Ach.) Hale	No	Parmeliaceae	common	UNITEC 6961
<i>Parmotrema reticulatum</i> (Taylor) M.Choisy	No	Parmeliaceae	common	UNITEC 6960
<i>Parmotrema tinctorum</i> (Despr. ex Nyl.) Hale	No	Parmeliaceae	uncommon	UNITEC 6959
<i>Ramalina australiensis</i> Nyl.	No	Ramalinaceae	uncommon	UNITEC 6953
<i>Ramalina celsa</i> (Spreng.) Krog et Swinscow	No	Ramalinaceae	uncommon	UNITEC 6955
<i>Ramalina exiguella</i> Stirt.	No	Ramalinaceae	common	AK 330754
<i>Ramalina leiodea</i> (Nyl.) Nyl.	No	Ramalinaceae	uncommon	UNITEC 6954
<i>Ramalina microspora</i> Kremp.	No	Ramalinaceae	common	AK 330753
<i>Ramalina pacifica</i> Asahina	No	Ramalinaceae	common	UNITEC 6957
<i>Teloschistes flavicans</i> (Sw.) Norman	No	Teloschistaceae	uncommon	UNITEC 6966

The Naturalised Flora of Niue

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Abstract

The Polynesian island of Niue is home to c. 160 flowering-plant species that have naturalised since European contact. Another 60 or so wild-growing species are either pre-European ('Polynesian') introductions or native plants favoured by today's disturbance-regimes. There are also four 'data deficient' species—recent introductions whose degree of naturalisation is as yet unclear. All these species, and some that seem likely to occur just in cultivation, are briefly characterised with respect to their history and ecology on Niue and other islands in the central Pacific Ocean region. A first appendix covers the history of botanical collecting on Niue. A second discusses whether European visitors to the Pacific prior to Cook might have spread weeds in this region.

Keywords

Niue Island; Polynesia; naturalised flora; new records; indigenous flora; conservation; James Cook.

INTRODUCTION

The Polynesian island of Niue, the world's second-largest raised coral atolls (after Lifou in the Loyalty Is) lies isolated in the central tropical expanse of the Pacific Ocean, 19° south of the equator. Approximately five hundred kilometres to the west and northwest are the island groups of Tonga and Samoa, while the scattered islands of the Cook Islands Group are mostly situated twice that distance and more to the east.

Inland from its rugged coastline Niue once was forested by *Calophyllum*, *Dysoxylum*, *Planchonella*, *Pometia*, *Rhus*, *Syzygium* and *Terminalia* species. That forest has been greatly depleted and fragmented, first by a thousand years of Polynesian occupation and then by European-era logging and agricultural clearances, activities that intensified after World War II with the advent of the bulldozer and chainsaw (Wright and van Westerndorp 1965; Walter and Anderson 1995; Butler 2001; Pointer 2015). Forest now covers just a fifth of the island.

The altered terrain extends over nearly half the island, that is, c. 100 sq. km (Butler 2001). It comprises regenerating forest, scrub, *Nephrolepis*-dominated 'fernland', exhausted plantations, former pasture, roadsides, and waste ground. Limestone or coral sand is seldom far from the surface and the soils are generally drought-prone and somewhat deficient in potassium and nitrogen. Yearly rainfall is usually adequate for cultivation of the less-demanding crops, notably that of dryland 'talo' (*Colocasia esculenta*), but surface water is lacking. Introduced plants here find extensive opportunities but also a severe testing ground.

This article comprehensively records the species that in various ways and to various degrees have been able

to naturalise on Niue and adds ecological and historical information relevant to these naturalisations. Note that all taxa treated are flowering plants; no naturalised pteridophytes or gymnosperms have ever been recorded.

Fifty years ago, when agriculture was of primary importance to the island's economy, it was useful to know something about at least the most deleterious of the island's weeds. Today, with a declining population and an increased interest in low-input land uses like honey and vanilla production, and ecotourism, the reasons for studying the introduced flora have taken on a scientific focus. In particular, observations in the present article may be relevant to the planning of rare-plant conservation and habitat-restoration projects. They may also help focus paleoecological research with respect to the identification of pre-European and early post-European plant material.

PREVIOUS STUDIES

Because of Niue's isolation, and the quirks of history—no 19th C. missionary-collector like Samoa's Graeffe, Powell or Whitmee was ever stationed there—a long time elapsed between 1774, when the island was visited by James Cook and his botanists, and the first thorough examination of its flora by American botanist T.G. Yuncker in 1940. Between these dates only a few collections were made and these were generally of native species rather than introduced ones. (See Appendix 1 for a history of plant-collecting on Niue).

So the opportunity to document the original, pre-European flora of the island was lost, and modern authors have not always been able to decide on the status of its long-established introductions: are they Old World plants

that accompanied the Polynesians from island to island, or indigenous species that became weedy once humans created suitable habitat, or weeds that arrived more or less simultaneously with the Europeans and their imported goods, animals and bags of impure crop-seed, etc.?

Nevertheless, Yuncker's *Flora of Niue* (1943), written after more than a month's collecting (c. 600 numbers), together with the re-evaluation of his work by New Zealand botanist W. R. Sykes (1970) in an equally productive visit in 1965, provide a very adequate listing and ecological summary of the species introduced to Niue up until the latter time.

That baseline work has not been systematically updated, but additional records and commentary have been given by Whistler (1988), who compiled from the literature and herbarium collections a list of the flowering-plants he believed had naturalised in "Western Polynesia", that is, Wallis and Futuna, Niue, Tonga and Samoa. That list has several new records for Niue, most of which are based on collections Sykes had obtained in his second, 1975 visit, with one from a visit that Whistler himself had made in 1981. Later visits to Niue by each of these botanists (Sykes in 2006, Whistler in 1984, 1997, 2003 and 2013) have provided more information about its naturalised flora. Some of this, including nine new records, is published here for the first time.

The following list of naturalised species, then, can be regarded as being nearly up to date. The ecological information it contains, however, cannot because:

- a) the notes of Yuncker and Sykes are now more than fifty years old;
- b) several of the species Sykes said were common or abundant in 1965 have not been recollected, presumably because such plants do not get the attention that rarer ones do;
- c) the label-notes of the collections made since 1965 only occasionally refer to island-wide distribution and abundance. Consequently, the Discussion below of the island's naturalised flora is offered in just a discursive kind of way.

TERMINOLOGY AND PRESENTATION

What is a naturalised ('wild') plant? The list below includes all the slightly to very doubtful cases of Yuncker, Sykes, and later collectors, on the grounds that it is more useful just to state what a plant is doing in the way of growth and reproduction rather than to try to press it into some hard-to-define category. Generally, though, the conventional view of 'fully naturalised' is taken: it applies to an introduced plant that seems likely to be able to spread and persist indefinitely, either by seed or through some special vegetative feature. Growing vigorously, or 'seeding down' for a generation or two just at the place where it was planted, is not enough. Such plants can be termed 'casuals'—see the glossary of Sykes (1970: 299).

The term 'introduction' applies to a plant deliberately or accidentally brought to a place by humans. Niue's famine-food plants (*Amorphophallus paeoniifolius*, *Cordyline fruticosa*, *Dioscorea bulbifera* and *D. pentaphylla*, *Tacca pinnatifida*) in particular are so much at home in the island's natural vegetation that they might well be native species, but because some authors have supposed they might be 'ancient' (pre-European) introductions to some parts of Polynesia a liberal view has again been taken and these taxa have been included in the list, along with the evidence one way or the other. (Definite answers here though can only come from dating-studies—cf. the similar view taken by Clayton and Snow (2010: 5) about the status of Polynesian grasses).

Similarly, the list includes species that seem likely to be native to Western Polynesia but have a somewhat weedy lifestyle. This group includes at least the following: three grasses (*Chrysopogon acicularis*, *Eleusine indica*, *Miscanthus floridulus*), three climbers (*Abrus precatorius*, *Merremia peltata*, *Operculina turpethum*), a shrub (*Achyranthes aspera*) and three herbs (*Boerhavia diffusa* s.l., *Centella asiatica* and *Rorippa sarmentosa*).

At the other extreme are several species that are probably native to Western Polynesia but on Niue are found almost entirely just in cultivation: *Casuarina equisetifolia*, *Cocos nucifera*, *Cycas celebica* and *Phaleria disperma*. Except for the cycad (which is rare in gardens) these species too have been listed, the implicit question being, why have they not naturalised to a greater degree?

For some of the listed species comments are made, following the citation of the records and specimens, as to whether their naturalisation has been recorded elsewhere in the 'central Pacific Ocean region' (hereafter, CPO), that is, the islands from Fiji and Western Polynesia east to French Polynesia and the Pitcairn Islands. Generally, reliance has been placed on published sources, especially Whistler (1988) and Smith (1979–1991), but on-line databases, notably those included by the Consortium of Pacific Herbaria website (<https://serv.biokic.asu.edu/pacific/>), have been consulted too.

In making statements of a species' natural distribution, before it became a weed in the Pacific (and usually, elsewhere around the world), the historical and bibliographical information cited by Smith (1979–1991) has again been relied on. Indications of a species' preferred habitat can often be found in Sykes (2016), especially where the plant grows on the smaller islands of that archipelago, whose raised-coral ('makatea') terrain resembles that of Niue. For cultivated ornamental or otherwise useful species valuable ecological information will often be found in Staples and Herbst (2005).

Critical data as to whether an Indo-Malesian species might also have had a pre-European presence in the CPO are provided by the collections and records of the botanists of Cook's First, Second and Third Voyages in the latter part of the 18th C.—especially those of Banks

and Solander on the First Voyage (Society Islands only) and the Forsters on the Second Voyage (Society Islands and Tonga). In particular, if there is First Voyage material from the Societies, and Second Voyage material from Tonga, one has reason to think that the species might have long been widespread in the CPO. (Complications that could arise from the earlier presence of Europeans in the Pacific are addressed briefly in Appendix 2).

The invaluable monograph by Nicolson and Fosberg (2004) mainly concerns the collections made by J.R. and G. Forster on the Second Voyage (including those from Tanna, Vanuatu) but sometimes mentions Banks and Solander collections as well. Numerous references to Cook's Voyages 'material' (i.e., collections, and references published or in manuscript) can also be found in Seemann (1865–73), Drake (1892), and Smith (1979–91).

The nomenclature of the species-list largely follows Smith (1979–91), Nicolson and Fosberg (2004), and Sykes (2016).

Many of the determinations on the specimens of Yuncker, Sykes, Whistler and later collectors have been accepted at face value, but sometimes it has seemed that a check is advisable and in such cases it has been indicated whether or not this has been done. Taxonomic problems have brought an unavoidable vagueness to the entries for *Boerhavia*, *Leontodon*, *Oplismenus*, *Solanum* sect. *Lasiocarpum* (*S. repandum*), *Sorghum*, *Sporobolus*, and *Taraxacum*.

Where there are collections of a particular species subsequent to those obtained by Sykes in 1965 some or all of them have been cited, especially those with useful label notes. Quite a few notably weedy species said to be common in 1965 have not been collected subsequently, e.g., *Ageratum conyzoides*, *Commelina diffusa*, *Cyperus rotundus*, *Malvastrum coromandelianum*, *Mikania micrantha*, *Sida rhombifolia*, and *Spermacoce assurgens*. As noted above, this probably relates more to collectors' habits than to a decline in abundance.

The ecological notes in Yuncker (1943) and Sykes (1965) have been brought together ("Y, S — ") where it seems they might differ only by some chance or personal factor. Their actual words and phrases have generally been altered in the interests of brevity and clarity. Sometimes the notes of the two authors can be only partly combined, thus: "*f.* Sykes". Where they differ substantially each is given.

Yuncker and Sykes often referred to the physical geography of the island, noting whether a collection came from one or other of the two coastal terraces, or from the 'inland basin', that is, the old lagoon floor that lies centrally in the island and comprises about a third of its area (Schofield 1959; Wright and van Westerdorp 1965; Terrey and Nunn 2003). Here just the latter term has been kept, with "on the coastal terraces" replaced by "(very) near the sea". Fig. 1, from Sykes (1970), shows most of the localities he cited but not the airport and golf course, which lie close together on the southwest side of the island.

Page numbers have generally been included in the references because the principal works consulted vary so much in the arrangement of their families and genera.

The present article arranges the dicotyledons before the monocotyledons, their families alphabetically ordered. The composition of the latter is that of the latest (fourth) scheme of the Angiosperm Phylogeny Group (Byng *et al.* 2016), except that the family name Leguminosae is adhered to.

Only the best-attested Niuean plant names are cited (McEwen 1970; Sperlich 1997) and are given in italics following the binomial in the heading line for the species. Their pronunciation, variant spellings and sometimes their derivation can be found in the latter work.

Abbreviations and codes

The heading for each of the following 235 entries is annotated as follows:

- FNI fully naturalised introduction (from outside Western Polynesia). 99 spp.
 CAS casual, incompletely naturalised introduction. 59 spp.
 IND native to Niue or Western Polynesia, or at least an ancient (pre-European) introduction to the central Pacific Ocean region. 61 spp.
 DD data-deficient, a recent introduction, whose status cannot yet be assessed. 4 spp.
 ER introduced species apparently eradicated soon after discovery. 2 spp.
 NN introduced species not considered to have naturalised at all. 11 spp.
- S record of Sykes (1970)
 Y record of Yuncker (1943)
 esp. especially
f. according to
 nr near
 occ. occasionally
 us. usually,
 ! specimen seen
n.v. specimen not seen
- CPO central Pacific Ocean region, i.e., WP/F east to Pitcairn I. Gp, not incl. Hawaiian Islands
 WP/F Western Polynesia (Samoa, Tonga, Niue, Wallis and Futuna) and Fiji and Rotuma
- AK Auckland War Memorial Museum
 BISH Bishop Museum, Hawaii
 BM Natural History Museum, London
 BRI Queensland Herbarium, Brisbane
 CHR Allan Herbarium, Landcare Research, Lincoln New Zealand
 HAW University of Hawaii
 PTBG National Tropical Botanical Garden, Hawaii
 US United States National Herbarium, Washington D.C.
 WELT Museum of New Zealand Te Papa Tongarewa Herbarium, Wellington

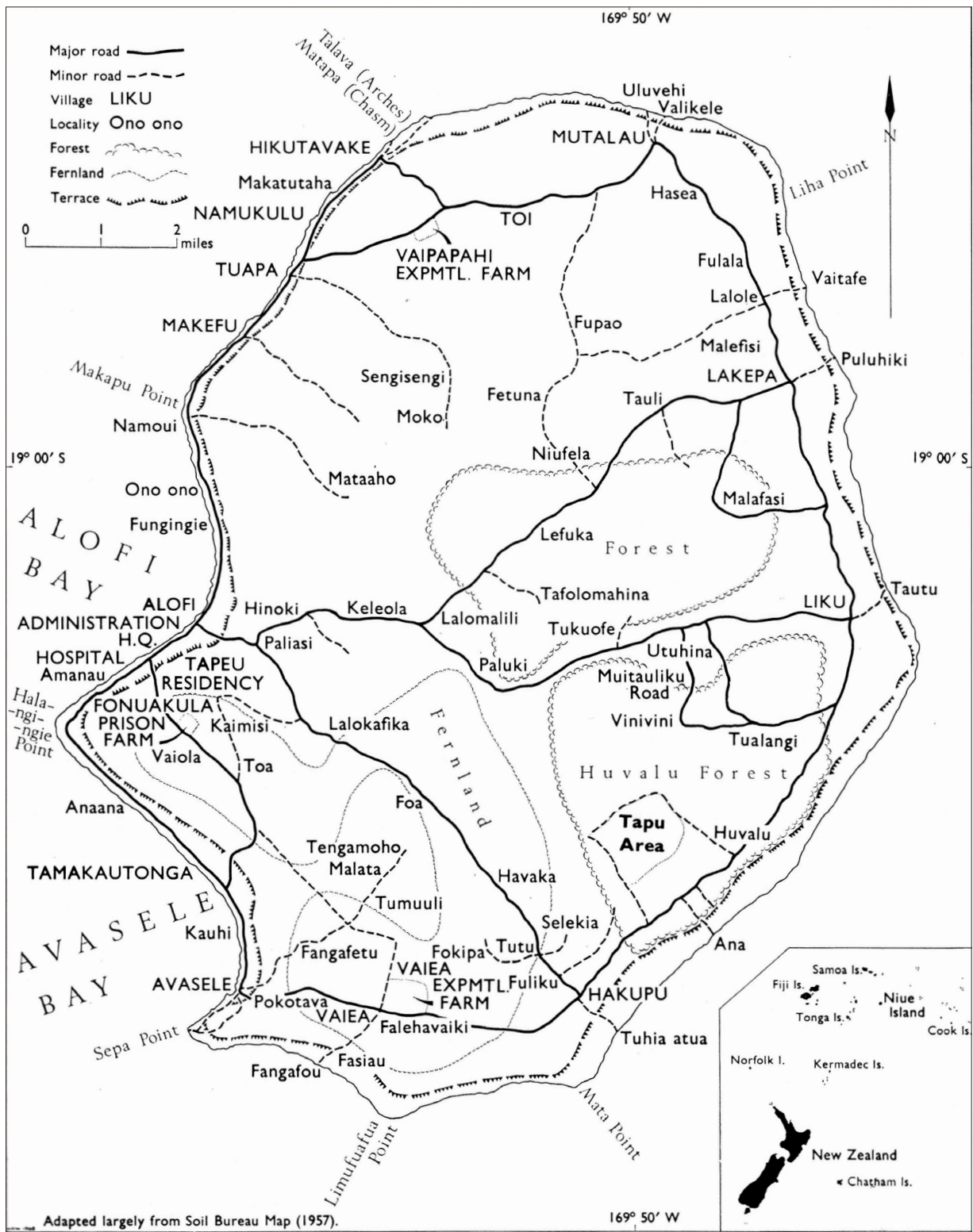


Figure 1. Map of Niue Island showing the collecting localities. Source: Sykes (1970, fig. 1).

SPECIES LIST

DICOTYLEDONS

ACANTHACEAE

***Asystasia gangetica* (L.) T.Anderson** FNI
Y — cultivated ornamental. S — in waste, us. nr houses. A later collection is *Sykes* 1644/N CHR 654742, coll. 2006, Alofi South, on coral rubble, very common locally.
• This New World subshrub appears to have been present in Western Polynesia and Fiji for nearly a century (Whistler 1988: 5) but is still just a minor weed of the CPO.

***Hemigraphis alternata* (Burm.f.) T.Anderson** FNI
Y as *H. colorata* (Bl.) Hallier f. — cultivated ornamental, and wild along roadsides and in waste. S — in several places nr the west coast, in disturbed forest. There are no later collections.
• This low-growing Malesian herb is a fairly recent introduction to Western Polynesia; Whistler (1988: 5) notes its abundance here locally in disturbed forest and on roadsides.

***Ruellia prostrata* Poir.** FNI
Recorded by Whistler (1988: 5), on the basis of *Sykes* 1384/N CHR 282433, coll. 1975, Amanau, in mown lawn. A later collection is *Sykes* 1406a/N CHR 658697, coll. 2006, Alofi North, abundant at old house site and a short way along track.
• This mat-forming Malesian herb also appears to be a recent introduction to Western Polynesia, but perhaps arrived accidentally rather than as a garden plant. It is said by Whistler (1988: 5) to flourish in pasture and under tree crops.

***Thunbergia fragrans* Roxb.** CAS
Y — cultivated ornamental. S — in grassy waste ground, an “escape from cultivation” (Sykes 1970: 39). There are no later collections.
• Whistler (1988: 6) noted that in Tonga this Indo-Malesian vine was a fairly recent introduction that was “becoming weedy” in waste places. Sykes (2016: 382) describes it as a common weed in the Cook Islands, twining on low shrubs and grasses in waste land, etc.

AMARANTHACEAE

***Achyranthes aspera* L.** *talamoa fiti* IND
Y, S — locally common in plantations and waste, esp. nr tracks. The only later collection is *Gardner* 10731 AK 292170, coll. 2005, Matapa, on coral rubble, uncommon on island.
• This weedy Old World subshrub is also an ancient species of the CPO—Nicolson and Fosberg (2004: 262) cite Cook’s Voyages material from the Society Islands and there are early post-European collections from Fiji, Tonga and Samoa (Smith 1981: 290; Whistler 1988: 6). The absence of Cook’s Second Voyage collections from Tonga and Vanuatu is surprising.

***Amaranthus lividus* L.** CAS
Recorded by Whistler (1988: 6), on the basis of *Sykes* 341/N CHR 169886, coll. 1965, Alofi Radio Station, by wall, det. P.W. Michael 1974. There are no later collections.

• This weedy herb, also known as *A. blitum* L., may be native to the Old World. It seems to have appeared in Western Polynesia only in the last half-century or so (Whistler 1988: 6).

***Amaranthus viridis* L.** FNI
Y — occ. in plantations, around houses and in waste. S — common esp. nr Alofi. A later collection is *Sykes* 1335/N CHR 282381, coll. 1975, Amanau, weed in plant container.

• This short-lived weedy herb is sometimes thought to be native to the New World. The first record for Western Polynesia was made in Samoa in 1839 (Whistler (1988: 7), while Smith (1981: 286, as *A. gracilis* Desf.) has noted mid-19th C. collections from Fiji. According to Merrill (1917: 212) this plant was present on Amboina in the mid-17th C.

***Gomphrena globosa* L.** CAS
Y — Cultivated ornamental. S — cultivated nr houses and occ. in waste nearby. There are no later collections. The earliest collection is *Moore* 382, US 1216080, coll. 1899.
• It seems that in all the time this New World subshrub has been growing on Niue it has just remained a casual. Whistler (1988) does not list it as a Western Polynesian weed.

APIACEAE

***Apium leptophyllum* (Pers.) F.Muell. ex Benth.** FNI
Y — common roadside weed. S — fairly common in waste (perhaps mostly nr houses) and on roadsides, less so in old plantations. There are no later collections.
• This New World herb is now a near-cosmopolitan weed of warm-temperate and tropical regions. It is uncommon in Fiji (Smith 1985: 658), and in Western Polynesia too, despite first being recorded here in 1888 (Whistler 1988: 38). Similarly, in the Cook Islands it is said to be “often very local and rare, although not a recent introduction” (Sykes 2016: 405, as *Cyclosporum leptophyllum* (Pers.) Sprague).

***Centella asiatica* (L.) Urb.** *tono* IND
Y, S — common to abundant in waste and plantations. There are no later collections.

• This mat-forming Indo-Malesian herb is generally considered to be native to some western part of the CPO too, or at least an ancient introduction here. Seemann (1866: 113) and Nicolson and Fosberg (2004: 271, as *Hydrocotyle* sp.) have noted Cook’s Second Voyage material from New Caledonia.

• The uniformity of the plant’s name in Western Polynesia and Fiji (Whistler 1988: 38; Smith 1985: 655) must signify a long-held and continuous familiarity with this plant. It has a distinctive appearance, is sometimes

an abundant weed of cultivated ground, and is also a common ingredient of Polynesian herbal medicines, a practice which can be traced back to Asia a very long time ago (Burkill 1966: 1230, as *Hydrocotyle asiatica* L.).

Foeniculum vulgare Mill. CAS
Y — occ. on roadsides. S — sparingly wild around houses, esp. in Alofi, Avasele, and Liku. There are no later collections.

- This perennial Northern Hemisphere herb, a weed mainly of temperate and subtropical places, is known elsewhere in the CPO just as a rare weed in Fiji (Smith 1985: 659). It may have been deliberately introduced to Niue for its culinary value, or perhaps accidentally, most likely from New Zealand, where it has long been abundant in the wild.

ANACARDIACEAE

Mangifera indica L. mago CAS
Y, S — Cultivated and occ. wild along roadsides. There are no later collections.

- Fruit-bats (*Pteropus tonganus*) ought to be able to disperse this well-known Indian tree into scrub and forest across the island, but these animals are now uncommon here.

APOCYNACEAE

Catharanthus roseus (L.) G. Don CAS
Y as *Lochnera rosea* (L.) Reichb. ex Steud. — cultivated for ornament and wild about houses, along roadsides and in waste. S — plentiful locally around houses and plantations. A later collection is Sykes 1645/N CHR 659743, coll. 2006, Alofi South, a very common spontaneous plant in and around gardens.

- Whistler (1988) overlooked the weediness of this familiar Old World (Madagascar) shrub, a widespread escape from cultivation in Western Polynesia and in the CPO at large.

Nerium oleander L. NN
Y — cultivated ornamental and wild in thickets. S — common ornamental, not seen wild.

- The oleander, a shrub native to the Mediterranean region and eastwards into Asia, seems unlikely to naturalise on Niue, since this island lacks the necessary streamside habitat (cf. Gardner 2016). But it is known in the wild in Fiji (Smith 1988: 103), a voucher being Smith 4431 US 1155027, coll. 1947, Viti Levu, Mt Evans Range, along creek in forest.

ASTERACEAE

Achillea millefolium L. CAS
New record, based on Sykes 1199/N CHR 282248, coll. 1975, Vaipapahi, in mown grass.

- There are no later collections of this Northern Hemisphere temperate-zone weedy herb. In other parts of the world, e.g., southern England (Grime *et al.* 1990), it is generally associated with *Plantago lanceolata*, which suggests it should be looked for on Niue in places where the latter is particularly abundant.

Adenostemma viscosum J.R.Forst & G.Forst. IND
Y, S, as *A. lavenia* non (L.) Kuntze — apparently a very rare plant, not seen. Only two specimens seem to be known: Smith 97 AK 89524, coll. 1901, “pupulele”, and Cockerill WELT *n.v.*, coll. c. 1924.

- This weedy Old World herb is an ancient species of the CPO—Nicolson and Fosberg (2004: 289) cite Cook’s Second Voyage material from the Society Islands. Throughout its range it is generally found in rather damp and sheltered sites, like forest clearings, but even in such places it seems to have declined considerably, e.g., in the Cook Islands (Sykes 2016: 441).

Ageratum conyzoides L. FNI

Y — occ. along roadsides. S — only locally common, mainly in fairly open places inland. There are no later collections.

- It has been suggested that this New World herb could be one of the rare plants introduced to the CPO prior to Cook’s Voyages—Nicolson and Fosberg (2004: 290) cite Second Voyage material from Vanuatu only, and say that “just one pre-1774 ship leaving behind some ballast or baggage could have introduced this aggressive weed”. Certainly, the species was present in Amboina, not far to the west, in the mid-17th C. (Merrill 1917: 497). But regardless of source, its presence in Vanuatu seems not to have resulted in it getting to Western Polynesia and Fiji in time to be found by the U.S. Exploring Expedition in 1839–40 (Whistler 1988: 9; Smith 1991: 296).

Aster subulatus Michx. FNI

New record, based on two Sykes collections made in 1975 from waste areas: 1248/N CHR 282297, Amanau, and 1301/N CHR 282347, Halagigie Point. A later collection is Sykes 1428/N CHR 659522, coll. 2006, Alofi North, waste ground in gravel.

- According to Smith (1991: 304) this New World herb is likely to be a recent introduction to Fiji, perhaps in ship’s ballast, and might not have persisted there. In the CPO it is known otherwise just from the Cook Islands, as a recent introduction that is rapidly spreading (Sykes 2016: 439, as *Symphytotrichum subulatum* (Michx.) G.L. Nesom).

Bidens pilosa L. kofetoga FNI

Y, S — common along roadsides and in plantations. One of only two later collections is Whistler 4950 CHR 433621, Niue Hotel, in grassy area.

- This weedy New World herb seems to have become widespread in the CPO early in the 19th C. (Gardner 1985; Whistler 1988: 9). The Niuean plants are veritable *Bidens pilosa*, not the very similar Old World species *B. biternata* (Lour.) Merr. & Sherff, which was collected on Tonga for the first and only time during Cook’s Second Voyage (Sherff 1937: 392; Nicolson and Fosberg 2004: 294), and, apparently, once in Fiji, in 1860 (Seemann 270 *p.p.*, cited by Sherff 1937: 395).

Conyza sumatrensis (Retz.) E.Walker FNI

S as *C. canadensis* non (L.) Cronquist — common in plantations, esp. on exposed soil. A later collection

is *Sykes* 1454/N CHR 659548, coll. 2006, Avatele, common in old quarry.

- This weedy herb, presumably native to the New World, is a fairly recent arrival in the CPO. It was recorded by Whistler (1988: 9) as *C. canadensis* var. *pusilla* (Nutt.) Cronq.

***Cosmos sulphureus* Cav. CAS**

Y, S — introduced ornamental, occ. persisting locally by seed. There are no later collections.

- An annual herb from Central America often grown for ornament this plant is just a casual weed elsewhere in the CPO, e.g., in Fiji (Smith 1991: 284).

***Crassocephalum crepidioides* (Benth.) S.Moore FNI**

S — local, mainly in the western part of the island. Another collection is *Falasin* CHR 188453, coll. 1968, *sine loc.*, spreading rapidly in plantation. There are no later collections.

- This African herb has spread through the CPO in the last seventy or so years, mainly in rather damp, fertile places (Whistler 1988: 10; Smith 1991: 317).

***Eclipta prostrata* (L.) L. FNI**

S — seen once, in a damp place. The only later collection is *Sykes* 1119/N CHR 282169, coll. 1975, Alofi wharf, in rain-wash channel in waste ground.

- This weedy New World herb seems to be a fairly recent arrival to Western Polynesia (Whistler 1988: 10) but was known from Fiji in the mid-19th C. (Smith 1991: 275). It prefers relatively damp sites.

***Eleutheranthera ruderalis* (Sw.) Sch.Bip. FNI**

Recorded by Whistler (1988: 10), on the basis of *Sykes* 1121/N CHR 282171, coll. 1975, Alofi wharf, on heap of coral sand. A later collection is *Sykes* 1425/N CHR 659519, coll. 2006, Alofi North, one plant among graves.

- This weedy New World herb seems to be a fairly recent arrival to Western Polynesia (Whistler 1988: 10). It was first found in Fiji in the 1930s (Smith 1991: 275).

***Emilia sonchifolia* (L.) DC. *pupu lele* FNI**

Y — common in plantations, waste and on roadsides. S — locally common in plantations, esp. on the western side of the island. There are no later collections.

- This weedy Asian herb has been known in the CPO for slightly more than a hundred years (Smith 1991: 319). Its tolerance extends to dry shaded habitats.

***Leontodon taraxacoides* (Vill.) Willd. ex Mérat *s.l.* FNI**

S — A few plants in short turf, Fonuakula golf course. A later collection is *Waterhouse* 7084 CHR 551751, coll. 2004, Kaimiti [Alofi Radio Station], common here and around airport and golf club, and occ. around the island's settlements.

- There seem to be no other CPO occurrences of this temperate-zone European herb.

***Mikania micrantha* Kunth *fue saina* FNI**

Y — common in plantations and waste. S — abundant weed of cleared areas, esp. nr forest. There are no later collections of this pernicious New World vine, first recorded in the CPO from Fiji in 1907 (Smith 1991: 298) and then from Samoa in 1924 (Whistler 1988: 11).

***Pseudelephantopus spicatus* (B.Juss. ex Aubl.)**

Rohr ex Gleason FNI

S — uncommon in waste at Alofi and Makefu. The only later collection is *Sykes* 1133/N CHR 282183, coll. 1975, Fonuakula, roadside.

- A 1945 collection from Fiji seems to be the earliest record from the CPO of this very weedy New World herb. It favours relatively dry sites and can be abundant in mown grass.

***Sonchus oleraceus* L. *pupu lele* FNI**

Y — common in plantations and waste. S — mostly in plantations. There are no later collections.

- This familiar Old World herb is an abundant weed of disturbed, often rather damp and fertile, places in temperate-zone regions around the world. Its annual life-cycle allows it to evade droughty periods.

***Synedrella nodiflora* (L.) Gaertn. FNI**

Y — common in plantations and waste. S — very common in plantations, less so in waste. There are no later collections.

- This weedy New World herb was first collected in the CPO in Samoa in 1905 (Whistler 1988: 12).

***Tagetes erecta* L. CAS**

Y — cultivated ornamental, occ. escaping along roadsides. S — rarely cultivated, occ. casual in villages. The label notes on later specimens, e.g., CHR 659642, suggest that this New World herb can persist locally by seed for a while.

***Tagetes patula* L. CAS**

Y — cultivated ornamental, occ. escaping along roadsides. S — fairly common in all the villages, and a casual in waste places. There are no later collections of this New World herb.

***Taraxacum officinale* (L.) Weber ex F.H.Wigg. *s.l.* FNI**

S — in waste at Fonuakula Farm and nearby at golf course. Later collections (CHR *n.v.*) of this Old World weed, the dandelion, are from the airport in 1975 and Vaipapahi Farm in 2006.

- The earliest specimen, *Sykes* 131/N CHR 1700427, coll. 1965, was determined in 1979 by A. J. Richards as *Taraxacum argutifrons* A.J.Richards. A comment on the nomenclature of the dandelion species-complex is made by Smith (1991: 268), along with the observation that in Fiji the plant is uncommon and found only at higher altitudes. It is also a rare weed of grassy places in Tonga, where it was first collected in 1953 (Whistler 1988: 12).

***Tithonia diversifolia* (Hemsl.) A.Gray** FNI
S — forming large stands, mainly in the Alofi area, also around Tuapa and Mutalau. A later collection is *Sykes* 1386/N CHR 282435, coll. 2006, airport, in rough pasture.
• This ornamental Mexican subshrub was first seen in the CPO in Samoa and Fiji at the start of the 20th C. (Whistler 1988: 12; Smith 1991: 280).

***Vernonia cinerea* (L.) Less.** FNI
Y, S — common throughout, in plantations, lawns and waste. A later collection is *Whistler* 4946 CHR 433650, coll. 1981, Alofi South, common on roadsides.
• This weedy Old World herb, sometimes called *Cyanthillium cinereum* (L.) H. Rob., has been known in the CPO for more than a hundred years (Whistler 1988: 13; Smith 1991: 262). It was present in Amboina in the mid-17th C. (Merrill 1917: 497).

***Youngia japonica* (L.) DC.** FNI
Recorded by Whistler (1988: 13) on the basis of a collection made in 1975, presumably by Sykes. I have not been able to locate that specimen. A later collection is *Sykes* 1463/N CHR 658696, coll. 2006, Alofi, common around old house site.
• This weedy Indo-Malesian herb was collected in Fiji in 1894 (Smith 1991: 267) but seems to have been slow in getting to the rest of Western Polynesia (Whistler 1988: 13). A recent arrival to the Cooks, it grows there in disturbed, shaded or moist places (Sykes 2016: 468).

***Zinna violacea* Cav.** CAS
***Zinnia elegans* Jacq.**
Y — cultivated ornamental. S — persisting in small groups, mostly near houses. A later collection, which does seem to indicate a further degree of naturalisation by this New World herb, is *Sykes* 1548/N CHR 659643, Lakepa, spontaneous plants at side of track in forest.

BALSAMINACEAE

***Impatiens balsamina* L.** CAS
S — Small populations in waste nr most of the villages, perhaps not cultivated now but persisting slightly by seed. There are no later collections.
• This somewhat weedy ornamental Asian herb is apparently a recent introduction to the CPO, e.g., to Fiji (Smith 1985: 630).

BASELLACEAE

***Anredera cordifolia* (Ten.) Steenis** FNI
Y as *Boussingaultia baselloides* Kunth, S as *B. cordifolia* Ten. — cultivated ornamental, spreading into coastal vegetation at several places.
• Whistler (1988) does not include this New World vine as a weed in West Polynesia. On Niue's rocky terrain this persistent, tuber-bearing, all-smothering plant will only be eliminated through biological control measures.

BRASSICACEAE

***Brassica juncea* (L.) Czern.** CAS
Y — along roadsides and in waste. S — uncommon on roadsides. There are no later collections of this weedy Old World herb.

***Brassica pekinensis* Skeels** CAS
S — cultivated, rarely wild. There are no later collections of this leafy Old World food-plant.

***Lepidium didymum* L.** FNI
Y — along roadsides and on rocky cliffs. S — locally common in plantations, rare elsewhere.
There are no later collections of this mat-forming South American herb, which is now a cosmopolitan weed, though mainly in temperate to subtropical regions.

***Lepidium virginicum* L.** FNI
Y — rare, in plantations. S — common locally in waste, particular near Alofi, Fonuakula and Vaiola. There are no later collections.
• This North American temperate-zone weedy herb seems to be known elsewhere in the CPO just from Tonga, where it was first collected in 1926. It also occurs in the Tokelau Islands, where it was first collected in 1980 (Whistler 1988: 16).

Rorippa sarmentosa* (DC.) J.F.Macbr. *holofa IND
Y — roadsides, plantations. S — uncommon on rocky cliffs, seen mostly in the chasms of the west coast, also seen once on the south-east coast: *Sykes* 787/N CHR 170267, coll. 1965, Hakupu–Tuhia'atua, a single plant among the track's coral pebbles, det. W.R. Sykes 2013. The only later collection is *Whistler* 12993, coll. 2013, shallow pockets of soil near the sea inside Avaiki cave (Whistler 2013: 28).
• This inconspicuous short-lived herb is ancient in the CPO—Nicolson and Fosberg (2004: 346) cite Cook's Voyages material from the Tuamotu and Society Islands. Its distribution currently extends from the Solomon Islands and New Caledonia east to French Polynesia and Hawaii. As a weed it is seen (usually rather infrequently) on the edges of wetland taro gardens, etc.

CAPPARIDACEAE

***Cleome viscosa* L.** CAS
S — in a taro plantation at Fonuakula; a recent introduction? There are no later collections.
• This weedy Asian herb seems to have arrived in the CPO a hundred or so years ago (Whistler 1988: 8). It was present on Amboina in the mid-17th C. (Merrill 1917: 241).

CARICACEAE

***Carica papaya* L.** *loku* FNI
Y, S — cultivated, and extensively wild around houses, in scrubby ravines, waste ground, etc.
• In late 1830 or early 1831 this familiar New World fruit-tree, the pawpaw, was introduced to Niue by the island's first missionaries (Smith 1902: 95; Langdon 1989: 12). Seeds from that time on might be preserved in cave shelters, middens, subsoils and coprolites.
• The pawpaw's Niuean name has clearly (*pace* Langdon) been transferred from that of the ancient Polynesian food-plant *Solanum repandum*—see further below.

CASUARINACEAE

Casuarina equisetifolia L. *toa* IND

Y — a few plantings along the road on the west side of the island. S — planted in all the villages and common around schools. A later collection, which shows that this familiar CPO tree can sometimes naturalise on Niue, is Sykes 1460/N CHR 659585, coll. 2006, Vaiea, Hakupu Road, a few young trees in low roadside scrub, a parent tree (planted?) nearby.

- The original range of this coastal tree (Southeast Asia, Malesia and northern Australia as well as some part of the western Pacific?) may have been extended eastwards by humans in both ancient and modern times.

CONVOLVULACEAE

Ipomoea cairica (L.) Sweet CAS

Y as *Ipomoea* sp. — collected once, in waste nr Hikutavake. S — rare plantation weed. There are no later collections.

- This Old World vine may have been introduced relatively late to the CPO as an garden plant but in Fiji at least it occurs just as a fairly common weed (Smith 1991: 67).

Ipomoea fimbriepala Choisy DD

New record, based on Flynn 6702 PTBG 30173, coll. 2000, Vahaha NE of Hakupu, in scrub.

- This vine, now with a nearly pantropical distribution, seems to be a fairly recent arrival in the CPO. It is currently abundant in New Caledonia and French Polynesia.

Ipomoea hederifolia L. DD

New record, based on Sykes 1422/N CHR 659516 *n.v.*, Alofi, coll. 2006, among tall shrubs. There are no later collections.

- This New World vine was first found in the CPO in Tonga, in 1874 (Whistler 1988: 14).

Ipomoea indica (Burm.) Merr. IND

Recorded by Whistler (1988: 14, as *I. congesta* R.Br.), on the basis of Sykes 1093/N CHR *n.v.*, coll. 1975. There are no later collections.

- This well-known weedy vine, native to the Old World (including Australia) and perhaps some way east into the Pacific too, was found in Vanuatu during Cook's Second Voyage (Nicolson and Fosberg (2004: 373). Whistler (1988: 14) mistook such "Tanna" material as relating to Tonga.
- St John (1976) cited an 1876 Jensen collection from Niue, but this represents the kumara plant, *I. batatas* (L.) Lam. (BM 1011120, det. G. S. Staples; Whistler 1984).

Merremia peltata (L.) Merr. *fue, fue vao* IND

Y, S — abundant in secondary and primary forest. There are no later collections.

- On forest edges this large-leaved weedy Old World liane can overwhelm regrowth communities and established trees alike. It is though an ancient plant of the CPO—Nicolson and Fosberg (2004: 375) cite Cook's Second Voyage material from the Society Islands.

Merremia tuberosa (L.) Rendle CAS

Y as *Ipomoea tuberosa* L. — cultivated for its attractive seed pods. S — wild nr Alofi Radio Station, not seen elsewhere. A later collection of this New World liane is Sykes 1584/N CHR 659680, coll. 2006, Amanau, rampant in a field.

Operculina turpethum (L.) Silva Manso IND

S — on an exposed coastal slope at Tautu (CHR 169783 *n.v.*). There are no later collections.

- This Old World vine can be a weed in other parts of the Pacific, e.g., Fiji (Smith 1991: 45), but it is an ancient species of the CPO—Nicolson and Fosberg (2004:375) cite Cook's Second Voyage material from the Society Islands, Tonga and Vanuatu.

Operculina ventricosa (Bertero) Peter CAS

New record, based on Sykes 1354/N CHR 282400, coll. 1975, Lakepa–Puluhiki, in windswept coastal scrub. A later collection from the same place is Sykes 1558/N CHR 659653, coll. 2006, a few plants.

- This New World vine is said to be a recent arrival in Samoa and Tonga (Smith 1991: 45).

CRASSULACEAE

Kalanchoe pinnata (Lam.) Pers. FNI*Bryophyllum pinnatum* (Lam.) Oken

Y, S — widespread and often abundant in open rocky ground, mainly nr the coast. There are no later collections.

- This shrubby African succulent, sometimes grown as an ornamental, has been a weed in dry disturbed places in Samoa and Fiji for c. 100 years (Whistler 1988: 15; Smith 1991: 36).

CUCURBITACEAE

Cucumis melo L. *subsp. agrestis* (Naudin) Pangalo IND

Y, S, apparently as *C. anguria* L. — cultivated and occ. wild in waste. S as *C. sativus* L. — cultivated, and a rare casual in waste. There are no later collections.

- Both Yuncker and Sykes gave the name *atiu* ["*asiu*"] for the plants they saw, which accords with the usual Polynesian name for the 'island melon', the wild subspecies of the Old World *Cucumis melo* L. This scrambling vine was cultivated anciently in the CPO (Nicolson and Fosberg 2004: 383) and in this region is said to have edible fruits the size of a walnut (Whistler 1991: 22; 2000: 159).

- Two Sykes collections from Niue in 1965 lack fruit but without doubt represent *C. melo* subsp. *agrestis*: CHR 170280 !, Toa nr Vaiola, nr house, probably cultivated, and CHR 170281 !, Amanau, waste place. The latter was recorded by Sykes (1970: 78) as *C. sativus* while the former went unnoted.

- A complication is that Yuncker (1943: 114) described the fruit of the Niuean plant as being ellipsoidal, c. 5 cm long, and sometimes striped [with green, *f.* Sykes], that is, more like the fruit of *C. anguria* L., the gherkin. I have not seen either of his vouchers (*Yuncker* 9794, 10010), nor that for Sykes's *C. anguria* record (CHR 169895). So, the possibility remains that some of the

material of those collectors is actually *C. anguria*. This species seems not be known to be wild elsewhere in the CPO but has become so in Australia (Telford 1982: 190).

• *Cucumis melo* subsp. *agrestis* is now a very rare plant in the CPO, e.g., see Whistler (1991: 22) for its occurrence in Tonga. But it may still exist on Niue, in the seed bank—cf. the “resurrection” of the rare cucurbit *Diplocyclos palmata* on Norfolk Island when the soil is disturbed by vegetation clearance or harrowing (Green 1994: 129; O. Evans, pers. comm).

***Luffa cylindrica* (L.) M.Roem. var. *cylindrica* NN**
S — cultivated in several of the villages: “the seeds are sown near to an available tree and the plants left to climb unchecked ... fruit 30 cm or more long” (Sykes 1970: 79).
• The variety *insularum* Cogn. of this long-domesticated Old World vine has fully-ripe fruit c. 5 cm long (Seemann 1866: 105) and is an ancient food-plant of the CPO—Nicolson and Fosberg (2004: 384) cite Cook’s Voyages material from the Society Islands. Smith (1981: 682) said this variety had naturalised in Fiji and elsewhere but he seems not to have realized that it is distinguished mainly by its small fruits, so his statement cannot be considered reliable, and there is no reason to think it has grown on Niue, at least in the European era.

***Momordica charantia* L. NN**
S — in a few plantations in the central part of the island, perhaps not truly wild. Nor does a later Sykes collection (CHR 659580, coll. 2006) indicate even a casual naturalisation.
• Seemann (1866: 105) stated that this long-domesticated Old World food-plant had been collected in Tahiti on Cook’s First Voyage. Nicolson and Fosberg (2004: 384) do not mention such an occurrence, only that there might be Second Voyage material from the Atlantic Ocean’s Cape Verde Islands. The lack of evidence that *M. charantia* was generally known to the ancient Polynesians makes one doubt the correctness of Seemann’s statement.

CUSCUTACEAE

***Cuscuta campestris* Yunck. FNI**
S — apparently a recent arrival at Fonuakula, on various weeds in a taro plantation. A later specimen of this slender, parasitic New World vine is Sykes 1508/N CHR 659603, coll. 2006, Fonuakula, fairly common in waste ground.

EUPHORBIACEAE

***Acalypha indica* L. FNI**
S as *Laportea interrupta* non (L.) Chew — rare in plantations and waste on the west side of the island. There are several later collections, e.g., from forested roadsides.
• This Old World herb was first found in the CPO in Samoa, in 1905 (Whistler 1988: 17).
• On Niue *A. indica* (and *A. lanceolata*, see below) appear to have two Niuean names, *mangihō* and *hongohongo/ongoongo*. Respectively, these would have formerly

belonged just to the island’s two native urticaceous plants, the tree nettle *Dendrocnide harveyi* and the herb *Laportea interrupta*. The latter and the two acalyphas are very much alike in the shape of their leaves and their inconspicuous flowers, bristly indument, and weediness.

***Acalypha lanceolata* Willd. *A. boehmerioides* Miq. FNI**

Y — occ. in plantations and on roadsides. S — only seen in a plantation near Mutalau. There are no later collections.

• There are early post-European collections of this weedy Old World herb from Samoa and Tonga (Whistler 1988: 17). It is probably declining on Niue, just as it seems to be in the Cook Islands (Sykes 2016: 557). For comment on this plant’s Niuean names see *A. indica* above.

***Aleurites moluccanus* (L.) Willd. *tuitui* IND**
Y, S — Common in the villages and along the principal tracks.

• The ancient Polynesians are well-known to have cultivated (and presumably, distributed) this Indo-Malesian village tree. Predation of its seeds might be stopping it from becoming a common member of Niue’s scrub and secondary forest communities.

***Chamaesyce hirta* (L.) Millsp. FNI**
***Euphorbia hirta* L.**

Y, S — common in plantations and waste. There are no later collections.

• This weedy low-growing herb, a probable native of the New World, was an early post-European introduction to Western Polynesia (Whistler 1988: 16). It was present in mid-17th C. Amboina (Merrill 1917: 328).

***Chamaesyce hypericifolia* (L.) Millsp. CAS**
***Euphorbia glomerifera* (Millsp.) L.C.Wheeler**

S — in waste at Amanau. The single later collection of this New World herb (CHR 282301, coll. 1975), from the same place, does not suggest an extensive local naturalisation.

***Chamaesyce prostrata* (Aiton) Small FNI**
***Euphorbia prostrata* Aiton**

Y, S — common in lawns, plantations and waste. There are no later collections.

• This mat-forming New World herb was first collected in the CPO in Samoa in 1893 (Whistler 1988: 18). It is generally thought to grow best in sandy soils.

***Codiaeum variegatum* (L.) Blume *talaposi* CAS**
Y, S — introduced ornamental, perhaps occ. wild in scrub. There are no later collections.

• Both authors comment on the variety of leaf shape and variegation they saw. A form of this small Malesian tree, var. *moluccanum* (Decne) Müll.Arg., has uniformly green, non-lobed, lanceolate leaves. It occurs wild in dry forest in Fiji and might be a pre-European introduction there (Smith 1981: 550). It seems to be absent from Niue.

***Euphorbia cyathophora* Murr.**

FNI

S — apparently recently introduced as a cultivated ornamental; spreading rapidly in waste places around the perimeter of the island. A later collection of this familiar New World subshrub, the poinsettia, is *Sykes* 1534/N CHR 659629, coll. 2006, Hakupu–Tuhia’atua trackside, in low forest.

***Euphorbia heterophylla* L.**

CAS

Recorded by Whistler (1988: 14), on the basis of *Sykes* 1251/N CHR 282300, coll. 1975, Amanau, waste place on cliff edge. A later collection is *Whistler* 4957 CHR 433648, coll. 1981, Alofi South, on the roadside and in other disturbed areas.

- Like *E. cyathophora* (and similarly known as poinsettia) this New World subshrub may have come to Niue quite recently as a garden plant. It is not recorded from the wild elsewhere in Western Polynesia (Whistler 1988: 18), nor in Fiji (Smith 1981).

***Ricinus communis* L.**

FNI

Y, S — common in scrub and waste. A later collection is *Sykes* 1376/N CHR 282426, coll. 1975, Huvalu, in pasture near forest.

- Smith (1981: 499) thought that this familiar weedy African shrub, the castor-oil plant, might be an ancient introduction to Fiji, but this seems very unlikely—there is no Cook’s Voyages material from the CPO, nor were collections made from Tonga, Samoa or Fiji by the United States Exploring Expedition in 1839–40 (Whistler 1988: 19; Smith *loc. cit.*).

LAMIACEAE

***Clerodendrum buchananii* (Roxb.) Walp. var. *fallax* (Lindl.) Bakh.**

CAS

Y as *C. fallax* Lindl., S as *C. speciosissimum* van Geert — sparingly cultivated, occ. wild in forest, waste and along tracksides in plantations. The only later collection of this ornamental Asian shrub is *Flynn* 6694 PTBG 15790, coll. 2000, Fonuakula, at entry to golf course.

***Clerodendrum chinense* (Osbeck) Mabb.**

CAS

S as *C. philippinum* Schauer — rare in cultivation but abundant at Tamakautonga in a coconut grove, all plants there the double-flowered form [sterile but spreading widely by rhizomes]. Neither the voucher (CHR 169882) for this record, nor any later collection of this ornamental Asian shrub, have been located.

***Leonurus sibiricus* L.**

FNI

Y — occ. along roadsides and in waste. S — around houses, esp. near Alofi. A later collection is *Waterhouse* 7076 CHR 551718, coll. 2004, Alofi, in waste along main road.

- This weedy herb, native to temperate parts of Asia, appears to be uncommon in Tonga and has failed to establish in Samoa (Whistler 1988: 20). In saying that this plant “was to be anticipated” in Fiji Smith (1991: 218) was unaware of *B.E.V. Parham* 10940 CHR 181978, coll. 1967, Viti Levu, Nadroga, Lawaqa, weed in flower bed, det. W.R. Sykes.

***Leucas decemdentata* (Willd.) R.Br. *L. flaccida* R.Br.**

IND

Y, S — local in plantations, waste, tracksides in open forest. There are no later collections.

- This wide-ranging herb of drier parts of the Indo-Malesian and Australian tropics is also indigenous to the CPO or at least a pre-European introduction there—Nicolson and Fosberg (2004: 466) cite Cook’s Voyages material from the Society Islands. Its small stature and lack of medicinal value, etc., make it an unmemorable plant, and its names across Polynesia (Rensch and Whistler 2009: 654) seem to be just the result of local improvisation.

***Orthosiphon aristatus* (Blume) Miq.**

CAS

S — on roadside at Tapeu, perhaps after having been introduced to the nearby Residency as an ornamental. There are no later collections of this Indo-Malesian subshrub.

***Plectranthus scutellarioides* (L.) R.Br.**

CAS

***Coleus blumei* Benth.**

Y, S — locally abundant along roadsides; not cultivated. A later collection is *Waterhouse* 7081 CHR 551724, coll. 2004, Alofi–Mana road, around graves, naturalised or persistent?

- This erect semi-succulent herb is native to the region between Asia and Australia and has long been cultivated (for its variegated leaves) here and elsewhere (Smith 1991: 222, as *Solenostemon scutellarioides* (L.) Codd). It is not clear that it spreads much by seed (Sykes 2016: 669), and Whistler (1988) does not mention it as being weedy in Western Polynesia.

***Salvia coccinea* Buc’hoz ex Etl.**

FNI

Y, S — common throughout in plantations and waste. There are no later collections of this ornamental New World subshrub.

***Salvia occidentalis* Sw**

FNI

Y, S — common throughout in plantations and waste. There are no later collections.

- This weedy New World herb is infrequent in Western Polynesia (Whistler 1988: 21) and unknown in Fiji (Smith 1991).

***Teucrium vesicarium* Mill.**

IND

Y as *T. inflatum* Sw. — occ. along roadsides. Sykes (1970: 105) confirmed this record, the only one known, which is based on *Yuncker* 10075 (BISH *n.v.*).

- The status of this small weedy New World herb as an ancient species of the CPO rests just on Cook’s Second Voyage material from Tonga (Nicolson and Fosberg (2004: 470). But its apparent absence from the rest of the region until about a century later, and its continued extreme rarity here (except perhaps in New Caledonia; McKee 1985: 66) would seem to require a special explanation: might it have been introduced to Tonga by Abel Tasman in 1643? Unfortunately for this hypothesis, there is no indication that the plant could have been an

abundant weed of Tasman's starting point at Batavia; that is, it is not mentioned by Merrill (1917) as present on Amboina in the mid-17th C.

- The Niuean name *hongohongo*, as recorded for *Yuncker 10075*, is one that in Polynesia refers particularly to urticaceous herbs, notably *Laportea interrupta*. The resemblance between this and the teucrium is considerable, and the latter lacks any distinctive physical qualities or medicinal uses, etc., that might have enabled it to acquire a name of its own.

LEGUMINOSAE

Abrus precatorius* L. *matakamea*, *pōmea mataila IND
Y, S — common in open scrub.

- Sykes (1970: 144) said that this scrambling bush or vine mostly grew near villages and in disturbed coastal forest. Finding it in such habitats might have been why he thought it was not a native plant. Nevertheless, the CPO was part of the extensive range of this Old World species—Nicolson and Fosberg (2004: 432) cite Cook's Voyages material from the Society Islands, and the U.S. Exploring Expedition got it in Tonga, Samoa and Fiji in 1839–40.
- Oddly, then, its two recorded Niuean names are very different from the name (in the forms *matamoho* and *matamoso* respectively) found in Tonga and Samoa (Rensch and Whistler 2009: 619). Both Niuean names seem to refer to the seeds. The first apparently just means something like “appearing bluish”. The second means “like *Adenanthera pavonina* [*pomea*] but the seeds with a blotch”. Since that tree is a post-European introduction (see below) this name must also be a recent one.

Adenanthera pavonina* L. *pōmea FNI
Y, S — common in thickets and secondary forest.

- This Indo-Malesian tree is now widely naturalised in the CPO. Smith (1985: 57) thought, because of the lack of early to mid-19th C. collections in Fiji, that it might be a fairly recent introduction there. Whistler (1988) omitted the species as a Western Polynesian weed but later called it an introduction, e.g., to Samoa (Whistler 2000: 178).
- Kinsky and Yaldwyn (1981: 31) note that Niue's fruit-doves eat the seed of this tree.
- The name for this tree in Tonga and Samoa is a very different one, *lopa* (Rensch and Whistler 2009: 620).

***Alysicarpus vaginalis* (L.) DC.** CAS

Recorded by Whistler (1988: 21), citing *Whistler 4965*, coll. 1981, *n.v.* A later collection is *Sykes 1469/N* CHR 659564, coll. 2006, Alofi South, edge of old lawn.

- This low-growing Old World herb is a fairly recent weed in Western Polynesia, perhaps after having been introduced as a fodder plant (Whistler 1988: 21; Smith 1985: 199).

***Bauhinia monandra* Kurz** NN

Y — introduced ornamental, occ. wild in thickets. S — rarely cultivated, not seen wild.

- This New World tree is not known to naturalise elsewhere in the CPO (Whistler 1988; Smith 1985: 120), so Yuncker's record probably applies just to relics of cultivation.

***Centrosema pubescens* Benth.** CAS

S — introduced as a pasture plant in 1955 and collected wild in at least one place in 1965. A later collection is *Sykes 1456/N* CHR 659550, coll. 2006, Fuata Road, scrub by old plantation.

- This low-growing New World perennial herb is a fairly recent weed in Western Polynesia, perhaps after being introduced here as a fodder plant (Whistler 1988: 22; Smith 1985: 232).

***Chamaecrista nictitans* (L.) Moench. var. *glabrata* (Vogel) H.S.Irwin & Barneby** FNI

S as *Cassia mimosoides* L. — mainly seen as a wayside weed near Lalole. A later collection is *Sykes 1484/N* CHR 659579, coll. 2006, Vaiea, track in scrubby forest.

- This weedy New World subshrub seems to have first appeared in the CPO in Samoa in 1921 (Whistler 1988: 22). In Fiji it is abundant on Viti Levu's drier coasts (Smith 1985: 118).

***Crotalaria micans* Link** FNI

Y, S as *C. anagyroides* Kunth — introduced for soil improvement c. 1940, now widely naturalised in waste and open scrub, esp. (*f.* Sykes) on the west side of the island. A later collection is *Sykes 1524* CHR 659619, coll. 2006, Hakupu, in low scrub.

- This New World shrub is a fairly recent weed in Western Polynesia, perhaps after being introduced as a cover plant and green manure (Smith 1985: 271).

***Crotalaria pallida* Aiton** FNI

Y as *C. saltiana* non Andrews — common along roadsides and in waste, esp. on the eastern side of the island. S as *C. mucronata* Desv. — common throughout. There are no later collections.

- Whistler (1988: 22) recorded this weedy African subshrub as first seen in Samoa in 1920 and then in Tonga in 1926. For Fiji, Smith (1985: 270, as var. *obovata* (G. Don) Polhill) gives a similar date of entry and notes that it is Fiji's only abundantly naturalised *crotalaria*.

- In my opinion, a glaucescent-leaved 1965 *Sykes* collection (CHR 150543 !) also represents this species.

***Crotalaria verrucosa* L.** FNI

Y as *C. angulosa* Lam. — occ. along roadsides and in waste. S — occ. in small wayside populations in the west, from Alofi to Tuapa. The single later collection is *Fullerton AK 219427*, coll. 1975, nr Makefu, roadside.

- This Asian subshrub was first found in the CPO in Samoa in 1905 (Whistler 1988: 23).

***Desmodium heterocarpon* (L.) DC.** IND

S — seen in only one inland place, at Tukuofe nr Tafalomahina. There are no earlier collections, nor any later ones.

- This Indo-Malesian subshrub is an ancient weed of the CPO—Nicolson and Fosberg (2004: 436) cite Cook's Voyages material from the Society Islands. It is now rare in the CPO and mostly grows in cultivated areas and disturbed scrub. For the Cook Islands *Sykes* (2016:

602) describes it as found mainly in fernland on the volcanic slopes of Rarotonga and Mangaia, so perhaps it is not a calcicole.

***Desmodium incanum* DC. CAS**

S as *D. canum* (J.F.Gmel.) Schinz & Thell. — on a grassy slope in Alofi, apparently from an earlier introduction in a forage-plant trial. A later specimen of this New World herb, perhaps representing a wild plant, is Sykes 1136/N CHR 282186, coll. 1975, Fonuakula, in waste.

***Desmodium triflorum* (L.) DC. FNI**

S — common among low grasses and herbs. A first collection is Wright CHR 90056, coll. 1949, Fonuakula Farm. A later collection is Sykes 1184/N CHR 282234, Mutalau, in waste.

- This clover-like weedy herb, having found wide use as a green manure, etc., is now a pantropical species. Its original range is unclear but probably did not include the CPO, e.g., it was first collected in Western Polynesia (Samoa) only in 1894 (Whistler 1988: 24).

***Desmodium uncinatum* (Jacq.) DC. FNI**

S as *D. adscendens* non (Sw.)DC. — introduced as a forage plant in 1961, and not seen wild. A later specimen, which does represent a naturalisation, is Sykes 1571/N CHR 659667, coll. 2006, Alofi South, Peleni's Guest House, common in edge of lawn, and seen elsewhere.

- This sprawling New World subshrub is also a fairly recent naturalisation in Tonga (Whistler 1988: 24) and in Fiji too (Smith 1985: 192).
- Included here (on the grounds that the taxa are insufficiently distinct from one another) is the single Niuean specimen that has been determined as *D. intortum* (Mill.) Urb.: Sykes 1128/N CHR 282178 *n.v.*, coll. 1975, airport, near runway, det. G. P. Lewis 1985.

***Glycine tabacina* (Labill.) Benth. FNI**

S — rare, just seen in a grazed coconut grove. A later collection is Sykes 1139/N CHR 282189, coll. 1975, Fonuakula, in mown turf at edge of golf course.

- Smith (1985: 229) noted that “the tetraploid form” of this small perennial scrambler is found in Asia and Japan and eastward to New Caledonia, Fiji and Tonga. He considered it indigenous to Fiji and cited an 1860 collection by Seemann. Its status on Niue then is very unclear. It has been indicated in this entry as fully naturalised but it may actually be a native species that reappears sporadically from the seed bank.

***Indigofera hirsuta* L. CAS**

S — introduced as a pasture-improvement plant (1960s?) and said to be growing well (Wright and van Westerdorp 1965: 68). A later specimen, perhaps indicating only that the plant persists once sown, is Sykes 1241/N CHR 282290, Vaiola, rare in old rough pasture.

- This Old World subshrub is known elsewhere in Western Polynesia (Samoa) and in Fiji too but it seems not to have naturalised in these places (Whistler 1988: 25; Smith 1985: 184).

***Indigofera suffruticosa* Mill. CAS**

Recorded by Whistler (1988: 25), on the basis of Sykes 1127/N CHR 282177, coll. 1975, small colony by airport runway. There are no later collections.

- This New World shrub is said to have been introduced to Fiji some time before 1860, to provide indigo dye (Smith 1985: 183), and there are similar dates for naturalisations in Tonga and Samoa (Whistler 1988: 25).

***Lablab purpureus* (L.) Sweet IND**

***Dolichos lablab* L.**

Y — occ. in thickets. S — in a few widely separated areas, mainly on the west side of the island, in scrub and forest towards the coast. There are no later collections.

- This vine, an Indo-Malesian food plant, might be a deliberate ancient introduction across the CPO—Smith (1985: 236) says “present in Tahiti at the time of Cook's visits”, apparently relying on the record of Seemann (1865: 62, as *Lablab vulgaris* Savi var. *albiflorus* DC.). Nicolson and Fosberg (2004) make no reference to this species.

***Leucaena leucocephala* (Lam.) de Wit pepe FNI**

Y as *L. glauca* (L.) Benth. — occ. in thickets near the sea. S — common in disturbed waste, esp. near the sea on the western coast. A later collection is Gardner 10469, AK 293556, -7, coll. 2005, Opaahi sea-cliffs, abundant above the *Schleinitzia* zone.

- Smith (1985: 64) notes that in Fiji in 1860 Seemann had found this South American tree in use as a hedge plant. It is now familiar as one of the CPO's most conspicuous weeds.

***Macroptilium atropurpureum* (DC.) Urb. FNI**

S as *Phaseolus atropurpureus* DC. — growing well in a trial and making much seed. A later collection is Sykes 1294/N CHR 282340 coll. 1975, Halagie Point, roadside, scrambling on forest edge.

- Widely introduced through the tropics as a cover crop and pasture legume, this creeping New World perennial is a recent introduction to the CPO and has begun to naturalise widely here (Whistler 1988: 25; Smith 1985: 247).

***Macroptilium lathyroides* (L.) Urb. CAS**

S as *Phaseolus lathyroides* L. — in waste at Paliasi. There are no later collections.

- A New World subshrub of value as a pasture legume, this species too has recently begun to appear as a weed in Western Polynesia (Whistler 1988: 26) and Fiji (Smith 1985: 247).

***Mimosa pudica* L. ER**

Y — not seen but claimed by local informants to be present. S — seen just in a *talo* plantation at Fonuakula Farm. Sykes (1970: 59) recommended the eradication of this South American weed, and it appears to have been done—no later collections are known.

***Pueraria lobata* (Willd.) Ohwi aka IND**

Y as *P. thunbergiana* (Sieb.&Zucc.) Benth. — common along roadsides, in waste, etc.

S — uncommon, mainly seen in waste nr Paliasi. There are no later collections.

- This Indo-Malesian famine-food plant is not listed by Nicolson and Fosberg (2004) but is almost certainly ancient in the CPO, perhaps as an introduced species—its name (*aka* and cognates) is found throughout Western Polynesia and Fiji (Whistler 2000: 154; Smith 1985: 226).

***Pueraria phaseoloides* (Roxb.) Benth. CAS**

S — introduced for pasture improvement, perhaps first in 1954; not definitely seen wild anywhere but persisting in at least one place. There are no later collections from the wild.

- This low-growing Indo-Malesian vine has “scarcely” naturalised in Fiji (Smith 1988:227), and is not mentioned by Whistler (1988) as a weed of Western Polynesia.

***Rhynchosia minima* (L.) DC. FNI**

Y, S — common in plantations and scrubby waste and on roadsides. A later collection, giving quite a different picture, is Whistler 4972 CHR 392243, coll. 1981, Hio (just north of Tuapa), in disturbed roadside vegetation, not seen elsewhere. There is just one later collection, Sykes 1398/N CHR 658691, coll. 2006, Amanau—Alofi South, quite common on derelict building site.

- This slender Old World herb is a widespread tropical weed but in Western Polynesia is found only on Niue (Whistler 1988: 27). Nor is it a weed in Fiji (Smith 1985: 255).

***Senna occidentalis* L. FNI**

Y as *Cassia occidentalis* L. — infrequent on rocky cliffs near the sea. S — rare, in waste at Alofi. A later specimen is Flynn 6693 US 3399461, coll. 2000, Fonuakula, at roadside.

- This shrub, native perhaps to the Old World tropics, might be an early post-European introduction to the CPO, e.g., it was collected from Fiji in 1860 (Smith 1985: 112). The very similar *S. sophora* (L.) Roxb., also a probable Old World species, was found on Tonga by Cook’s Second Voyage (Nicolson and Fosberg 2004: 427) but has never been found on Niue.

Both species were present on Amboina in the mid-17th C. (Merrill 1917: 258).

***Senna tora* (L.) Roxb. FNI**

New record, based on two Sykes collections made in 2006: 1409/N CHR 658703, Amanau, between old concrete foundations of old building site; 1507/N CHR 659602, Vaipapahi Farm, in waste nr buildings.

- Widespread now as a pernicious weed, this Indo-Malesian subshrub was collected in Fiji by Seemann in 1860, but first records for Western Polynesia come from more than a half a century later (Smith 1985: 110; Whistler 1988: 27). The plant was present on Amboina in the mid-17th C. (Merrill 1917: 257).

***Tephrosia purpurea* (L.) Pers. kohuhu, kauhuhu IND**

Y — frequent in waste, along roadsides etc. S — quite common in plantations, particularly in the open parts of the inland basin. The only later collection is Sykes 1158/N CHR 282208, coll. 1975, Liku, in a passionfruit plantation.

- This subshrub is widespread on tropical shores of the Old World and is an ancient species of the CPO—Nicolson and Fosberg (2004: 446) cite Cook’s Voyages material from Tahiti and Tonga. Smith (1985: 173) said that in Fiji it grows in rocky, open dry places, usually near the coast. He did not note it as a weed, but speculated that in view of its use as a fish-poison it might have been deliberately introduced to Fiji and further eastwards.

***Uria lagopodoides* (L.) DC. uluhega IND**

Y — occ. in waste areas and clearings. S — locally common in old pasture and waste, mainly on the western side of the island and at Vaiea Farm. The only later collection is Sykes 1109/N CHR 282160, coll. 1975, airport, in mown lawn.

- Whistler (1988: 28) said that this low-growing herbaceous scrambler, widespread naturally from India eastwards at least as far as Australia, might be a pre-European introduction to Western Polynesia. The only relevant Cook’s Voyages material however seems to be an observation by Georg Forster for New Caledonia (Nicolson and Fosberg 2004: 447). Smith (1985: 198) thought that despite its weediness in Fiji it was probably indigenous there, and cited collections by the U.S. Exploring Expedition and Seemann.

MALVACEAE

***Abutilon grandifolium* (Willd.) Sweet *Abutilon indicum* (L.) Sw. FNI**

Y — on sea-cliffs and in thickets. S — uncommon, just on the west coast, in waste or disturbed scrub nr houses. There are no later collections.

- This weedy shrub, probably an Old World species, may have died out on Niue. It is recorded elsewhere in the CPO only from Fiji, as a possible garden escape (Smith 1981: 439). For Hawaii, Hillebrand (1888: 46) noted that it was a cultivated plant “bidding fair to become naturalized”, but it has not done so (Wagner *et al.* 1990: 873). The species was present in Amboina in the mid-17th C. (Merrill 1917: 355).

***Gossypium barbadense* L. CAS**

Y as *G. brasiliense* Macfad. — introduced, uncommon in villages. S — Persisting after cultivation at least.

- The record of Sykes (1970: 111) comes from “a small adventive colony from near an isolated house at Toa in the middle of the fernland”. This New World shrub was widely grown in Fiji in the days of the cotton boom (1860s) but lacks a comparable abundance in the wild there—Smith (1981: 430) just notes that it “persists infrequently” [from self-sown seed?]. It is not listed by Whistler (1988) as a Western Polynesian weed.

***Hibiscus abelmoschus* L. fou igo IND**

Y — frequent in clearings and waste. S — uncommon, in open waste in the centre of the island, esp. in the young coconut plantations of Vaiea Farm. A later collection is Flynn 6700 US 3399444, coll. 2000, Vahavaha area NE of Hakupu, roadside, secondary vegetation. The earliest collection for Niue is Jensen, coll. 1876 (BM *n.v.*; cited by Whistler 1988: 29).

• This Indo-Malesian shrub, often seen as a garden weed, is an ancient species of the CPO—Nicolson and Fosberg (2004: 484) cite Cook’s Voyages records for the Society Islands.

***Hibiscus diversifolius* Jacq.** *fou hele* FNI
Y, S, as *H. cannabinus* non L. — occ. in waste places, often near habitation, perhaps most common (*f.* Sykes) in Liku on the east side of the island. There are several later collections.

• This sprawling Indo-Australian subshrub was found in Fiji in 1860 (Smith 1981: 419) but further to the east, e.g., in the Cook Islands (Sykes 2016), the only records are recent ones.

• The first part of the Niuean name is the invariable Polynesian generic for hibiscus species, while *hele*, “entangling”, would refer to the plant’s spreading, prickly branches.

***Hibiscus rosa-sinensis* L.** *kaute* NN
Y — cultivated, common about houses, wild along roadsides and in thickets. S — much-planted by houses, graves, etc. The first collection is Moore 390 US 1217132, coll. 1899.

• Sykes (1970: 114) said that the most commonly seen form of this ornamental Indo-Malesian shrub had single scarlet flowers. He also ascertained, from Niuean informants, that fruit was unknown on this plant (or on any other form of it) and concluded that Yuncker’s record referred just to relics of cultivation. The question of whether some of the island’s plants belong to a pre-European cultivar is an open one (Nicolson and Fosberg 2004: 487).

***Malvastrum coromandelianum* (L.) Garcke** FNI
Y, S — abundant weed of waste and plantations. There is just one later collection (CHR 282349, coll. 1975) of this New World subshrub, which is now a pantropical weed.

***Sida acuta* Burm.f.** *mōtofu* FNI
Y, S — rather uncommon in pasture and plantations. The only later collection is Sykes 1285/N CHR 282321, coll. 1975, Halagigie Point, in [recently?] cleared area.

• This weedy shrub, perhaps originating from the New World tropics, might be an early post-European introduction to the CPO (Smith 1981:436). It is probably declining on Niue.

***Sida parvifolia* DC. incl. *S. samoensis* Rech.** *mōtofu, mōtofu totolo* IND
Y, S — local in waste and plantations, mainly in the Alofi and Fonuakula areas.

• Sykes (1970: 117) thought that this low-growing weedy subshrub, native to tropical coasts from the Indian Ocean eastwards, might have been introduced to Niue. But it is ancient in the CPO—Nicolson and Fosberg (2004: 491) record it under the name *S. pusilla* Cav. (a taxon they say probably includes *Sida samoensis*) and cite Cook’s Second Voyage material from Tonga and Vanuatu.

***Sida rhombifolia* L.** *mōtofu* FNI
Y, S — common on roadsides and in waste and plantations. There are no later collections.

• According to Nicolson and Fosberg (2004: 491) all Cook’s Voyages records of this nearly-pantropical shrub actually refer to *S. parvifolia* (see above). The earliest Western Polynesian collection of *S. rhombifolia* appears to be an 1840 one for Tonga (Whistler 1988: 30).

***Triumfetta rhomboidea* Jacq.** *mōtipo* FNI
Y as *T. bartramia* L., S — common in plantations and waste. A later collection is Flynn 6710 US 1211260, coll. 2000, Toi–Mutulau, roadside.

• The original range of this weedy, burr-fruited tropical subshrub is unclear, but might not have included the western part of the CPO, since the plant was collected in Tonga only in 1891 and in Samoa in 1905. It grew on Amboina in the mid-17th C. (Merrill 1917: 354).

***Urena lobata* L.** *mōtipo* IND
Y, S — common in clearings and waste. There are no later collections.

• This weedy, burr-fruited subshrub, native perhaps to tropical Asia, is an ancient species of the CPO—there is Cook’s Second Voyage material from the Society Islands (Nicolson and Fosberg 2004: 494) and a Third Voyage collection from Hawaii (Wagner *et al.* 1990: 903). It seems that it might be declining in abundance on Niue.

***Waltheria indica* L.** IND

S — uncommon, in a few old taro plantations. The only later collection appears to be Flynn 6701 US 3399445, coll. 2000, nr Hakupu, along side of road to Liku, a single plant.

• Sykes (1970: 204) thought that this small shrub, native perhaps to the New World but nearly pantropical as a weed in historic times, might be a recent introduction to Niue. However, it is of ancient occurrence in the CPO—Nicolson and Fosberg (2004: 654) cite Cook’s Second Voyage material from the Society Islands and New Caledonia, and St John (1978) has noted Third Voyage material from Hawaii. The situation for Western Polynesia is less clear, with the first collections from Tonga and Samoa being made as late as 1891 and 1905 respectively (Whistler 1988: 37).

• Regardless of status, *W. indica* perhaps survives on Niue mainly in the seed-bank—cf. a collection from Samoa: Whistler 9462 PTBG 10612, coll. 1994, Savai’i, “by a bulldozed track across lava, the first Samoan collection for 90 years”. Also, given its present-day abundance on the volcanic terrain of the Marquesas Islands, it is clearly not a calcicole.

MELASTOMATACEAE

***Dissotis rotundifolia* (Sm.) Triana** DD
New record, based on Flynn 6709 (PTBG, US; *n.v.*), coll. 2000, Alofi–Lakepa roadside. It is unclear that this collection comes from a wild plant rather than a garden discard.

• This creeping African ornamental herb is not mentioned by Whistler (1988) but Smith (1985: 384) said that it is naturalised to some degree in Samoa, along [forest] trails in Upolu.

MELIACEAE

Aglaia saltatorum A.C.Sm. *lagakali* IND
Y as *A. samoensis* A.Gray — in thickets and forested areas. S — only seen in the villages and abandoned sites. A later collection is Sykes 1629/N CHR 659727, coll. 2006, Hakupu village, cultivated.

- This small tree, native to Tonga and Fiji's Lau Group, is grown in villages there and in Niue for its scented flowers. One of Sykes' collections (CHR 169811) is said to be fruit-bearing, but it seems that (*pace* Yuncker) naturalisation does not occur. Why this should be so is unclear.

MYRTACEAE

Psidium guajava L. incl. *P. cujavillus* Burm.f. *kautoga* FNI

Y, S — common in scrub and disturbed forest all over the island, except at the coast; often pioneering in abandoned cultivations. There are no later collections.

- S. P. Smith (1902: 96) said that on Niue this shrubby New World fruit-tree, the yellow guava, had already covered many hundreds of acres in the more open parts of the island. It was first recorded in the CPO from Fiji in 1860 (Smith 1985: 307).

Syzygium samarangense (Bl.) Merr. & Perry *kolivao* FNI

Y as *Eugenia richii* non A.Gray — common in forest. S, as *Syzygium richii* non (A.Gray) Merr. & Perry — common in older secondary forest, occ. in primary forest. A later collection is Gardner 10748 AK 293529, coll. 2005, Hakupu sea-track, [flowering at bush edge].

- Whistler (1980) pointed out that in Western Polynesia this tree was an introduced, Malesian species [long known as *Eugenia javanica* Lam.]. No collections from the 19th C. are known from Niue, Tonga or Samoa, and Smith (1985: 351) states that it appeared to have been introduced to Fiji only “in the past half century” and had not naturalised.

- Clearly, *S. samarangense* is well-suited to Niuean conditions. Its fruit has a single, fairly small seed (c. 1.5 cm diameter), which could easily be taken by fruit-bats or the Pacific Pigeon, or even by the next-largest of the island's frugiverous birds, the Crimson-Crowned Fruit Dove (cf. McConkey 2005).

- The Niuean name of this tree, *kolivao*, was first recorded by Yuncker (1943: 91). However, Tregear and Smith (1907: 66) note *koli* as the “name of a shrub”. This name relates not to any other of Niue's several species of *Syzygium* but to the Tongan *S. neurocalyx*, a well-known indigenous small tree cultivated there for its scented fruit. For this reason Whistler (2013: 11) has suggested that *S. neurocalyx* was once also present on Niue. The Niuean name *koli vao* simply means “the *koli* of the forest”.

NYCTAGINACEAE

Boerhavia diffusa L. *kātule* IND

Y, S — common in plantations and waste, esp. (*f.* Sykes) in the more open areas of the inland basin. A later collection is Sykes 1426/N CHR 659520, coll. 2006, Alofi North, around graves, rare?

- It seems likely that some members of the pantropical *B. diffusa* complex (Nicolson and Fosberg 2004: 538–9, as *B. acutifolia* and *B. tetrandra*) are native to the CPO. These succulent herbs grow naturally on coral rock and sand at the coast, so it might be significant that neither Yuncker nor Sykes mention finding members of the genus in such places.

- Whistler (2013: 47) recorded this plant as *B. acutifolia* (Choisy) J.W.Moore, and saw it only once, in 2013: Whistler 12994, uncommon along the trail to the Talava Arches.

Mirabilis jalapa L. FNI

Y — cultivated for ornament and commonly wild in waste and along roadsides. S — rare, mostly in waste places near Alofi. A later collection is Sykes 1582/N CHR 659678, Alofi South, Peleni's Guest House, in shrubbery, regenerating by seed.

- This New World subshrub has not been recorded as a weed elsewhere in Western Polynesia (Whistler 1988) but is said to be so in Fiji (Smith 1979: 263).

OXALIDACEAE

Oxalis corniculata L., incl. var. *repens* (Thunb.) Zucc. *kihikihi* FNI

Y, S — locally common in plantations and waste, also seen on roadsides and in lawns. There are no later collections.

- Whistler (1988: 31) gives 1876 as the date of the first Niuean collection, that is, a *Jensen* specimen (BM *n.v.*). Nicolson and Fosberg (2004: 549) imply that the Cook's Voyages records of the species might just refer to occurrences in New Zealand and Norfolk Island, places likely to be within the original distribution of this widespread Old World herb. On the other hand, Whistler (1988: 31) described it as being “an aboriginal introduction to Polynesia” and cited collections from Tonga and Samoa made by the U.S. Exploring Expedition in 1839–40.

PAPAVERACEAE

Argemone subfusiformis G.B. Ownbey subsp. *subfusiformis* ER

S as *A. mexicana* L. — in waste ground at Fonuakula Farm, apparently as a very recent introduction and increasing rapidly; requiring to be eradicated. There are no later collections. The voucher for this prickly-leaved South American herb is CHR 168709, det. G. B. Ownbey 1997.

- There are no other records from the CPO, but Green (1994: 56) in discussing the species' occurrence on Norfolk Island suggests that material presently identified as *A. mexicana* (as for example, in Fiji) needs re-evaluation.

PASSIFLORACEAE

Passiflora foetida L. FNI

Recorded by Whistler (1988: 32), on the basis of Sykes 1225/N CHR *n.v.*, coll. 1975. A later collection is Sykes 1391/N CHR 658664, coll. 2006, nr Amanau, on

derelict building site created by January 2005 hurricane [correctly, Cyclone Heta of Jan 2004?].

• This New World vine, its fruit barely edible to humans, is now a pantropical weed. It was first seen in Western Polynesia (Samoa) in 1921 (Whistler 1988: 32).

Passiflora laurifolia L. NN

S — infrequent in cultivation, growing well but perhaps not naturalised anywhere. There are no later collections.
 • Whistler (1988: 32) records this edible-fruited New World vine as wild in Tonga and Samoa, in disturbed forest.

Passiflora maliformis L. CAS

Y, S — cultivated, and wild near houses and in disturbed scrub and plantations. There are no later collections.
 • Whistler (1988: 32) records this edible-fruited New World vine as occasionally found [wild] in Tonga, Samoa and Wallis and Futuna, in secondary vegetation.

PHYLLANTHACEAE

Bischofia javanica Blume IND

S — Tree at forest edge on upper terrace, Alofi–Paliassi Road. There are no later collections, but Whistler (2013) was informed of another tree in a garden on the island.

• Given the extreme rarity of the species on Niue, Sykes's record might be that of a cultivation relic, or a casual naturalisation from other, unsighted, cultivated trees.

• Smith (1979: 494) included Niue in the natural, Indo-Pacific range of the species, and suggested it might have been introduced further eastwards in ancient times (but the only Cook's Voyages material cited by Nicolson and Fosberg (2004: 411) is a record from New Caledonia). In Tonga *B. javanica* is a common forest tree, and, being valued for its wood and the dyestuff from its bark, might have been taken from there to Niue long ago.

Phyllanthus amarus Sch. & Thon. FNI

Phyllanthus niruri L.

Y, S — quite common, particularly (*f.* Sykes) in plantations. The only later collection is *Sykes* 1249/N CHR 282298, coll. 1975, Amanau, waste place on cliff edge.

• This African subshrub is now a pantropical weed. Whistler (1988: 19) noted that it was first collected from Samoa in 1893 and is still relatively common there in disturbed places and cultivated ground, but that it is uncommon in Tonga.

Phyllanthus virgatus G.Forst. IND

Phyllanthus simplex Retz.

Y, S — common around houses and in plantations. Two of the several later collections are: *Whistler* 10822 PTBG *n.v.*, coll. 1997, Mafeku, in a plantation; *Sykes* 1597/N CHR 659654, coll. 2006, nr start of Liku–Tautu track.

• This small weedy Indo-Malesian subshrub is believed to be a pre-European introduction to the CPO (Nicolson and Fosberg 2004: 424). *Sykes* (1970: 95) described it as being more frequent than the similar-looking *P. amarus* and found in a greater variety of habitats, including the

dry plantations of the island's central basin. In contrast, it appears to have declined elsewhere in the region, e.g., in Samoa and Tonga (Whistler 1988: 19) and perhaps in the Cook Islands too (*Sykes* 2016: 767).

PLANTAGINACEAE

Angelonia biflora Benth. in DC., incl. *A. angustifolia* Benth. in DC. CAS

New record, based on *Whistler* 10822 PTBG *n.v.*, coll. 1997, Maleoa (Makefu), uncommon weed in plantation. A later collection is *Sykes* 1569/N CHR 659665, coll. 2006, Alofi South, relic of cultivation, uncommon.

• This might be the taxon recorded by Yuncker (1943: 107) as *A. gardneri* Hook. and seen by him just as an ornamental herb. *Sykes* (1970: 192) did not record the plant. Smith (1991: 76) tentatively distinguished between *A. biflora* and *A. angustifolia* in Fiji and said that both were quite commonly cultivated, and casually naturalised.

Plantago lanceolata L. mōtie FNI

Y, S — common on roadsides and in plantations. A later collection is *Sykes* 1649/N CHR 659747, coll. 2006, Alofi South, in lawn; very common in gardens, waste places, roadsides.

• Elsewhere in Western Polynesia this weedy Northern Hemisphere herb is much less abundant (Whistler 1988: 33), and it is unknown in Fiji (Smith 1991: 148). For the Cook Islands, *Sykes* (2016: 782) says that it is locally abundant near the airfield on Mangaia (on crushed coral?) but is just is an uncommon weed on the volcanic terrain of Rarotonga.

• The Niuean name is a generic for grasses and similar herbs.

Plantago major L. FNI

Y — common on roadsides and in plantations. S — rare, seen just in two places. No later collections are known.

• There are mid- to late-19th C. collections of this Old World herb from Samoa, Tonga and Fiji (Whistler 1988: 33; Smith 1991: 149) but the plant is still uncommon in these places. For the Cook Islands, *Sykes* (2016: 782) notes that it is found, like *P. lanceolata*, just on the two largest islands (Rarotonga and Mangaia), in relatively moist habitats.

Russelia equisetiformis Schlttdl. & Cham. CAS

Y, S — cultivated for ornament, and wild along roadsides, mainly (*f.* *Sykes*) down the western side of the island. There are no later collections.

• Whistler (1988) does not include this New World shrub as a Western Polynesian weed, but it is now at least a casual there and in Fiji (Smith 1991: 78). In the Cook Islands, where it is commonly cultivated, *Sykes* (2016: 852) notes that fruit capsules are not formed.

POLYGALACEAE

Polygala paniculata L. FNI

S — Vaipapahi Farm, apparently new to the island. There are no later collections.

• The first Western Polynesia record of this small weedy New World herb, now widespread in the CPO, comes from Samoa in 1905 (Whistler (1988: 33).

POLYGONACEAE

***Antigonon leptopus* Hook. & Arn. CAS**
Y — cultivated. S — cultivated, and wild in a small area of cleared forest opposite the Alofi Hospital. There are no later collections.

• This ornamental New World vine is not noted by Whistler (1988) as a weed in Western Polynesia but Smith (1981: 305) says that in Fiji it has naturalised along roadsides, etc.

PORTULACACEAE

***Portulaca oleracea* L. kamole FNI**
Y, S — common in plantations and waste, esp. (f. Sykes) where the ground has been compacted. There are no later collections.

• This succulent herb now has a nearly pantropical distribution but there is no Cook's Voyages material of it from the CPO (Nicolson and Fosberg 2004: 563); rather, it seems to be an early European introduction here, having been found, for example, in Tonga in 1840 (Whistler 1988: 34).

• Niue's two indigenous members of the genus, *P. lutea* Sol. ex G.Forst. and *P. samoensis* Poelln., only grow close to the sea, in more or less natural habitats (Sykes 1970: 171).

RUBIACEAE

***Gardenia taitensis* DC. tiale IND**
Y — frequent in thickets, esp. nr the sea. S — locally common nr the sea; occ. cultivated in gardens, for its scented flowers.

• Sykes (1970: 176) said Niueans told him that this plant was not indigenous to the island. But it is certainly an ancient species of the CPO—Nicolson and Fosberg (2004: 594) cite Cook's Second Voyage material from the Society Islands and Tonga. Smith (1988: 181) suggests that its native range extends from Vanuatu to Niue and perhaps further to Samoa. East of here this ornamental shrub is often planted in gardens and around graves (cf. Whistler 2015: 96), but it hardly seems to have naturalised in these places— Sykes (2016: 808), for example, notes that in the Cook Islands fruit is rarely formed.

***Hedyotis biflora* (L.) Lam. IND**

S — nr Namoui, in an old plantation some way inland. There are no later collections.

• This small sprawling Indo-Malesian herb is likely to be native to the CPO—in Fiji, for example, Smith (1988: 358) notes it as a plant of coastal rocks rather than a weed. The only Cook's Voyages material known, perhaps from Tonga, is of uncertain identity (Nicolson and Fosberg 2004: 594).

***Spermacoce assurgens* Ruiz & Pav. FNI**
***Borreria laevis* (Lam.) Griseb.**

Y — in clearings and waste. S as *B. laevis* and *B. verticillata* (L.) G.Mey. —abundant throughout, probably the island's most numerous weed. There are no later collections.

• A straggling New World herb now nearly pantropical as a weed, this plant was first collected from Western Polynesia (Samoa) in 1931 (Whistler 1988: 35). Some recent works give its correct name as *S. remota* Lam.

• Several specimens of this genus (CHR 170396, 658688, 659569, 659605) have been tentatively identified by Sykes (in sched. 2002) as *S. pusilla* Wall., but I cannot see that they are other than *S. assurgens*. The former species, a small Old World herb of seasonally damp, sandy ground, seems to be unknown in the CPO.

RUTACEAE

***Citrus aurantifolia* (Christm.) Swingle *tipolo* CAS**
Y, S — cultivated, and (f. Sykes) wild to some degree.

• This species, the lime, was said by Sykes (1970: 182) to be the only member of its genus to thrive on Niue, and that “bushes often grow near the tracks to plantations, where the seed was dropped either accidentally or deliberately”. Whistler (1988) does not record it as having naturalised elsewhere in Western Polynesia, but it seems to have done so (infrequently) in Fiji, having been introduced, according to Seemann, from Tahiti in 1823 (Smith 1985: 520).

• The American ecologist Daniel Janzen (quoted by Barlow 2000: 35) has commented on the lack of appreciation of the role horses and cattle have in dispersing large fruits and seeds. Both kinds of animal were common enough on Niue fifty years and more ago. On Norfolk Island, cattle are said to have been the principal dispersers for the rough lemon, *Citrus jambhiri* Lush. (O. Evans, pers. comm.), and in Fiji Twyford and Wright (1965: 215) note that “citrus trees and occasional groves are scattered ... often in the most unlikely [*sic*] places deep in the forest and frequently alongside interior tracks of the main islands”.

SAPINDACEAE

***Cardiospermum halicacabum* L. IND**

S — on building-site spoil at the new Paliasi High School, seed being freely produced. There are no later collections.

• Presumably this forest-edge climber is a recent introduction to Niue. However, its natural range seems to be a nearly pantropical one and includes the CPO—Nicolson and Fosberg (2004: 622) cite Cook's Voyages material from the Society Islands. It was found early in the European era in Tonga and Samoa (Whistler 1988: 35) and Fiji (Smith 1985: 583).

***Pometia pinnata* J.R.Forst. & G.Forst. *tava* IND**

Y, S — common except nr the sea, able to regenerate in secondary stands.

• There is no evidence that this well-known forest tree, valued for its edible fruit and easily-worked wood, was ever cultivated on Niue or introduced there from further west in its extensive Indo-Pacific range. It is certainly an ancient species of the CPO—Nicolson and Fosberg (2004: 625) cite Second Voyage collections from Tonga and Vanuatu. But its pre-European absence from the Cook Islands and French Polynesia (Sykes 2016: 842) makes one wonder whether it was humans or fruit-bats that brought it to Niue.

SOLANACEAE

Capsicum frutescens L.

FNI

Y, S — cultivated and occ. wild around houses and disturbed scrub and forest. There are no later collections from the wild of this familiar New World subshrub.

Cestrum nocturnum L.

NN

Y, S — uncommon as a cultivated plant (*f.* Sykes), mainly in Alofi.

- Whistler (1988: 36) accepted this ornamental New World shrub as a naturalisation but this appears not to be the case, e.g., the collection Sykes 1486/N CHR 659581, coll. 2006, Hakupu village, was just from a cultivated plant.

Datura metel L.

CAS

Y as *D. fastuosa* L., S — cultivated, occ. in waste, persisting locally (*f.* Sykes) through producing prolific seed. There are no later collections.

- This Asian subshrub is not noted by Whistler (1988) as a weed in Niue or anywhere else in Western Polynesia, but it is said to be somewhat weedy in Fiji (Smith 1991: 32).

Nicandra physalodes (L.) Gaertn.

CAS

Recorded by Whistler (1988: 36), on the basis of Sykes 1235/N CHR 282284, coll. 1975, Vaiola, by old cow shed. There are no later collections.

- This weedy New World subshrub is apparently very rare on Niue. It appears to be a relatively recent and largely unsuccessful introduction to the CPO (*cf.* Whistler 1988: 36).

Nicotiana tabacum L.

CAS

Y, S — sparingly cultivated, and (*f.* Sykes) rarely wild, e.g., on coral walls at Fonuakula golf course. There are no later collections.

- This familiar New World herb would have been cultivated throughout the CPO early in the European era, but it appears to have been able to naturalise only locally, e.g., in the drier parts of Fiji (Smith 1991: 37), and on Mangaia in the Cook Islands, along roadsides through coral rock (Sykes 2016: 859).

Physalis angulata L., incl. *P. minima* L.*fua manini, manini*

FNI

Y, S — common in plantations etc., esp. (*f.* Sykes) in the inland basin. A later collection is Sykes 1307/N CHR 282353, coll. 1975, Fangafetu, in *talo* plantation in fernland.

- Whistler (1988: 36) noted the early (c. 1840) first-collection dates for this subshrub in Tonga and Samoa. It seems likely to have been an early introduction to Niue as well, with Smith (1902: 92) even saying that it was regarded as a native species. It would have been known at that time as a food-plant, but with fruits smaller and not nearly as edible as those of *P. peruviana*.

- *Physalis angulata* is said to be a New World species, but remarkably, there is Cook's First and Second Voyage material of it from the Society Islands (Nicolson and Fosberg 2004: 645). The apparent absence of this weedy plant from elsewhere in the Pacific at that time (including Hawaii) seems to call for a special explanation: was it

introduced to the Societies by Bougainville, from Brazil? It may also be relevant, with respect to the western CPO records, that this plant, including the form known as *P. minima*, was present on Amboina in the mid-17th C. (Merrill 1917: 461, 462).

Physalis peruviana L. *manini pālagi*

FNI

Y, S — occ. in plantations and waste. There are no later collections.

- Whistler (1988: 36) has noted the early (c. 1840) first-collection dates for Tonga and Samoa of this edible-fruited New World subshrub, the Cape gooseberry. Its copious production of long-lived seeds may have enabled it to spread quickly through the CPO, as a stowaway in soil and in association with farm animals and planting material, etc.

Solanum americanum Mill. *polo, polo kai*

IND

Y, S, as *S. nigrum* non L. — common in plantations and waste.

- This weedy subshrub is believed to be of pre-European occurrence in the Pacific—Nicolson and Fosberg (2004: 645) record Cook's Second and Third Voyage material from at least Tahiti and Easter Island.

- Sykes (1970: 197) described his Niuean plants as having umbellate inflorescences, small (less than 1 cm diam.) flowers on peduncles that become deflexed in fruit, and fruit that are “scarcely glossy”. An earlier Niuean specimen, S. P. Smith 71 AK 93708, coll. 1901, “*polo kai*” was determined by S. D. Knapp in 2017 as the very similar species *S. opacum* A. Braun & Bouché. Both the specimens of Sykes that bore fruit, (CHR 169995, -7) are labelled as having black fruit, as in *S. americanum*, but Sykes (1970: 198) also mentions “scarcely glossy” fruits, as in *S. opacum*. Perhaps both species are present.

Solanum repandum G. Forst. *lokumoka*

IND

Y as *S. album* non Lour. — occ. in plantations. S — rare, seen in only three places, incl. an old banana plantation at Utuhina. The only later collection (*f.* Whistler 2013) is Whistler 10819, *n.v.*, coll. 1997, in a plantation at Makefu (Maleoa) The first collection from Niue is the one cited by Yuncker (1943: 106): S. P. Smith 47 AK 93695, coll. 1901, “*lukumoka*”.

- The species was regarded by Smith (1991: 15) as an ancient one in the CPO—he cites Cook's Voyages material from the Society and Marquesas Islands—but he also thought that “in view of the fact that *Solanum repandum* is found only in association with human disturbances, it is probably not truly indigenous [here]”. Whistler (2013: 77) concurred, calling this plant “the Polynesian tomato” and treating it as a cultivar of the Indo-Malesian *Solanum ferox* L. [but the closely related *S. lasiocarpum* Dunal is another possibility].

- Whistler (2000: 202) recorded the following cognates of the Niuean name in Western Polynesia: *taulo'u* (Samoa), *to'uloku* (Tonga), *tauloko* (Uvea) and *tauloku* (Futuna). Perhaps recording an actively varying vocabulary of his time McEwen (1970) gives *lokumoka*, *lukumoka*, and *lokufulu*. The first contrastive, *moka*, is hard to explain, but the second, *fulu*, would seem to refer to the obvious hairiness of the young fruit.

***Solanum torvum* Sw.**

CAS

Recorded by Whistler (1988: 37), on the basis of Sykes 1126/N CHR 282176, coll. 1975, near airport, in a plantation of *Leucaena*. There are no later collections.

• Now a pernicious pantropical weed, this shrub from the West Indies was firmly established on Fiji (Viti Levu) by 1906 (Smith 1991: 10).

***Solanum viride* R.Br. polo, polo miti**

IND

S as *S. uporo* Dunal and *S. tongaense* St John — in open ground in plantations and on a recently cleared track. The first collection of this rare plant from Niue is *S. P. Smith* 72, AK 93683, coll. 1901, common, “*polo miti*”. (Another *Smith* collection from this time, AK 93696 *n.v.*, was also accepted by Sykes (1970: 200) as belonging to this species).

• Whistler (2013) thought that this shrub had not been seen on the island since 1965, but there is a single later collection: *Sykes* 1254/N CHR 282303, coll. 1975, Alofi, cultivated by house, det. D. E. Symon 1986.

• Smith (1991: 20) treated *S. viride* as indigenous to Fiji, Tonga and Samoa, “from which its range may have been extended eastwards to Niue [and further] by human assistance”. He noted that the fruits of the “wild type”, as seen in Niue, are c. 1 cm diameter, while those of cultivated plants are 3 cm diam., tomato-like and edible. Both forms are now uncommon everywhere in the CPO. The notes of Sykes’ collections would suggest that this is another rare species that now occurs on Niue mainly in the seed-bank.

• The plant that Yuncker (1943: 199) determined as *S. uporo* was noted by Sykes (1970: 199) as having a greater amount of pubescence on its leaf undersides and a different habitat (the coast north of Alofi). Sykes’ conclusion that this collection (*Yuncker* 10039, *n.v.*) belongs to *S. amicorum* Benth., an uncommon native species of Tonga, was accepted by Whistler (pers. comm. c. 2013). An earlier collection (*S. P. Smith* 63 AK 93685, coll. 1901, “*polo*”) was determined by Sykes as possibly belonging to *S. amicorum* but in my opinion might just as well be *S. viride*.

THYMELAEACEAE

***Phaleria disperma* (G.Forst.) Baill.**

IND

S — cultivated ornamental, occ. in villages from Alofi North to Avasele; a number of plants of various ages in a coconut plantation at the latter place. The only later collection is *Sykes* 1568/N CHR 659664, coll. 2006, Alofi South, relic of cultivation, with ripe fruit.

• This shrub is native to Fiji, Samoa and Tonga, where it is usually found in sandy or rocky coastal places. Sykes (1970: 206) thought it likely to be a recent [presumably, deliberate] introduction to Niue.

URTICACEAE

***Laportea interrupta* (L.) Chew hogohogo, ogoogo**

IND

Y as *Fleurya interrupta* (L.) Gaudich. — occ. in waste and clearings. The only later collection is *Sykes* 1116/N CHR 282167, Alofi wharf, by building in light shade. The first collection is *Jensen* BM *n.v.*, coll. 1876 (Whistler 1988: 210).

• The several specimens that Sykes (1970: 210) referred to under this name actually belong to *Acalypha indica* (see above), so *L. interrupta* might now be extinct on Niue or exist there only in the seed-bank. This annual herb, which is said to have stinging hairs only sometimes, is widespread in the tropics from India to Australia and is also ancient in the CPO—Nicolson and Fosberg (2004: 678) cite Cook’s Voyages material from the Society Islands.

***Pilea microphylla* (L.) Lieb.**

FNI

Y, S — common on shaded damp rocks, walls, moist ground nr houses, and (*f. Sykes*) locally abundant in open coastal forest. There are no later collections of this New World herb.

• Three other species of *Pilea*, *P. cadierei* Gagn. & Guillaumin, *P. depressa* (Sw.) Blume, and *P. serpyllacea* Lieb., are cultivated on Niue and are spreading (partly by seed?) from their original sites, but they are said to be less common than *P. microphylla* (CHR !).

VERBENACEAE

***Lantana camara* L.**

FNI

S as *L. camara* var. *aculeata* (L.) Mold. — mainly in waste ground near Fonuakula Farm, apparently a recent introduction for ornament but already spreading. The only later collection is *Sykes* 1480/N CHR 659575 coll. 2006, Lemanga inland of Vaiea, scattered in scrub along road and tracks.

• This scrambling New World shrub, a pernicious weed in many tropical and subtropical countries, was first found in the CPO in Samoa in c. 1895 (Whistler 1988: 39).

***Stachytarpheta jamaicensis* (L.) Vahl**

CAS

Recorded by Whistler (1988: 39), on the basis of *Sykes* “1374” [correctly, 1324]/N CHR 282370, coll. 1975, Vaiea Farm, in rough grazed pasture, not seen elsewhere. There are no later collections.

***Stachytarpheta urticifolia* (Salisb.) Sims**

FNI

Y as *S. indica* non Vahl — uncommon, in waste. S — widespread in waste and pasture, also locally common along roadsides through forest. A later collection of this well-known New World weed is *Herrick* AK 220562, coll. 1994, Palaha sea-track, common at edge of clearing.

***Verbena bonariensis* L.**

CAS

S — in waste at Fokipa near Hakupu. The voucher is *Sykes* 1014/N CHR 169881, coll. 1965, det. H. N. Moldenke 1968. There are no later collections of this New World subshrub.

***Verbena officinalis* L.**

CAS

Y — occ. weed of roadsides and waste. *Sykes* (1970: 216) confirmed the record, which is based on *Yuncker* 9645 (BISH?, *n.v.*) but did not see the plant growing on Niue, and neither has any later botanist. The first collection, its habitat not recorded, is *Moore* 393 US 653393, coll. 1899, det. N. O’Leary, 2006.

• It is unexpected that this European ornamental herb should have naturalised on Niue, since it is unknown

elsewhere in the CPO, even in gardens. However, it is recorded from New Caledonia (MacKee 1985: 136), and its native habitat in Britain is said to be fairly dry calcareous grassland (Stace 1991: 658).

MONOCOTYLEDONS

AMARYLLIDACEAE

Crinum asiaticum L. IND

Y, S — cultivated for ornament; persisting at house sites, along roadsides and around graves etc. “as an escape” but (*f.* Sykes) apparently not naturalising.

- The absence of this widespread Indo-Pacific species from the natural coastal habitats of Niue suggests that it is probably a post-European introduction here. However, there is Cook’s Second Voyage material from Tonga that might belong to this species, and a likely record for Vanuatu (Nicolson and Fosberg 2004: 166).

Hymenocallis pedalis Herb. NN

H. littoralis non (Jacq.) Salisb.

Y — cultivated for ornament around houses and commonly wild along roadsides and in waste. S — cultivated esp. in the villages along the western side, not seen wild.

- This robust New World herb is widely grown in the CPO but seems merely to persist rather than naturalise, e.g., in the Cook Islands (Sykes 2016: 169).

Proiphys amboinensis (L.) Herb. NN

Eurycles amboinensis (L.) Lindl.

Y, S — cultivated for ornament, persisting around graves etc. but probably not naturalising.

- This robust Malesian herb is widely cultivated in the CPO, but, like the *hymenocallis* and the *crinum*, persists rather than naturalises. In this region, however, all three species seem to be able to make fruit and seed (Sykes 2016).

Zephyranthes rosea Lindl. FNI

Y — introduced ornamental, cultivated about houses, frequent along roadsides and in waste. S — occ. cultivated, wild in lawns and waste esp. in Alofi and Avasele. An earlier collection is *Woods* AK 118908, coll. 1959, “growing everywhere after the hurricane”.

- This bulb-bearing New World herb is a fairly recent arrival to Western Polynesia but had naturalised in New Caledonia by 1966 (MacKee 1985: 62). In the Cook Islands it has become abundant as a weed of lawns, just as on Niue (Sykes 2016: 171).

ARACEAE

Amorphophallus paeoniifolius (Dennst.) Nicolson

A. campanulatus Decne *teve* IND

Y — common in thickets and forest clearings. S — not common, seen just in and around a few old inland plantations. There are no later collections.

- This robust Old World herb grows wild in coastal forest and open waste throughout the CPO. It is a well-known famine-food plant of the Polynesians and there has never been any doubt about its antiquity here, e.g., it

was seen in the Society Islands during Cook’s Second Voyage, being cultivated under forest trees (Nicolson and Fosberg 2004: 167).

ARECACEAE

Cocos nucifera L. *niu* IND

Y, S — common around the island, but (*f.* Sykes) relatively scarce in the south, esp. inland.

- Georg Forster wrote that very few “coco-palms” were seen on island’s west coast (Pointer 2015: 33). A 1903 map of the island (*loc. cit.* 233) shows “extensive coconut cultivations” at Mutalau in the north-west.

- The coconut palm, originating it seems in Southeast Asia, might be indigenous to various islands of the CPO, or at least an ancient introduction to them. On Niue, naturalisation perhaps occurs only where rats and coconut crabs cannot eat the seedlings.

Pritchardia pacifica Seem. & Wendl. *piu* IND

Y as *Eupritchardia pacifica* (Seem. & Wendl.) Kuntze, S — cultivated for ornament around houses and (*f.* Sykes) occ. seen elsewhere, apparently having sprung up from discarded fruit [or bird-dispersed seed?]. There are no later collections.

- This palm is native somewhere in the western Pacific (Watling 2005) but perhaps not to Niue, to judge especially by its lack of integration into the island’s primary forest.

ASPARAGACEAE

Cordyline fruticosa (L.) A.Chev. *tī* IND

C. terminalis (L.) Kunth

Y, S — cultivated in hedges and for ornament, and commonly wild across the island in scrub and forest. There are no later collections.

- This Indo-Malesian shrub is an ancient plant of the CPO (Nicolson and Fosberg 2004: 162) and was formerly of great cultural significance, in ritual, boundary-marking, and as a famine food. The evidence from pollen studies is that it accompanied Polynesian migrations across the Pacific (M. Prebble, cited in Hinkle 2004).

Furcraea foetida (L.) Haw. *toua* FNI

Y as “possibly *F. gigantea* Vent.”, S — once cultivated for its fibres, now wild in many open areas in the east and south of the island. There are no later collections.

- It is just by coincidence that the Niuean name for this robust South American herb should recall the obsolete English word “tow”, meaning the fibres of flax (*Linum*), etc.—it is in fact the Niuean form of the usual Polynesian word for rope.

CANNACEAE

Canna indica L. (and hybrids) CAS

S — cultivated, naturalised locally. There are no later collections.

- This genus of robust rhizomatous herbs is a strictly tropical American one. Sykes (1970: 224) noted that plants matching *C. indica* in the strict sense (small stature, slender yellow to crimson flowers) are present on the island, make good seed, and grow wild to a slight

degree around houses and in waste (CHR 169965). In contrast, the larger-flowered hybrids (*C. × generalis* L.H. Bailey) do not set seed and are seen in the wild just as cultivation relics, e.g., in the Cook Islands (Sykes 2016: 207).

COMMELINACEAE

Commelina diffusa Burm.f. IND

Y — along roads and in waste, on moist soil. S — common in plantations, also nr houses.

There are no later collections.

- This succulent Indo-Malesian herb is an ancient species of the CPO—Nicolson and Fosberg (2004: 175) cite Cook's Second Voyage material from the Societies and Tonga and probably Vanuatu as well. Despite not having been collected recently on Niue *C. diffusa* seems unlikely to have declined there—it is currently recorded, for example, as abundant in the Cook Islands (Sykes 2016: 209), although it is said to grow well on coral rock and sand here only if conditions are moist enough.

Rhoeo spathacea (Sw.) Stearn FNI

Y as *Rhoeo discolor* (L'Hér.) Hance, S — cultivated for ornament, also commonly wild in waste, occ. abundant in open rocky coastal ground esp. nr Alofi. There are no later collections of this New World succulent.

Tradescantia zebrina Bosse FNI

Zebrina pendula Schnizl

Y — cultivated, and common on exposed rocks around houses nr the coast. S — seldom cultivated, and a rare wild plant of rocky waste. There are no later collections of this New World succulent.

CYPERACEAE

Cyperus alternifolius L. DD

Y, S — cultivated for ornament, uncommon. A specimen of unclear status (a garden discard?) is *Flynn* 6698 US 3442144, coll. 2000, Alofi-Lakepa Rd, in secondary forest.

- Recorded by Whistler (1988: 41) as a weed in Western Polynesia. Niue has few of the damp habitats required by this familiar garden plant, a native of the Indian Ocean region.

Cyperus brevifolius (Rottb.) Hassk. CAS

S — only in damp ground near Alofi wharf. There are no later collections.

- This pantropical species is widespread in Western Polynesia, as a relatively recent introduction (Whistler 1988: 43).

Cyperus cyperoides (L.) Kuntze FNI

Y — common along roadsides and in waste. S — occ. in waste, common only in the Fonuakula and Vaiola areas. A later collection is *Sykes* 1280 CHR 282326, coll. 1975, Vaipapahi, in mown area of plantation.

- This weedy Old World sedge is regarded as a post-European introduction to the CPO. The first collection for Niue, and apparently the first for Western

Polynesia, is *Jensen*, coll. 1876, BM *n.v.*, which was recorded by Whistler (1988: 44) as *Mariscus sumatrensis* (Retz.) Raynal.

Cyperus gracilis R.Br. FNI

S as *C. compressus* non L. — rare, in shaded ground at Alofi. Two later *Sykes* collections were made in 1975 (CHR !), both coming from low-growing grass under trees.

- This slender sedge, native to Australia and New Caledonia, is known elsewhere in the CPO only from Tonga (Whistler 1988: 41).

Cyperus javanicus Houtt. IND

S — rare, near a shelterbelt at Vaiea Farm, and perhaps at one plantation elsewhere. There are no later collections.

- Elsewhere in the CPO this robust Old World sedge grows mainly in unmodified coastal habitats, and Nicolson and Fosberg (2004: 180) cite likely Cook's First Voyage records from the Society Islands. Its absence from Niue's coast, then, supports the contention of Sykes (1970: 227) that it might be a recent introduction to the island.

Cyperus mindorensis (Steud.) Huygh IND

Y, S as *Cyperus kyllingia* Endl. — common in waste nr houses, less so (*f. Sykes*) along roadsides. There are no later collections.

- Koyama (1979: 262) knew of the Cook's Voyages material from the Society Islands (Nicolson and Fosberg 2004: 184), but, with respect to Fiji, appears to have regarded this widespread weedy sedge as an early post-European introduction. It was found at a relatively early date (1839) in Samoa too (Whistler 1988: 43, as *Kyllinga nemoralis* (J.R. & G.Forst) Dandy ex Hutch. & Dalz.).

Cyperus polystachyos Rottb. FNI

Recorded by Whistler (1988: 44, as *Pycreus polystachyos* (Rottb.) P.Beauv.), on the basis of *Sykes* 1118/N CHR 282168, coll. 1975, Alofi wharf, in sandy rainwater channel. A later specimen of this widespread weedy sedge is *Sykes* 1443/N CHR 659537, coll. 2006, Tapeu, moist ground at base of municipal water tank.

- The native range of the species is unknown but apparently did not include the CPO—for example, it was a fairly recent arrival to Western Polynesia (Whistler 1988: 44).

Cyperus rotundus L. FNI

Y — common around houses and in waste. S — common in plantations and waste but not a very troublesome [crop] weed. There are no later collections of this weedy Old World sedge.

Cyperus seemannianus Boeckeler IND

S — scattered in secondary forest inland, probably more frequent in older forest, able to persist after forest clearance if left shaded. There are no later collections

- This sedge is believed to be endemic to the CPO, including the Society Islands (Koyama (1979: 255).

Sykes (1970: 228) thought it was “probably indigenous” to Niue. It favours relatively damp sites.

- Nicolson and Fosberg (2004: 179) record possible Cook’s Voyages material from the Society Islands as the similar-looking *C. cyperoides*, but this plant (see above) is a post-European introduction to the CPO. Yuncker (1943: 25) might not have recorded *C. seemannianus* for a similar reason, so his “*C. cyperoides*” specimens (9670 & 9739, *n.v.*) should be checked.

***Fimbristylis ovata* (Burm.f.) J.Kern FNI**

Y as *Fimbristylis* cf. *acuminata* Vahl — seen once in waste. S — rare, local nr two villages.

Also known from collections made by Sykes in 1975 from nr Vaiola (1348/N CHR 282394) and nr the Alofi wharf (1377/N CHR 282427). A collection (CHR 90054) was made by A. C. S. Wright in 1949 from Fonuakula Farm, the place where Yuncker (1943: 26) had found his single collection.

- The original distribution of this weedy perennial sedge is unclear (Whistler (2013) thought it indigenous to the CPO). Now a pantropical weed, it favours relatively dry sites.

DIOSCOREACEAE

***Dioscorea alata* L. ufi IND**

Y, S — widely cultivated, and (*f.* Sykes) occ. persisting in old plantations. There are no later collections.

- This species, the winged yam, is well-known as a pre-European species in the CPO (Nicolson and Fosberg 2004: 188). It is not recorded by Whistler (1988) as a Western Polynesian weed, but for Fiji Smith (1979: 171) described it as “fully naturalised”.

***Dioscorea bulbifera* L. hoi IND**

Y, S — common as a wild climber, along tracksides and in old plantations, waste and secondary forest. There are no later collections.

- This yam is also an ancient species of the CPO (Nicolson and Fosberg 2004: 189). Being a famine-food plant it might have been taken from island to island deliberately, or, thanks to its stem bulbils, might have spread as a contaminant of soil around the planting stock of some other species. It is the only yam recorded by Whistler (1988: 45) as a weed in Western Polynesia.

***Dioscorea esculenta* (Lour.) Burkill ufilei IND**

Y — frequent in thickets. S — mostly in the more central areas, in open fernland but also in taller vegetation there. The only later collection (CHR 659623, coll. 2006) is of a crop plant.

- This yam is often regarded as a pre-European introduction to the islands of the CPO (to Fiji at least, according to archaeological research; Horrocks and Nunn 2007) but there seem to be no supporting Cook’s Voyages specimens.

***Dioscorea pentaphylla* L. pilita IND**

Y, S — quite common in dry waste and scrub, like *D. bulbifera* in this regard but (*f.* Sykes) less frequent.

The only later collection is Sykes 1628/N CHR 659699 coll. 2006, Vaikona Chasm track, quite common in understorey of open forest.

- This yam is an ancient famine-food plant of the CPO—Nicolson and Fosberg (2004: 190) cite Cook’s Second Voyage material from the Society Islands.

ORCHIDACEAE

***Vanilla planifolia* Andrews NN**

Y as *V. fragrans* (Salisb.) Ames, S as *V. mexicana* Mill. — originally cultivated for house decoration and garlands, but sometimes (*f.* Sykes) long-persistent in the wild, e.g., in the former village of Fasiau, where it was “climbing to the tops of small trees” (Sykes 1970: 265).

- The vanilla orchid seems not to have naturalised by seed in Tonga, Samoa or the Cooks (Cribb and Whistler 2011: 121) but might have done so in dry forest in Fiji (Kores 1991).

- The recent revival of the vanilla industry on Niue has meant that seed-pods, formed through hand-pollination, are now commercially available. The plant involved could be the ‘Tahitian vanilla’, said to be a hybrid between *V. planifolia* and *V. odorata* C.Presl.

POACEAE

***Axonopus compressus* (Sw.) P.Beauv. FNI**

S — common around houses and in plantations. The first collection is Wright CHR 67612, coll. 1949, Fonuakula Farm. A later collection is Sykes 1314/N CHR 282360, coll. 1975, old pasture area, abundant here and in many other places.

- A New World grass that has become a pantropical weed, *A. compressus* has been known in the CPO for a hundred years or so, e.g., in Fiji (Parham 1979: 333).

***Axonopus fissifolius* (Raddi) Kuhlm. FNI**

Recorded by Whistler (1988: 46, as *A. affinis* Chase), on the basis of Sykes 1378/N CHR 282428, coll. 1975, Amanau Hotel, in rough lawn. A possible later collection is Sykes 1599/N CHR 659696 *n.v.*, coll. 2006, Liku–Tautu trackside, in scrub.

- Clayton and Snow (2010: 65) do not list this New World grass as occurring on Niue.

***Bothriochloa bladhii* (Retz.) S.T.Blake FNI**

Recorded by Whistler (1988: 46), citing Krause 1588 BISH 421407, coll. 1978. An earlier collection is Sykes 1309/N CHR 282355, coll. 1975, Fangafetu, small area in grassy fernland, det. T.A. Cope 1985. A later collection is Sykes 1451/N CHR 659545 *n.v.*, coll. 2006, airport, common at boundary fence.

- Clayton and Snow (2010: 86) do not list this Old World grass as occurring on Niue.

***Cenchrus ciliaris* L. CAS**

S — cultivated at Vaipapahi and Vaiea Farms. A specimen from the wild, recorded by Whistler (1988: 47), is Sykes 1332/N CHR 282378, coll. 1975, Amanau Hotel, waste place on cliff edge. There are no later collections of this Old World fodder grass and weed.

***Cenchrus echinatus* L. *mōtie vihilago* FNI**
Y, S — common along roadsides and in waste and plantations, esp. on the poor soils of the inland basin.

• Nicolson and Fosberg (2004: 223) referred Cook's Second Voyage material to this New World species, in error for the widespread Pacific endemic *C. caliculatus* Cav. The confusion dates back to Banks and Solander, who found *C. caliculatus* in the Society Islands but recorded it in their *mss.* as *C. echinatus* (Merrill 1954; Gardner 2007).

***Cenchrus purpureus* (Schumach.) Morrone CAS**
S as *Pennisetum purpureum* Schumach. — uncommon, cultivated as a fodder plant (introduced in 1954) and apparently persisting for a number of years. A later collection is Sykes 1334/N CHR 282380, coll. 1975, Amanau, in waste. Whistler (1988: 55) cites this large African grass as having naturalised on Niue.

• The records (under *Pennisetum*) in Clayton and Snow (2010: 74) of *Cenchrus macrostachyus* Hochst. ex Steud. and *Cenchrus polystachios* (L.) Morrone. (syn. *P. setosum* (Sw.) L. Rich.), appear to be based just on the cultivated plants noted by Yuncker (1940: 23) and Sykes (1970: 250).

***Chloris barbata* Sw. FNI**
Recorded by Whistler (1988: 48), citing Krause 1592 BISH 421404, coll. 1978. An earlier collection is Sykes 1123/N CHR 282193, coll. 1975, Alofi wharf, on sand heap. A later collection of this nearly pantropical weedy grass is Sykes 1466/N CHR 659561, Alofi South, very common in waste ground.

***Chloris gayana* Kunth CAS**
S — seen in two places away from where it was trialed in 1961 as a pasture grass. A later collection of this African grass is Sykes 1532/N CHR 659627, coll. 2006, Hakupu, Tuhia'atua track, edge of sea cliff.

***Chrysopogon aciculatus* (Retz.) Trin. *mōtie fisi* IND**
Y, S — common in lawns, waste and in some [grazed?] plantations.

• Sykes (1970: 238) implied that this Indo-Malesian grass had been introduced to Niue. Nicolson and Fosberg (2004) do not mention the species, but it is well known to have been found by Cook's First Voyage botanists Banks and Solander in the Society Islands (Seemann 1868: 320), and the dates of its first collections in Western Polynesia (Whistler 1988: 378) and Fiji (Parham 1979: 378) are also early ones. Its bristly seed-heads would seem to give it an effective means of long-distance dispersal, so it is treated here as a native Niuean plant.

***Coix lacryma-jobi* L. *tagataga* IND**
Y, S — occ. cultivated around houses. There are no later collections.

• In those Pacific islands where damp habitats are plentiful this Old World grass is a common weed. It is an ancient species of the CPO—Nicolson and Fosberg

(2004: 225) cite Cook's Second Voyage material from Tonga. But there is no Cook's Voyages material from the Society Islands, nor was it found on Hawaii until the later part of the 19th C. (Wagner *et al.* 1990: 1517).

• This weedy grass can be assumed to have been widespread in Malesia in the mid-17th C. (it was certainly present on Amboina at that time; Merrill 1917: 84) so one can conjecture that it might have been introduced from there to Tonga by Tasman in 1643.

***Cymbopogon nardus* (L.) Rendle NN**
Y, S — Occ. cultivated around houses, persisting. There are no later collections.

• This tropical Asian grass is widely grown for ornament and for its citronella oil.

***Cynodon dactylon* (L.) Pers. *mōtie molūlū* FNI**
Y, S — common in lawns and waste, and (*f.* Sykes) also on rocky ground at the coast, where it may reach down to a few metres above high-tide level. The only later collection of this Old World grass is Sykes 1135/N CHR 282185, coll. 1975, Fonuakula Farm, tall plants weedy in a vegetable garden.

***Cynodon nlemfuensis* Vanderyst CAS**
Recorded for Niue by Clayton and Snow (2010: 50), presumably on the basis of *Waterhouse* 7040 (BISH, CHR 551721; *n.v.*), coll. 2004, Vaipapahi Farm, on mound of sand and gravel.

• This African grass is now being used to improve dry pastures, e.g. in Australia. There seem to be no other records of it from Western Polynesia but it is present in Hawaii (Clayton and Snow 2010: 50).

***Cyrtococcum oxyphyllum* (Hochst. ex Steud.) Stapf FNI**
S — in an abandoned *talo* plantation at Niufela, within a forested area. Collections made in 1975 (Sykes, CHR 282305, –34) come from Lefuka and Halagigie Point. There are no later collections.

• This inconspicuous, shade-loving Indo-Malesian grass appears not to have been seen by the Cook's Voyages botanists, but Whistler (1988: 49) cites early post-European material for Tonga and possibly Samoa, as does Parham (1979: 351) for Fiji.

***Dactyloctenium aegyptium* (L.) Willd. FNI**
Recorded by Whistler (1988: 50), on the basis of Sykes 1246/N CHR 282295, coll. 1975, Anaana, roadside weed. A later collection of this weedy Old World grass is Sykes 1519/N CHR 659614, coll. 2006, Vaipapahi Farm, scattered in waste nr buildings.

***Dichanthium caricosum* (L.) A. Camus CAS**
S as *D. annulatum* (Forssk.) Stapf. This record is based on Sykes 241/N CHR 168786, coll. 1965, Amanau, in waste, det. ROG 2020. A second collection (CHR 168770, *n.v.*) which was identified by Sykes (1970: 239) as *D. caricosum*, was of a plant in a trial plot rather than from the wild.

- This Old World grass is widely used to improve dry pasture. It was introduced to Fiji in 1907 and has become a common weed there (Parham 1979: 384). The reason why it has not naturalised more widely on Niue is unclear—perhaps it is not a calcicole.
- Clayton and Snow (2010: 85) accept both this species and *D. annulatum* as present on Niue but there seem to be no verified collections of the latter.

***Digitaria ciliaris* (Retz.) Koeler** FNI

S as *D. adscendens* (Kunth) Henrard — in waste at Alofi and Amanau, apparently as a recent introduction. The only later collection is Sykes 1113/N CHR282164, coll. 1975, airport, on newly cultivated ground.

- Nicolson and Fosberg (2004: 227) record a Cook's Second Voyage specimen from the Society Islands as belonging this weedy (Indo-Malesian ?) grass. If this is correct that record would be by far the earliest occurrence of the species in the CPO (Gardner 2007: 52). Perhaps the specimen actually belongs with the other Second Voyage "*D. ciliaris*" material from Madeira and Ascension Island (Nicolson and Fosberg 2004).

***Digitaria setigera* Roth** IND

S as *D. pruriens* (Fisch. ex Trin.) Büse — perhaps quite widespread in waste ground, clearings in scrub near the coast, and in sweet-potato cultivations. Despite these notes there seem to be only two later collections, both made by Sykes in 1975: CHR 282175, Alofi, on cliff edge just above sea amid rank herbaceous plants; CHR 282248, Anaana, roadside clearing in coastal forest.

- Sykes (1970: 241) thought this Indo-Australian grass might be a fairly recent arrival to Niue. However, it is an ancient species of the CPO—Nicolson and Fosberg (2004: 227) cite Cook's Voyages material from the Society Islands. The first of the above-cited 1975 Niuean collections above suggest that it can grow in more or less natural coastal communities.

***Digitaria violascens* Link** CAS

S — in a small open area in fernland at Havaka. This small Asian grass appears not to have been seen subsequently.

***Echinochloa colona* (L.) Link** CAS

Recorded by Whistler (1988: 51), on the basis of Sykes 1250/N CHR 282299, coll. 1975, Amanau, waste place on cliff edge. Another collection of this Old World grass is Sykes 1115/N CHR 282166, coll. 1975, Alofi wharf, in sandy rain-wash channel.

- Sykes (1970: 242) recorded the rather similar species *E. crus-galli* (L.) P.Beauv., on the basis of a 1966 collection from a pasture-trial area. Whistler (1988: 52) suggested that the specimen, Lund CHR 156828, might represent *E. stagnina* (Retz.) P.Beauv., but in 1973 P. W. Michael determined it as *E. colona*.

***Eleusine indica* (L.) Gaertn.** IND

Y, S — common in waste, along roadsides, and in plantations. There are several later collections.

- This weedy Old World grass is an ancient species of the CPO—it was found on the Society Islands on both Cook's First and Second Voyages (Seemann 1868: 322; Nicolson and Fosberg 2004: 230). In this regard though the lack of Second Voyage material from Tonga and Vanuatu is disconcerting.

- The Niuean name *fahitalo* recorded by Yuncker and Sykes (as *mosie* [grass] *fahitalo*), a name not listed by McEwen (1970), was perhaps one made up for Yuncker on the spot. It means "grass at the edge of the *talo* garden".

***Eragrostis amabilis* (L.) Wight & Arn.** FNI

Y, S, as *E. tenella* (L.) P.Beauv. ex Roem. & Schult. — locally common esp. around houses. There are several later collections of this Old World grass, which is now a pantropical weed.

***Eragrostis minor* Host.** CAS

Recorded by Sykes (1970: 242, as *Eragrostis poaeoides* P.Beauv.) just on the basis of Lund CHR 156827, this specimen originating from seed impurity in a pasture trial at Vaiea Farm in 1966. There are no later collections of this small Northern Hemisphere grass.

***Ischaemum aristatum* L.** CAS

S as *I. indicum* (Houtt.) Merr. — being grown in trial pasture at Vaiea and Vaipapahi Farms. It was collected again from the latter place in 1975: Sykes 1201/N CHR 282250, persisting and spreading beyond bounds of original plot. This weedy Indo-Malesian grass seems not to have been seen elsewhere on Niue, but Whistler (1988: 53) accepted that it had naturalised.

***Melinis minutiflora* P.Beauv.** CAS

S — a rare plant in [sown?] old pasture at one place. A later collection is Flynn 6711 PTBG 30202, coll. 2000, Alofi, along roadside.

- This sprawling African grass, widely grown in the tropics as a pioneer, e.g., after forest clearance, was first recorded in Samoa in 1905 but has not become weedy there (Whistler 1988: 53).

***Miscanthus floridulus* (Labill.) Warb. ex K.Schum. & Lauterb.** kaho IND

Y as *Miscanthus japonicus* non (Thunb.) Anderss. — in cut-over area nr Fonuakula plantation. S — common in open fernland and scrub, esp. in the south. A later collection is Waterhouse 7045 CHR 551753, coll. 2004, Vaiea–Hakupu, infrequent on roadside.

- Sykes (1970: 232, 246) pointed out that *M. floridulus*, a well known ancient species of the CPO (Nicolson and Fosberg 2004: 235), was the basis for the recording by Yuncker (1943: 21) of "*Arundo donax* L. ... common in clearings and second growth". This Mediterranean grass occurs elsewhere in the CPO but has never been found on Niue, wild or cultivated. Yuncker's error has crept into the *Arundo donax* entry of Clayton and Snow (2010: 36).

***Oplismenus compositus* (L.) P.Beauv. IND**
S — in plantations in or near forest. There are several later collections.

• Yuncker (1943) did not record this species, nor the following one. The pre-European distribution of these two forest grasses across the CPO is unclear but *O. compositus* at least is generally thought to be a widespread native species here.

***Oplismenus hirtellus* (L.) P.Beauv. IND**
S — in an old clearing in forest nr Halagigie Point. There are several later collections.

• As for *O. compositus*, it is a vexed question as to whether this forest grass, widespread now across the CPO, might be native to just some part of this region.

***Paspalum conjugatum* P.J.Bergius. FNI**
Y, S — common in plantations, along roadsides and in waste. There are no later collections.

• This weedy perennial grass of the New World tropics generally favours sites that at least sometimes are quite wet.

***Paspalum dilatatum* Poir. FNI**
Y — occ. in waste. S — in a few plantations, esp. nr Fonuakula. There are no later collections. This weedy perennial grass of the New World tropics also generally favours sites that at least sometimes are quite wet.

***Paspalum orbiculare* G.Forst. incl. *P. thunbergii* Kunth ex Steud. IND**

Y — in taro plantations and waste. S — in pasture at Vaiea Farm, and (as *P. thunbergii*) fairly common in a few inland areas, esp. nr the northwestern villages of Makefu and Tuapa.

• Sykes (1970: 249) thought that this Old World grass might be a recent introduction to Niue. But it is certainly ancient in the CPO—Cook's First Voyage botanists found it in the Society Islands (BM !) and it was found on Tonga during the Second Voyage (Nicolson and Fosberg (2004: 239). It too prefers sites that are periodically very wet, like clay hillsides or poorly drained depressions (hence its English common name, "ditch millet").

• Clayton and Snow (2010: 64) place *P. orbiculare*, but not *P. thunbergii*, into *P. scrobiculatum* L., whose type comes from India.

***Paspalum vaginatum* Sw. *mōtie kalalahi* IND**
Y — occ. in waste. S — mostly near the sea on rocky ground, esp. in sheltered places.

• This vigorous mat-forming grass is ancient in the CPO—there are Cook's First Voyage collections from the Society Islands (BM *s.n.*, !). It seems likely to be native to Niue as well. It is now subcosmopolitan in warmer regions, often as an invasive weed of coastal wetlands.

• The first part of the Niuean name is a generic for grasses and similar small plants, and the second part might refer to the usual habitat (*kala* border, *hi* to catch fish from the reef).

***Sorghum halepense* (L.) Pers. FNI**
Y — occ. in waste areas and on rocky cliffs near the sea. S — common along roadsides, in waste, and in a few old pasture areas.

• Whistler (1988: 57) said that F. R. Fosberg had suggested to him that in Western Polynesia this common weedy Old World grass ought to be re-identified as *S. sudanense* (Piper) Stapf, [i.e., *S. × drummondii* (Steud.) Millsp. & Chase], since it lacked the notorious, far-spreading rhizomes of *S. halepense*. Such an absence is recorded on one collection from Niue: Leonard CHR 309327, coll. 1976, Fonuakula, waste, "no rhizomes on [similar] plants in the area". Clayton and Snow (2010: 84) however accept *S. halepense* as growing on Niue.

***Sorghum arundinaceum* (Desv.) Stapf CAS**
Y as *S. vulgare* non (L.) Pers., S as *S. verticillatum* (Steud.) Stapf — cultivated widely but seemingly wild in only a few places. Sykes (1970: 251) noted that the plant he considered to be *S. verticillatum* was much less common in the wild than his "*S. halepense*" and could be distinguished by its pubescent rather than tomentose spikelets and its lack of rhizomes.

• A tall perennial African grass, *S. verticillatum* is cultivated in the world's tropics especially for its edible seeds and value as a fodder grass.

***Sporobolus indicus* (L.) R.Br. s.l. *mōtie hikutaha* FNI**
Y as *Sporobolus elongatus* non R.Br, S as *S. africanus* (Poir.) A.Robyns & Tournay — common in waste and along roadsides, particularly (*f.* Sykes) in the inland basin.

• Clayton and Snow (2010: 47) accept both *S. africanus* and *S. fertilis* (Steud.) Clayton as occurring on Niue. The latter taxon, like the former, is part of the *S. indicus* complex. Native perhaps just to Africa, these grasses are now cosmopolitan weeds.

***Urochloa glumaris* (Trin.) Veldkamp IND**
S as *Brachiaria paspaloides* (Presl) C.E.Hubb. — occ. in disturbed places near the coast.

• Sykes (1970: 235) suggested that this rather inconspicuous grass might also be present "in many plantations" on Niue and in 1975 was able to collect it twice more (CHR *n.v.*). There are however no later collections.

• This Indo-Malesian grass is an ancient species in the CPO and might have been widespread in the region—there is Banks and Solander material (BM 508016 !) from the Society Islands, and early post-European collections from Western Polynesia (Whistler 1988: 47) and Fiji (Seemann (1868: 325, as *Panicum ambiguum* Trin.).

***Urochloa humidicola* (Rendle) Morrone & Zuloaga FNI**

New record, based on Sykes 1316/N CHR 282362, coll. 1975, Vaiea Farm, near buildings.

A later collection is: *Waterhouse* 7083 CHR 551715, coll. 2004, Kaimiti [Alofi radio station], widely dominant in unmown grass.

• This grass, native to Central and South America, is widely cultivated in the tropics as a pasture species and probably was introduced to Niue for this reason. It was listed by Gardner (2007: 68) as *U. dictyoneura* (Fig. & De Not.) Veldkamp, which may be a different species and one not present in the Pacific Ocean region (Clayton and Snow 2010: 59).

***Urochloa maxima* (Jacq.) R.D.Webster FNI**
S as *Panicum maximum* Jacq. — persisting in an old pasture trial area, and apparently wild at Vaiea, in a damp waste place. A later collection, from an undoubtedly wild population of this robust weedy African grass, is Sykes 1336/N CHR 282382, coll. 1975, Amanau, abundant in waste place at cliff edge.

***Urochloa mutica* (Forsk.) T.Q.Nguyen CAS**
Y as *Panicum purpurascens* Raddi — cultivated as a forage grass. S as *Brachiaria mutica* (Forssk.) Stapf — introduced at least twice, the second time in 1965 to Vaiea Farm, but also growing in waste near Alofi radio station, apparently as a naturalisation from an earlier introduction. There are no later collections of this widespread tropical pasture and fodder grass, which is said to favour dampish sites.

***Urochloa subquadripara* (Trin.) R.D.Webster FNI**
S as *Brachiaria subquadripara* (Trin.) Hitchc. — in a few waste places, mainly in the Alofi area, apparently a relatively recent introduction. A later collection is Sykes 1562/N CHR 659657, coll. 2006, Mutulau–Uluvehi, on trackside close to the sea.

• Elsewhere in the Pacific this weedy Indo-Malesian grass is quite frequent in lightly shaded sandy places, e.g., in coconut plantations; perhaps by now it has spread widely on Niue.

TACCACEAE

***Tacca leontopetaloides* (L.) Kuntze pia IND**
***T. pinnatifida* G.Forst.**

Y, S — common all over the island in waste, scrub and forest, but not found close to the sea.

• This robust herb, a famine-food plant that is not cultivated today, seems likely to be ancient across the CPO, even though Nicolson and Fosberg (2004: 250) cite Cook's Voyages material from the Society Islands only.

ZINGIBERACEAE

***Curcuma longa* L. ago IND**
***C. domestica* Valetou**

Y, S — occ. cultivated near houses.

• This robust herb, the turmeric plant, is certainly ancient in the CPO—Nicolson and Fosberg (2004: 252) just cite Cook's Second Voyage material from Easter Island, but Seemann (1868: 291) noted that Solander had recorded it for Tahiti. It appears not to make seed, but in other parts of its range, e.g., Fiji (Smith 1979: 196), it naturalises to a slight degree through the break-up and dispersal of its drought-resistant rhizomes.

***Zingiber zerumbet* (L.) Sm. poloi IND**
Y, S — common in and near plantations, esp. those in forested areas.

• Like the very similar-looking turmeric, this plant (widely known as the shampoo ginger) makes no seed but can spread a little by break-up of its rhizomes, e.g., in Fiji (Smith 1979: 195). It is an ancient species of the CPO—Drake (1893: 223) and Nicolson and Fosberg (2004: 252) cite Cook's First and Second Voyages material from the Society Islands.

DISCUSSION

The paragraphs under the five headings below address some significant aspects of Niue's naturalised flora.

Change in the naturalised flora over time

The naturalisation of 158 flowering-plant species is accepted here, 99 as 'fully naturalised' and 59 as 'casually naturalised'. These are all species whose introduction to Niue occurred in the post-European era. The island also has a number of other wild-growing species that are likely to have been introduced before that time. Some are ancient Polynesian food-plants while others behave as weeds or as plants that might be thought to be rare natives or even members of the primary forest. There are 61 species in this group (not including the 'cultivated-only' species *Aglaia saltatorum*, *Bischofia javanica*, *Crinum asiaticum*, and *Pritchardia pacifica*).

Yuncker (1943) recorded about half the naturalised species accepted here, largely the fully naturalised ones. He collected *Laportea interrupta* (Urticaceae) and *Verbena officinalis* (Verbenaceae), two weedy herbs that have not been seen again. Neither he nor any later person saw *Adenostemma viscosum* (Asteraceae), an 'ancient weed' of the CPO collected just by S. P. Smith in 1901.

Sykes (1970) enlarged Yuncker's list by more than 50 records, about half of them fully naturalised species. Seven of his records (*Antigonon leptopus*, *Asystasia gangetica*, *Citrus aurantifolia*, *Merremia tuberosa*, *Nicotiana tabacum*, *Thunbergia fragrans*, *Zinnia elegans*) were of plants that Yuncker had seen only in cultivation. Sykes also reduced the number of naturalisations Yuncker had recorded, saying that apparently wild individuals of these species were much more likely to be relics of cultivation. In view of the failure of later botanists to bring evidence to the contrary these judgments have been accepted. There are nine species in this group: *Bauhinia monandra*, *Cymbopogon nardus*, *Hibiscus rosa-sinensis*, *Hymenocallis littoralis*, *Luffa cylindrica*, *Momordica charantia*, *Nerium oleander*, *Passiflora laurifolia*, and *Proiphys amboinensis*. All are exotics, that is, species native to regions far from the CPO, but (as noted above) there are also four non-naturalised species that have probably been introduced to Niue from closer sources: *Aglaia saltatorum*, *Bischofia javanica*, *Casuarina equisetifolia* and *Crinum asiaticum*.

Whistler (1988) added 16 new naturalisations, most of them based on collections Sykes had made in 1975. They are: *Alysicarpus vaginalis*, *Amaranthus lividus*, *Axonopus fissifolius*, *Bothriochloa bladhii*,

Chloris barbata, *Cyperus polystachyos*, *Dactyloctenium aegypticum*, *Echinochloa colona*, *Eleutheranthera ruderalis*, *Euphorbia heterophylla*, *Indigofera suffruticosa*, *Nicandra physalodes*, *Passiflora foetida*, *Ruellia prostrata*, *Stachytarpheta jamaicensis*, and *Youngia japonica*. It seems reasonable to suppose, from their behavior elsewhere in the Pacific, that by now most of them are fully naturalised.

The present article contains nine new records, based largely on collections Sykes made in 1975 and 2006: *Achillea millefolium*, *Angelonia biflora*, *Aster subulatus*, *Dissotis rotundifolia*, *Ipomoea fimbrisepala*, *I. hederifolia*, *Operculina ventricosa*, *Senna tora* and *Urochloa humidicola*. Only the aster, senna, and urochloa are judged to have fully naturalised.

The naturalised ancient crop plants

With the exception of the famine-food plants (*Amorphophallus*, etc.) the members of this group—*Cucumis melo* var. *agrestis*, *Dioscorea alata* and *D. esculenta*, *Lablab purpureus*, *Solanum repandum* and *S. viride*—have all declined in abundance in the wild on Niue, just as they have elsewhere in the Pacific. These plants are candidates for *in situ* conservation.

The ancient weeds

About half of Niue's putative pre-European weeds are now uncommon, rare or extinct: *Achyranthes aspera*, *Adenostemma viscosum*, *Boerhavia diffusa*, *Desmodium heterocarpon*, *Hedyotis biflora*, *Hibiscus abelmoschus*, *Laportea interrupta*, *Leucas decemdentata*, *Rorippa sarmentosa*, *Teucrium vesicarium*, *Urochloa glumaris*, and possibly *Digitaria setigera*, *Glycine tabacina* and *Waltheria indica*.

As exceptions though there seems to be a continuing abundance of other weedy pre-European species: *Abrus precatorius*, *Centella asiatica*, *Chrysopogon acicularis*, *Miscanthus floridulus*, *Phyllanthus virgatus*, *Sida parvifolia*, *Tephrosia purpurea*, and perhaps *Commelina diffusa* and *Urena lobata* too. All are fairly drought-tolerant plants, but not to any obvious degree more so than several listed in the previous paragraph.

Unexplained absences

A number of Indo-Malesian weeds have long been established in the CPO but have never been found on Niue, e.g., *Cyathula prostrata* (Amaranthaceae), *Ipomoea alba* (Convolvulaceae), *Cyperus cyperinus* (Cyperaceae), and in the Asteraceae *Centipeda minima*, *Dichrocephala integrifolia*, *Glossocardia bidens* (syn. *Glossogyne tannensis*), and *Sigesbeckia orientalis*. With the exception of the first-mentioned these are generally found in quite shady or damp sites. But perhaps sheer lack of competitiveness is also to blame—even in Fiji, with its range of habitats, the last four taxa are uncommon ones (Smith 1991).

Secondly, there are some New World weeds that have spread widely through the CPO in the last hundred or so years but have not yet reached Niue. The milkweed *Asclepias curassavica* (Apocynaceae) is an

outstanding example, but most belong to the Asteraceae: *Acmella uliginosa*, *Ageratum houstonianum*, *Erechtites valerianaefolia*, *Elephantopus mollis*, *Struchium sparganophorum*, *Tridax procumbens*, and *Xanthium pungens*. Several require damp habitats but perhaps it is largely Niue's isolation from the main trade and tourist routes that is keeping them out. (Four other weedy daisies have appeared recently in the CPO: *Calyptracarpus vialis* Less., *Emilia fosbergii* Nicolson, *Erigeron bellioides* DC. and *Sphagneticola trilobata* (L.) Pruski. One of the last places they get to here may well be Niue).

The climatically anomalous species

Lastly, a striking feature of Niue's weed flora is the abundance of the temperate-zone *Plantago lanceolata*, along with the recent successful establishment of two flatweed daisies that *P. lanceolata* often grows with in cooler parts of the world, *Leontodon taraxacoides* and *Taraxacum officinale*. Also in this category, that is, of plants rarely found weedy in the humid tropics, are *Achillea millefolium*, *Foeniculum vulgare*, *Lepidium virginicum* and *Verbena officinalis*.

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APPENDIX 1. Botanical History

European discovery of Niue was made by James Cook in HMS *Resolution* on 20 June 1774, during his Second Voyage of exploration into the southern regions of the world (Robson 2000). On board were the two official naturalists, Johann Reinhold Forster and his son George, and an assistant, Anders Sparrman, a former pupil of Linnaeus, who had come on board at the Cape of Good Hope. In addition, surgeon's mate William Anderson had begun to make collections of his own (Beaglehole 1961; Nicolson and Fosberg 2004).

On the day after the island was sighted three brief landings were made on its western side, first at a coastal chasm north of Makapu Point and then in the vicinity of Opaahi, just south of where the wharf of the island's capital, Alofi, is now situated (Pointer 2015). The disputed nature of these landings (which led Cook to name Niue “Savage Island”) meant that just a few, coastal plants were got that day: *Bikkia tetrandra*, *Hedyotis foetida*, *Heliotropium anomalum*, *H. foertherianum* (syn. *Argusia argentea*), *Ochrosia oppositifolia*, *Scaevola sericea*, *Timonius polygamus* and *Xylosma orbiculata* (Nicolson and Fosberg 2004). Niue is the type locality for the *Bikkia*, *Ochrosia*, and *Xylosma* species. At BM there is also a “Savage Island Captain Cook” collection of *Dendrobium biflorum*

(Nicolson and Fosberg 2004: 206). This orchid is more usually found today in the forests of Niue's interior, so perhaps the collection actually belongs with the dozen or so *Forster* sheets of the plant from the Society Islands.

Few Niuean collections were made in the next 150 years. According to St John (1976) a certain Frits Jensen, who was associated with missionary and amateur naturalist Samuel Whitmee of Samoa, collected from Niue in 1876. His collections are at BM. It appears though that some of them, in particular those without a collector's number, were actually obtained elsewhere, perhaps mainly from the island of Lifu (Lifou) in the Loyalty Islands far to the west (Whistler 1984; Maberley 1990). But the latter authors also conclude that numbered *Jensen* specimens might well come from Niue. In the BM database at present (May 2020) the highest *Jensen* collecting number is 56, for a specimen of *Eulophia pulchra*, an orchid which does grow on the island. At the time of writing (May 2020) not all of *Jensen*'s collections appear on that database.

In June 1877 the New Zealand sea-trader Henry Abott Mair (1836–1881), collected ferns (but no higher plants) from Niue. This was during the “Victorian fern craze” era, and Mair might have been intending to sell his collections to a curio dealer, like Eric Craig of

Auckland (Goulding 1977). But he was soon to lose his life while labour-recruiting on Vanuatu, and in some way his specimens eventually came to AK.

In 1899 American ichthyologist Dr H. F. Moore visited Niue for a day or so during the Pacific cruise of the U.S. Commission of Fish and Fisheries Steamer *Albatross* (notable for providing geologist Alexander Agassiz the chance to study at first hand the ‘coral-reef problem’; Agassiz 1900). Moore made 28 collections on Niue (his 382 to 409, at the U.S. National Herbarium). A failure to write label notes deprives us of knowing, for example, whether his find of *Verbena officinalis* was made from a garden plant or a naturalisation.

In the acknowledgments accompanying his *Flora of Niue* Yuncker (1943: 13) thanked F. R. Fosberg for providing him with a list of Niue species “collected by H. F. Moore and P. H. Metcalf [*sic*] which he discovered in the US National Herbarium”. This list has not been relocated, and no Metcalf(e) specimens appear in the current US database. This collector seems likely to be Peter Herbert Metcalfe 1854–1913, medical doctor and naturalist on Norfolk Island (who, for example, donated insects from that island to the Smithsonian Institution in 1884). What is not clear is whether Metcalfe himself was on Niue in 1899 and assisted with Moore’s collecting, or whether he had collected separately at some other time, or whether the specimens referred to were actually from Norfolk Island.

A substantial contribution was made in 1901 by New Zealand’s Stephenson Percy Smith. A senior civil servant who had newly retired as Surveyor General and Secretary for Lands and Mines, Smith was persuaded by his government to go as Resident Agent to Niue and help prepare a Constitution for the island. In his stay of nearly four months he collected c. 100 specimens, which are deposited at AK. A capable amateur ethnologist and historian, he published his observations on Niue the following year (Smith 1902) and subsequently co-authored a dictionary that contains numerous Niuean plant-names (Tregear and Smith 1907).

In January and February of 1940 T. G. Yuncker of DePauw University, U.S.A., made an extensive collection from Niue. This is now housed at BISH (only a portion currently data-based) and US. From his specimens and a loan of pieces extracted from Smith’s AK material he was then able to write the island’s first Flora (Yuncker 1943).

In September to November of 1965 W. R. Sykes of the Botany Division, DSIR, New Zealand, visited Niue and subsequently published an updated Flora (Sykes 1970). A second visit was made in September 1975, and a third in September and October 2005. Currently, the CHR

database contains 1118 Niuean *Sykes* collections but since the highest such number to be found here is 1562 there must still be material yet to be data-based. Note that Sykes used a new set of numbers, each starting from 1, for the collections he made in various parts of the world, so a search for a collection of his from Niue needs to include either this place-name or “/N” after the number.

American botanist W. A. Whistler visited the island in 1981, 1984 (a single specimen at US), 1997, 2003 and 2013, and had c. 200 specimens from there in his private herbarium and at BISH, HAW, PTBG and US (Whistler pers. comm., c. 2013).

In 2005 the present author visited for three weeks in May-June and collected c. 100 numbers (AK, CHR and elsewhere). Other collectors, and the locations of their relatively few collections are: English traveller in the Pacific Mrs. D. V. G. Woods (coll. 1959; AK), New Zealand soil scientist A. C. S. Wright (coll. 1949, 1965; CHR), New Zealand entomologist P. A. Madison (coll. 1975; CHR), New Zealand plant pathologist R. A. Fullerton (coll. 1975; AK), Hawaiian mycologist N. L. H. Krauss (coll. 1978; BISH), American marine biologist G. Paulay (coll. 1986; US), herbarium technician J. Herrick (coll. 1994; AK), Hawaiian botanist T. Flynn (with others, coll. 2000; BISH), Australian botanist B.M. Waterhouse (coll. 2004; BISH, BRI, CHR), New Zealand ecologist L. Burrows (coll. 2015; CHR); also several (sometimes anonymous) New Zealand or Niuean civil servants, such as agricultural or medical officers (various dates; CHR).

Although he did not collect plants, New Zealand civil servant J. M. McEwen’s contribution must also be mentioned. McEwen, a fluent speaker of Maori, was Resident Commissioner on Niue from 1953 until 1956, and with assistance from knowledgeable Niueans, in particular Mr Leslie Richmond Rex, he subsequently published a dictionary of the Niuean language (J. McEwen 1970; M. McEwen 2016). Although he deprecated this as being “a sad disappointment to professional linguists” it is still very useful to naturalists and others who might mainly need to know Niuean vocabulary.

A larger, bilingual Niuean dictionary has been produced under the editorship of New Zealand linguist W. B. Sperlich (1997). Its plant-name entries, including some not found in Sykes (1970), are grouped together in its English to Niuean index under “plant”, but the Niuean entries sometimes give more descriptive or ethnobotanical information, as for example: “**titania** n. [biblical] A plant, tare [*sic*](an injurious corn weed as used in the Bible, but also said to occur on Niue, described as a thorny creeping weed”.

APPENDIX 2. Possible Limitations of the Cook’s Voyages Data

Merrill (1941, 1954) emphasized some uncertainties with respect to the Cook’s Voyages specimens, manuscripts and publications. He pointed out that “more than a dozen [in fact, many more; Quanchi and Robson 2005]

Spanish, Dutch, English and French explorers” had passed through the Pacific before Cook. Critically, Tahiti was discovered by Europeans (Samuel Wallis) in 1764 and then by Bougainville in 1768, the year before Cook’s

First Voyage arrived there. Conceivably those two visits could have introduced weeds into the Societies, as fruit, or seed on persons or animals, or in discarded bedding, etc. And the related question is: could weeds have been introduced there by Cook's First Voyage, to muddle the Second Voyage records?

The most likely candidates here would be plants of warmer regions, and for this reason Wallis's voyage, which stopped only briefly on the coast of southern Argentina, can probably be ruled out. Bougainville's expedition though stayed nearly half a year in Rio de Janeiro (c. 23°S), and Cook's First Voyage stayed a week in Madeira (33° N), restocking provisions and collecting plants.

With respect to the flora of Madeira in the late 18th C., none of the plants known to have occurred on this island at that time (Nicolson and Fosberg 2004; Francisco-Ortega *et al.* 2015) seem to have turned up in the Societies for the Second Voyage to find. However, there are two weedy species that Bougainville might possibly have brought into the Pacific. The first is *Physalis angulata* (Solanaceae). This is a New World plant but was found by Cook's First and Second Voyages in the Societies (Nicolson and Fosberg 2004: 645). The second is the Old World species *Amaranthus tricolor* (Amaranthaceae), found in the Societies by the Second Voyage but not by the First (Nicolson and Fosberg 2004: 263), and apparently not found anywhere further westwards at that time (although it was present on Amboina in the mid-17th C.; Merrill 1917: 213). Perhaps this plant had already spread to the Brazil by the time Bougainville got there and was taken on by him from there. Under this scenario the First Voyage would have missed it because not enough time had elapsed for it to appear as a conspicuous Tahitian weed.

With respect to the western part of the CPO, we could imagine that the value of the Cook's Second Voyage collections from Tonga might have been compromised by Abel Tasman's discovery and stay on Tongatapu in 1643. His voyage set out from Batavia and spent a month on the tropical island of Mauritius before reaching the CPO. Two Old World weeds, *Bidens biternata* (Asteraceae) and *Coix lacryma-jobi* (Poaceae), and one New World species, *Teucrium vesicarium* (Lamiaceae), might be implicated here—see the main text for details.

The other aspect of Merrill's thought was that weeds from the New World could have entered the Pacific from the west, via the "Spanish Galleon" route out of Acapulco to Guam and Manila, a path travelled from the mid-1550s onwards for two centuries or so. He contended that these would be able to spread rapidly in the Pacific, to give the impression to 18th C. visitors that they were native there.

But in fact, Cook's Second Voyage found no conspicuous presence of New World weeds in Tonga and Vanuatu, with the exceptions of *Teucrium vesicarium* (noted above) and *Ageratum conyzoides* (Asteraceae)—see the main text for detail. Also, numerous counterexamples exist, of weedy species (from both hemispheres) that were present in Amboina in the mid-17th C. and Southeast Asia or the Philippines a century later but were not found in Tonga, Samoa or Fiji by the first collectors there, e.g., *Abutilon indicum*, *Acmella uliginosa*, *Amaranthus spinosus*, *Crotalaria retusa*, *Senna alata*, *Senna tora*, *Talinum paniculatum*, and *Triumfetta rhomboidea* (Merrill 1917, 1918; Smith 1981, 1985, 1991; Whistler 1988).

In summary then, the usefulness of the Cook's Voyages records is largely confirmed.

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The Moa Fauna (Aves: Dinornithiformes) of the Auckland and Coromandel Regions, New Zealand

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Abstract

We examined museum collections to compile a list of all known moa remains collected within the Auckland area and Coromandel Peninsula (North Island, New Zealand) from both natural and archaeological contexts. Moa remains have been found at 45 locations within our study-area, with many locations represented by just a few bones in a largely fragmentary state. The collections are dominated by bones of the leg, with skulls, pelves and complete skeletons under-represented. Calculation of the minimum numbers of individuals (MNIs) represented by the remains reveals at least 74 moa individuals from Auckland and 101 from Coromandel Peninsula. Moa bones from the Auckland region were mostly recovered from natural sites (80% of the MNIs), principally the Late Holocene swamp site at Clevedon. Moa bones from the Coromandel were mostly found within archaeological sites (at least 60% of MNIs) that are concentrated on the Coromandel Peninsula's east coast. Identification of the remains shows that all four North Island moa species were present in Auckland and Coromandel during the last few thousand years. The regions differ in species representation, with *Anomalopteryx didiformis* best represented in Auckland and least represented in Coromandel, while *Dinornis novaeseelandiae* was strongly represented in Coromandel and least abundant in Auckland. These differences could be attributed to the habitat preferences of the moa species, and the uneven representation of habitats across our sites, but in the Coromandel region selective Māori hunting strategies may also have influenced the result.

Keywords

palaeontology; archaeology; Māori middens; *Anomalopteryx*; *Pachyornis*; *Euryapteryx*; *Dinornis*; geographical distribution; relative abundance

INTRODUCTION

The Auckland and Coromandel regions of the North Island, New Zealand, have few natural (non-archaeological) sites at which moa bones have been found compared to many other parts of New Zealand. The only major natural deposit of moa bones is a swamp site near Clevedon, Auckland, which yielded hundreds of bone elements, representing multiple individuals (Gill 2003). There are few archaeological sites containing moa bones in the Auckland area, in comparison to the east coast of the Coromandel Peninsula which has numerous early Māori sites in association with moa remains (Davidson 1979). However, nearly all natural and archaeological moa sites have yielded few and fragmentary moa remains.

A moa species, not currently recognised, was described from the Auckland-Coromandel region. A femur from Opito Bay, Coromandel Peninsula, is the type specimen of *Anomalornis gracilis* Hutton, 1897 (previously named

Dinornis gracilis by R. Owen) and now attributed to *Anomalopteryx didiformis* (see details in Gill *et al.* 2010).

We undertook to compile all known records of moa bones from the Auckland and Coromandel regions, based on palaeontological and archaeological collections, to establish the distribution and relative abundances of the species present. Of special interest is whether moa bones found on near-shore and off-shore islands of the regions indicate natural populations or resulted from the transport of moa bones or carcasses from the mainland to Māori settlements.

Of the moa species recognised in current taxonomic listings (Gill *et al.* 2010; Worthy and Scofield 2012) only four are known from the North Island and are therefore contenders for the Auckland-Coromandel regions:

Family Emeidae

- (1) Little bush moa *Anomalopteryx didiformis* (North and South Islands)
- (2) Mappin's moa *Pachyornis geranoides* (North Island only)

(3) Coastal moa *Euryapteryx curtus curtus* (subspecies restricted to North Island).

Family Dinornithidae

(4) North Island giant moa *Dinornis novaezealandiae*.

The synonyms of these species—the disused names that may be present on older museum labels—are listed in Gill *et al.* (2010).

Identification of *Euryapteryx* has been problematic. Gill *et al.* (2010) recognised two species: *E. curtus* in the North Island (only) and the larger *E. gravis* in both islands. Worthy and Scofield (2012), based on evidence in Bunce *et al.* (2009), proposed a single species of *Euryapteryx* with two subspecies: *E. curtus curtus* in the North Island, *E. curtus gravis* in the South Island, and larger birds in both islands assumed to be females. Discovery of separate North Island and South Island species of *Dinornis* based on DNA evidence (Bunce *et al.* 2003; Huynen *et al.* 2003) overturned the previous notion that there were three species of *Dinornis* throughout the country. All North Island species except *A. didiformis* had marked sexual dimorphism, with females larger (Worthy and Scofield 2012).

During the Holocene, *A. didiformis* and *D. novaezealandiae* typically inhabited wet forests throughout much of the North Island and were rarer in dry coastal scrublands in Northland, Auckland, Coromandel, Hawkes Bay, Wairarapa and Manawatu (Worthy

1990; Worthy and Holdaway 2002). *E. curtus* and *P. geranoides* dominated (singly or together) the dry coastal scrublands, although they too could be found across the North Island.

METHODS

We defined our study-area, with habitat-based boundaries, as Region 9 (Auckland) and Region 10 (Coromandel) of the Department of Conservation's Ecological Regions (McEwen 1987; Fig. 1). These regions are at the same latitude, but separated by the Firth of Thames, and form roughly the section of the North Island lying between about 36°00'S and 37°30'S. To begin compiling a list of known sites within the study-area at which moa bones have been found (Appendices 1 and 2), we extracted details from an unpublished list of North Island natural and archaeological deposits with Quaternary avifaunal remains (Millener 1981). Millener gave identification numbers to each location, and many sites have Fossil Record File Numbers (from a fossil locality database maintained by G.N.S. Science, Wellington). Archaeological sites have site numbers (from the Archsite database maintained by the New Zealand Archaeological Association). We extended Millener's list by adding more recent finds, supported by museum specimens and literature searches.

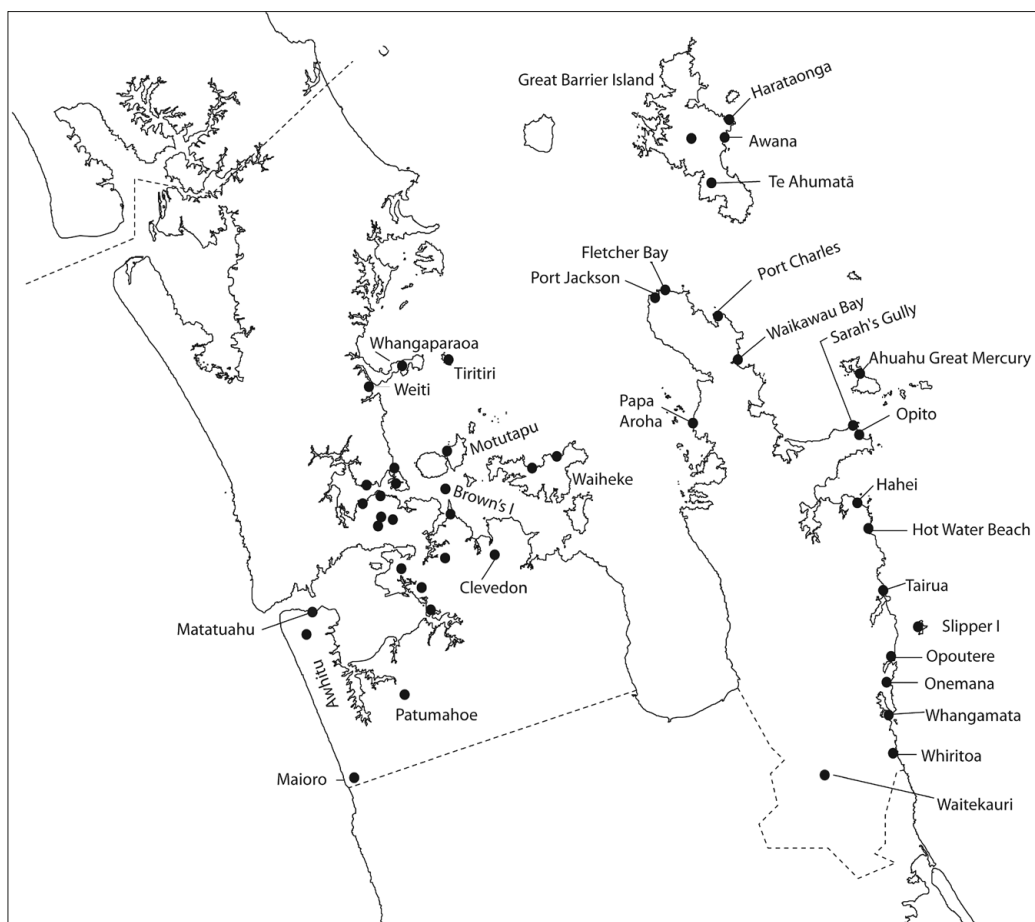


Figure 1. Auckland and Coromandel Ecological Regions showing places listed in the appendices.

Moa bones from most sites have been deposited in museum collections, with institutional codes as follows: AIM, specimen prefix LB (Auckland Museum land vertebrates collections); AIM, specimen prefix AR, AU or any other number without the LB format (Auckland Museum archaeology collections); AUG (Auckland University geology collections, Faculty of Science); AUA (Auckland University archaeology collections, School of Social Sciences); NMNZ (vertebrates collections, Museum of New Zealand Te Papa Tongarewa, Wellington); and CMC (vertebrates collections, Canterbury Museum, Christchurch). BJB examined the relevant bone material at AIM, AUG, AUA and NMNZ to confirm the bone elements, registration numbers and species identities. A list of relevant CMC holdings was obtained from the curator. Abbreviations used for the names of bone elements (singular or plural) are: fem = femur, tbt = tibiotarsus, tmt = tarsometatarsus. Side is indicated by L (left) and R (right). Fragments unable to be identified to species are common in archaeological collections and the number of fragments in each site is given to provide further information on relative abundance and distribution of moa bone. Undiagnostic fragments are predominantly in the archaeological collections at AIM unless otherwise stated. Identifications of some archaeological bone fragments from the Coromandel region have been determined using DNA (McCallum *et al.* 2013) and are included in Appendix 2.

Species identifications focused on the three principal leg bones since intact skulls and pelvis were rare from sites in our study regions. Worthy and Holdaway (2002: Appendix 2) provided an illustrated key to the identification of moa leg bones. This is the only modern identification tool, yet some of the important bone differences characterised in the key are typical rather than invariable. Thus, identification of moa bones from morphology can be difficult, even with whole bones. To compound identification problems, moa bones—especially those from archaeological sites—are often damaged, burnt, reworked or incomplete and lacking diagnostic features.

Bones of *Dinornis* are often recognisable by their large size and from some distinctive aspects of their shape. However, when considering fragments, conclusions on size alone are difficult because *D. novaezealandiae* and *E. curtus* had large females and smaller males. Therefore, the tibiotarsus of a large (female) North Island *Euryapteryx* may have a shaft as thick as that of a small (male) North Island *Dinornis*. Males of *E. curtus*, and both sexes of the two other North Island emeid species had smaller bones on average than those of *Dinornis*. The leg bones of the smaller North Island moas have a few distinguishing features (Worthy 2000; Worthy and Holdaway 2002) but if the diagnostic bone regions are missing or damaged, then species discrimination may be difficult. In our study we used the category ‘small moa (Emeidae)’ for bones from small species (i.e., not *Dinornis*) but for which no narrower identification was possible. Bones permitting no taxonomic identification narrower than ‘moa’ are listed as ‘moa (Dinornithiformes)’.

The moa species identifications given in this paper were determined by examination of the leg bones by BJB, or—as recorded on specimen labels, or in the literature—by R.J. Scarlett, P.R. Millener, T.H. Worthy or R.P. Scofield. A minimum number of individuals (MNI) was established for each species category at each site by identifying bone elements, determining their side (L or R), and considering individual size and immaturity (whether or not bones or fragments could have come from the same individual based on matching size and any signs of immaturity). For example, a collection comprising one L tmt and one R tmt would have MNI = 1 if the two bones matched in size, or MNI = 2 if they were a mismatch. Sites containing only undiagnostic fragmented remains were given MNIs of 1 to ensure they were represented in the counts for ‘small moa (Emeidae)’ and ‘moa (Dinornithiformes)’. MNIs were not assigned for eggshell fragments or presumed gastroliths.

We categorised the sites at which moa bones have been recorded as natural (i.e., palaeontological, with no indication of human associations), archaeological (Māori sites) or ‘dune/midden’ where bones from surface collecting might be natural or culturally associated. Moa bones in New Zealand coastal sand-dunes have two possible origins: (1) natural accumulation during the c. 5,500 years since current sea-levels were attained and the dunes began to be formed (e.g. Stevens 1985; Brook 1999a, b), or (2) accumulation in Māori kitchen middens following Polynesian settlement, from the early 1300s, and before moa extinction, which was possibly within 100–150 years of first human arrival (Holdaway and Jacomb 2000). Māori middens with moa bones also contain large numbers of artefacts such as fish hooks made from the bone. Very few intact moa bones have been recovered from archaeological contexts. The bone fragments tend to have patterns of breakage (especially greenstick fractures), cut or drill marks and scorching, suggesting they were from fresh bones. Potentially, repeated cycles of exposure and reburial in sand-dunes may jumble together bones from natural and archaeological contexts (Scarlett 1979). However, after consulting archaeological excavation reports we are confident that the majority of bones excavated from archaeological sites in this review are cultural in origin. Where this is not the case the bones are categorised as ‘dune/midden’ (Table 1), and in several instances bones that are clearly from below the cultural layers are identified as such.

RESULTS

Appendices 1 and 2 list the sites at which moa remains have been recorded in the Auckland and Coromandel Ecological Regions (respectively) and provide details of the remains (bones, gizzard stones/gastroliths and eggshell fragments). There are moa records from 24 Auckland geographic locations and 21 Coromandel locations. At most sites the moa remains are sparse and fragmentary, and our study confirms that the regions have not been conducive to the abundant and widespread preservation of moa remains. Estimated MNIs are given in the appendices for each site, or for separate

assemblages from within broader geographic locations. These MNIs are grouped in Table 1. In total the moa remains represent at least 74 individual birds in the Auckland region and 101 in Coromandel.

The main regional difference is that Auckland has yielded moa remains mostly from natural sites (60 individuals, 81%; Table 1), principally the swamp site at Clevedon (33 individuals) which accounts for more than half of those birds. The Coromandel region, by contrast, has a dominance of moa remains from archaeological sites (64 individuals, 64%; with additional remains—31 individuals, 31%—from ambiguous ‘dune/midden’ sites), and only 6 individuals, 6%, from natural deposits, reflecting the abundance and concentration of archaeological sites along the Coromandel east coast.

Of the total of 175 moa individuals from both regions, 112 individuals could be identified to species (64%; from Table 1) and 63 could not be identified because the remains were undiagnostic. The numbers show that during the last few thousand years all four North Island moa species were present in the Auckland-Coromandel regions although uneven in occurrence. *Euryapteryx curtus* was the most abundant moa across the two regions (36 individuals, 32% of the total identified to species). *Dinornis novaezealandiae* (29, 26%) and *Anomalopteryx didiformis* (28, 25%) were next in abundance, closely followed by *Pachyornis geranoides* (19, 17%).

However, the regional results differed markedly in species representation. In Auckland, for the 55 identified moas (from Table 1), the relative abundances were

A. didiformis 43%, *E. curtus* 31%, and *P. geranoides* and *D. novaezealandiae* 13% each. For the 57 identified Coromandel moas, the numbers were *D. novaezealandiae* 39%, *E. curtus* 33%, *P. geranoides* 21% and *A. didiformis* 7%. The commonest and rarest species in the two regions are reversed. This is shown in Fig. 2 which compares the two regions using the percentage frequency of MNIs for all the identification categories, not just identified species. There were too few identified moas in Auckland archaeological sites, or in Coromandel natural sites, to make sound intra-regional comparisons of species composition in natural vs archaeological sites. However, the scarcity of *A. didiformis* in Coromandel archaeological sites is notable: only Port Jackson and Opito Bay have firm identifications of *A. didiformis*, and in both cases from ambiguous dune/midden contexts (Appendix 2).

DISCUSSION

Our attempt to identify moa species from bone morphology was limited by the difficulty of this task generally, especially with isolated bones and those that are damaged and fragmented. There is further potential to examine the Auckland-Coromandel archaeological collections using DNA (e.g., McCallum *et al.* 2013) to confirm or expand the known species at each site, and understand better the hunting strategies of Māori and which species were more desirable as raw material for artefacts.

Besides difficulties with species identification, there are also limitations with assessing MNIs at sites

Table 1. Species composition of moa bones (as minimum numbers of individual birds) tallied across all known sites in the Auckland and Coromandel regions (Appendices 1 and 2). The species assignments use the current taxonomy (Gill *et al.* 2010; Worthy and Scofield 2012).

	Auckland				Coromandel			
	natural	archaeo-logical	dune/midden	TOTAL	natural	archaeo-logical	dune/midden	TOTAL
<i>Anomalopteryx didiformis</i>	24	0	0	24	0	0	4	4
<i>Pachyornis geranoides</i>	4	3	0	7	4	5	3	12
<i>Euryapteryx curtus</i>	17	0	0	17	0	19	0	19
unidentified small moa (Emeidae)	5	7	0	12	1	21	17	39
TOTAL Emeidae	50	10	0	60	5	45	24	74
<i>Dinornis novaezealandiae</i>	5	2	0	7	0	15	7	22
unidentified moa (Dinornithiformes)	5	2	0	7	1	4	0	5
TOTAL moa	60	14	0	74	6	64	31	101

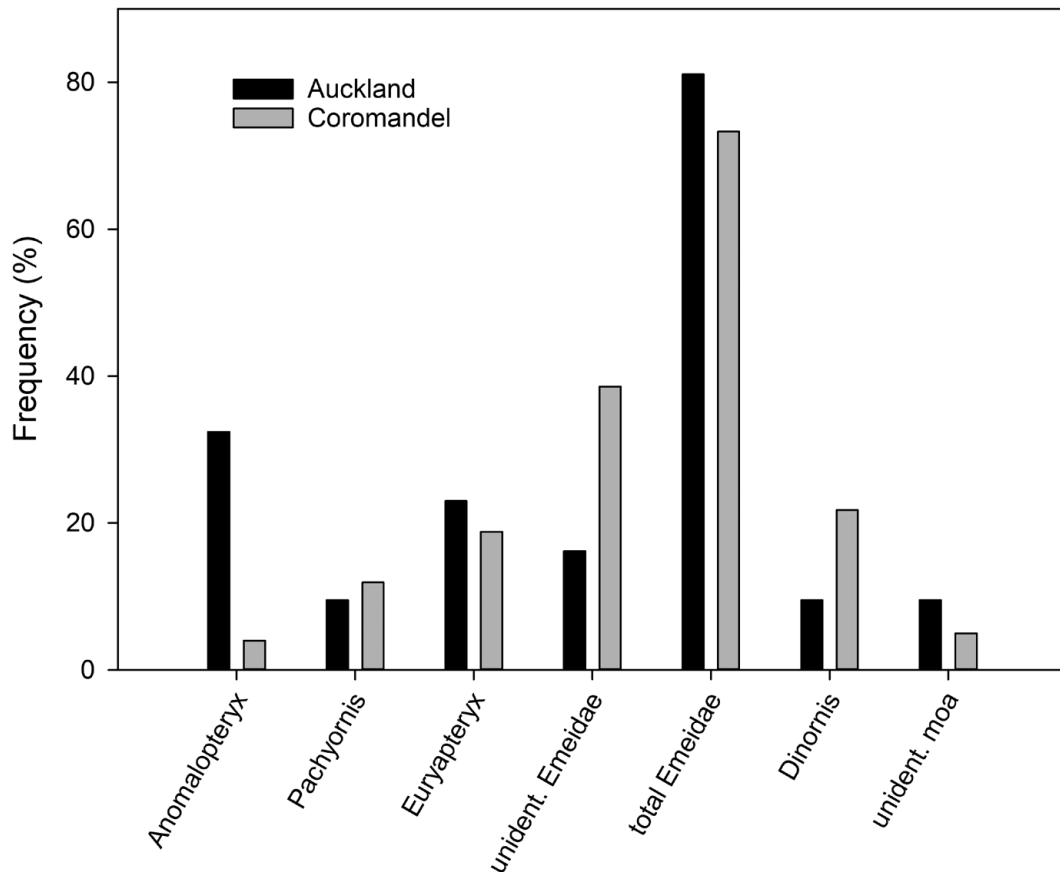


Figure 2. Histogram comparing the Auckland and Coromandel regions for the frequency (%) of the MNIs (minimum number of individuals) of the various taxonomic categories of moas as determined from bones in museum collections. The categories 'total Emeidae', 'Dinornis' and 'unidentified moa' add up to 100%.

to quantify and compare the relative abundance of moa species. If the same sites were sampled repeatedly at different times and the collections sent to different museums, we assessed these separately. This introduces a potential inflation of numbers as the same skeleton may have been re-sampled if it extended through multiple horizontal layers to be revealed by successive archaeological excavations or erosive periods followed by surface collection. However, this is countered by the conservative nature of MNIs which calculate only the minimum number of birds signified by a group of bones. Our numbers of moa individuals, and species identifications, are indicative rather than definitive.

The compilation of all known recorded moa remains from the Auckland and Coromandel regions confirms what we suspected at the outset—that moa bones are relatively scarce in the area, with usually only a few bones found at each site. In general there is a dearth of complete skeletons (Fig. 3), skulls (Fig. 4) and intact pelves. For archaeological sites, typically only leg bones (femur, tibiotarsus and tarsometatarsus), associated with a high yield of meat, and used to make artefacts (Figs 5–7), were carried back to living or hunting sites (Anderson 2003). Both regions have limited sand-dunes and swamplands, and no limestone caves, all of which have been major sources of preserved moa bones in other regions.

The only sizeable discovery of moa bones at a natural site within the study regions was at the Late Holocene swamp site near Clevedon, Auckland (Gill 2003), but even there the bones were mostly jumbled, rather than discrete skeletons, and few skulls and pelves are among the surviving specimens. Moa bone is a common feature of early Māori archaeological sites along the east coast of the Coromandel Peninsula, yielding numerous fragments, often displaying fracture patterning, drill holes or cut marks indicating its use as a resource in artefact manufacture. However, much greater numbers of moa bones have been recovered at other North Island archaeological sites, such as Houhora (Northland), Kaupokonui (Taranaki) and Foxton (Manawatu), and at many South Island localities (Anderson 2003).

A femur of *A. didiformis* from the Clevedon site was radiocarbon-dated (Millener 1981) with an estimated age of 1315 ± 70 years BP (NZ4871C). Large quantities of seeds of podocarps and other forest trees were found associated with the moa bones, indicating that the mire site had been surrounded by tall podocarp forest. All assessments of species composition at the site (Table 2) indicate a dominance of *A. didiformis* with lesser numbers of the three other North Island moas. This moa fauna is typical of North Island wet forest sites (Worthy 1990; Worthy and Holdaway 2002: 193), and Clevedon



Figure 3. Bones from a skeleton of *Pachyornis geranoides* collected from sand-dunes at Papa Aroha, Coromandel Peninsula, by S.C.L. McCall in 1926. The L femur at top left is 193 mm long. Auckland War Memorial Museum, LB6064.



Figure 4. Skull of *Anomalopteryx didiformis* collected at Eastern Beach, Bucklands Beach, Auckland, by E. Pegler in 1954. The bone is partly obscured by concretionary matrix. Smallest divisions on scale are 1 mm. Auckland War Memorial Museum, LB5806.

gives the best indication of the pre-human moa fauna of closed-forest sites in the Auckland-Coromandel region.

We noted differences in the relative abundance of moa species between Auckland and Coromandel, but the numbers were possibly biased by an unevenness of the habitats associated with the sites. In the Auckland region, moa bone sites were spread across a wide range of habitats including both tall forest (e.g., Clevedon) and scrubland (e.g., across the Auckland volcanic field). The Coromandel archaeological sites, in contrast, were all in, or close to, coastal sand-dunes and drier coastal margins more suited to *E. curtus*. The scarcity of *A. didiformis* in the Coromandel archaeological sites possibly reflects the species' natural preference for wet forest environments but absence from indisputably culturally associated deposits suggests that there may be other reasons. Māori were mobile, gathering food widely around a settlement site from many environments (Davidson 1979) and it is unlikely *A. didiformis* would be overlooked as food because it inhabited forest. *D. novaezealandiae* ranged widely through forest yet is present in most Coromandel sites. *A. didiformis* may yet be found in the undiagnostic fragments, but it is also possible that the species was scarce generally on the Coromandel at the time of Māori settlement.

In the Auckland region only four of the seven archaeological sites with moa have been excavated, and there is an expectation that a larger sample of bones would be recovered from these sites compared to surface finds. *A. didiformis* and *E. curtus* are not represented from the archaeological excavations as identifiable elements, but may be present in the undiagnostic fragments. However, with similar results to the distribution on



Figure 5. Near-intact *Euryapteryx curtus* L femur (left of picture), and R tarsometatarsus of small moa (Emeidae), from Port Jackson archaeological site. Auckland War Memorial Museum, 1995.47.6.

Table 2. Assessments of species composition of moa bones (as minimum numbers of individual birds) recovered from the swamp site near Clevedon, Auckland. The species assignments have been changed to the current taxonomy (Gill *et al.* 2010; Worthy and Scofield 2012). The first column is from an article in the *New Zealand Herald* of 25 September 1912 (p. 8), the year of discovery, after T.F. Cheeseman had visited the site and identified the bones. The remaining columns are based on specimens in the Auckland Museum collection, the *Euryapteryx* bones being missing in 2002.

	N.Z. Herald 1912	Millener 1981	Gill 2003
year of assessment	1912	1978	2002
<i>Anomalopteryx didiformis</i>	26	20	16
<i>Pachyornis geranoides</i>	0	2	2
<i>Euryapteryx curtus</i>	6	10	0
<i>Dinornis novaezealandiae</i>	1	1	1
species uncertain	1	0	1
TOTAL	34	33	20

the Coromandel Peninsula *A. didiformis* may also not have been common on the Tāmaki isthmus, and the abundance of *E. curtus* may have been distorted by the Clevedon Swamp individuals. *D. novaezealandiae* is also poorly represented in contrast to archaeological sites on the Coromandel Peninsula, and present only in the Matatua site on Awhitu Peninsula and at Owhiti Bay on Waiheke. Both are most like the Coromandel sites and have extensive evidence of fish hook manufacture and waste moa bone pieces. Overall, chronologically early sites which potentially could have contained moa are not well represented in the Auckland region, and in particular the Tāmaki isthmus, for reasons including reclamation and historic development of foreshore areas where the sites are more likely to be situated.

At the start of the Holocene Epoch, around 10,000 years ago, sea-levels were much lower than at present and all the islands in our study regions (including Great and Little Barrier Islands) were connected by land to

the current mainland (Stevens 1985). It is likely that all or most of the larger islands (including Waiheke Island) supported remnant moa populations at the time of Polynesian settlement. Smaller islands may have presented more challenging landscapes for moa survival after sea-level rise, with vegetation patterns dominated by monocotyledons and tree-ferns (Prebble *et al.* 2019), making moa populations vulnerable well before Polynesian settlement. Moa remains found on small islands (Tiritiri Matangi, Motutapu, Motukorea Brown's, Ahuahu Great Mercury and Slipper) are all from archaeological sites. On Ahuahu Great Mercury Island the tracheal rings, vertebrae, phalanges and fragments of leg bones from the Te Matakū Coralie Bay site, likely represent birds brought from the mainland. The low incidence of bone fragments and moa bone fish hooks in this site, when compared to similarly-aged sites on the Coromandel mainland, suggests moas were not readily available on the island.



Figure 6. Proximal end of *Dinornis novaezealandiae* L tarsometatarsus (top left) and moa bone fragments typical of archaeological sites, Opito Beach Midden. Auckland War Memorial Museum, 2014.80.783.



Figure 7. Awl fashioned from a thick bone fragment assumed to be from *Dinornis novaezealandiae*; Te Matakau archaeological site, Ahuahu Great Mercury Island. Auckland War Memorial Museum, 48928.

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APPENDIX 1. Moa Records from Auckland Ecological Region

Region comprises eight Ecological Districts but there are no recorded moa remains from 09.02 (Waitakere Ecological District) and 09.04 (Rangitoto Ecological District).

09.01 Rodney Ecological District

Weiti Heads, Silverdale

Millener's site 73; swamp.

P. geranoides. AIM LB6022 (181/28, Moa 110, MOA8.9), pres. by G. Graham 1928; L tmt. MNI = 1.

Whangaparaoa Peninsula

Millener's site 74; swamp. AIM LB6768 (9/58, Moa 465, MOA4.35), coll. by Mr Goymour 1958.

A. didiformis. L fem. MNI = 1.

Moa (Dinornithiformes). R tbt (immature?). MNI = 1.

09.03 Tamaki Ecological District

Takapuna Beach, North Auckland

Geological context uncertain.

Small moa (Emeidae). AUG 14934–5, coll. by B. Hayes; shafts of 2 R tbt. MNI = 2.

Moa (Dinornithiformes). AUG 15050, coll. by B. Hayes Dec. 1996; shaft of ?fem. MNI = 1.

Kendall Bay, Birkenhead, North Auckland

Swamp or sand-dune.

Small moa (Emeidae). AIM LB14135, coll. by D.L. Robinson 2010, found on beach at high-tide level; R tmt. MNI = 1.

Torpedo Bay, Devonport, North Auckland

(a) Fossil Record File No. R11/f195; geological context uncertain.

Small moa (Emeidae). AUG 15007, coll. by B. Hayes Feb. 1996; shaft of femur. MNI = 1.

(b) Site of Torpedo Bay Navy Museum. Archaeological site R11/1945; midden (Campbell *et al.* 2018). Unregistered (not yet in an institutional collection);

excavated 2009.

P. geranoides. L fem. MNI = 1.

Small moa (Emeidae). L fem, fragments of L&R tbt, phalanges. MNI = 1.

(c) Site of Masonic Tavern. Archaeological site R11/2517; natural sand-dune site underlying early Māori and historical deposits, but moa bones seem to be from Māori cultural layer; excavated 2010 and 2013 (Geometria 2014).

P. geranoides. Unregistered (not yet in an institutional collection); R fem, proximal end of L tbt, proximal end of fibula, vertebra, phalanx. MNI = 1.

Customs Street, Auckland City

Millener's site 84; Fossil Record File No. N42/f670; Holocene marine mud (Nelson and Grant-Mackie 1980).

A. didiformis. AIM MOA1.118 (157/70), coll.

by K. Goss 1969 during construction of hotel foundations, corner of Queen and Customs Streets; R fem (see Fig. 2 of Nelson and Grant-Mackie 1980). MNI = 1. The bone yielded a radiocarbon age of c. 7520 years B.P. (Nelson and Grant-Mackie 1980). No registration number was given by Nelson and Grant-Mackie (1980), but this bone is registered in the AIM land vertebrates collection (MOA1.118), as noted by Millener (1981); currently missing, possibly destroyed by the dating procedure.

Westmere, Auckland

Millener's site 87; swamp.

P. geranoides. AIM LB5978 (Moa 185, MOA9.4), coll. by L. Castle 1939; pelvis, L fem, L&R tbt. MNI = 1.

Royal Oak, Auckland

Tramways workshop. Millener's site 89; volcanic tuff.

Moa (Dinornithiformes). Bone found during site construction (Bartrum 1924); missing (not located in any institution by Millener or subsequently). MNI = 1.

One Tree Hill, Auckland

Millener's site 90; lava cave.

E. curtus. AUG 7883, coll. during construction of National Women's Hospital; missing, bones not located in collection Jan. 2019. MNI = 1.

Mt Wellington, Auckland

Millener's site 92; lava cave.

A. didiformis. AIM LB6245 (Moa 483, MOA17.7), coll. by M. Woods c. 1974; broken bones incl. R fem, L&R tbt. MNI = 1.

Ellerslie, Auckland

Millener's site 93; lava cave.

Moa (Dinornithiformes). Thomas Cheeseman explored a small cave near the Ellerslie race-course, obtaining a 'considerable number' of moa bones, 'but in such a bad state of preservation as to be useless for scientific purposes' (Cheeseman 1876). MNI = 1.

Bucklands Beach, Auckland

Eastern Beach. Millener's site 95; concretionary matrix in marine sand.

A. didiformis. AIM LB5806, coll. by E. Pegler of King's College Bird Club 1954; cranium (Fig. 4). MNI = 1. Found a little above high-tide level in a bayhead fill (R.B. Sibson, pers. comm. to BJG 1993). Largely intact but partly eroded and partly encased in hard sediment. The premaxillary is absent but both quadrates are in place; on the left side the jugal bar is present along with the proximal two-thirds of the mandible. The cranium is 66 mm wide between the postorbital processes. Species identification by Millener (1981).

Māngere, South Auckland

Māngere Speedway. Millener's site 91; geological context uncertain.

D. novaezealandiae. AIM LB7075 (Moa 230, MOA3.4), pres. by G. Henning before 1964, probably 1926–31; R tmt. MNI = 1.

Moa (Dinornithiformes). AIM LB1920, coll. by G. Henning c. 1930s; presumed gastroliths (3).

Wiri, South Auckland

"Rumney's Cave", Wiri Mountain; lava cave.

Moa (Dinornithiformes). LB15235, coll. by P. Crossley 2010; shafts of R fem and R tbt. MNI = 1. Found in cave (c. 10 m in from entrance) beside Rumney (Jacaranda) Cottage, Wiri Station Road.

East Tamaki, South Auckland

Whale's Quarry, Greenmount. Millener's site 98; scoria quarry.

E. curtus. AIM LB6246 (MOA1.162), coll. by J. Davidson 1978; broken bones incl. 3L fem, 4L&2R tbt, L tmt, skull fragments. MNI = 4. (Some of these bones are large, raising the possibility they are from a Pleistocene deposit, when individuals were larger on average than during the Holocene.)

09.05 Inner Gulf Islands Ecological District**Tiritiri Matangi Island**

Archaeological site R10/279; midden.

Unregistered (not yet in an institutional collection); excavated by R. Brassey 1997.

Small moa (Emeidae). Undiagnostic fragment (Rimmer 2004: 22). MNI = 1.

Motutapu Island

Sunde Site. Archaeological site R11/25 (N38/24);

Millener's site 76; midden (Scott 1970).

P. geranoides. AIM 2018.x.88.116; R fem. AIM AU1561.7; L tmt. MNI = 1.

Small moa (Emeidae). AIM 2018.x.88.123; phalanx.

AIM 2018.x.88.45, -63, -117; vertebrae, ribs, etc.

AIM 2018.x.88.48; tracheal ring. AIM 2018.x.88.125; undiagnostic fragment (1).

Moa (Dinornithiformes). CMC Av15925; partial phalanx.

Waiheke Island

(a) Owhiti Bay. Archaeological site S10/14; Millener's site 78; midden & possibly sand-dune.

Small moa (Emeidae). AIM AR7824; distal end of R tbt. AIM AR7825; distal end of L tbt. AIM AR8234; proximal end of R tmt. MNI = 1.

D. novaezealandiae. AIM AR7764; distal end of R tbt. MNI = 1.

Moa (Dinornithiformes). *E. curtus* (large, female) or *D. novaezealandiae*. AIM AR8234; distal end of R tbt. MNI = 1. AIM Archaeology collection; undiagnostic fragments (86).

(Plus, undiagnostic moa bones coll. by P.R. Millener 1978. Missing; bones not located in AUG collection Jan. 2019.)

(b) Onetangi Beach. Probably from sand-dune.

Small moa (Emeidae). Retained by finder, coll. by C. Anderson 2011, washed up on beach after storm; R tmt, water-worn, c. 170 mm total length. MNI = 1.

Motukorea Brown's Island

Archaeological site R11/565; midden.

Moa (Dinornithiformes). AIM 2019.77.8, AR7475.5; undiagnostic fragments (9). MNI = 1.

09.06 Awhitu Ecological District**Awhitu Peninsula**

(a) Matatuahu, Manukau South Head. Archaeological site Q11/344 (N46/16); midden.

Small moa (Emeidae). AIM AU402; distal end of R tbt. MNI = 1. CMC Av33204; burnt bone fragments; 3 large, 3 small. MNI = 3.

D. novaezealandiae. AIM AR7272; shaft of R tbt. MNI = 1.

Moa (Dinornithiformes). AIM archaeology site collection; undiagnostic fragments (18).

(b) Awhitu. Millener's site 101; sand-dune.

D. novaezealandiae. AIM LB7080 (Moa 327, MOA3.11), coll. 1922; shaft of R tbt. MNI = 1.

(c) Awhitu Swamp. Millener's site 103; swamp. *D. novaezealandiae*. AIM LB7071 (Moa 223, MOA3.2); R tbt, R tmt. AIM LB7077 (Moa 246, MOA3.7); L tbt, L tmt. Coll. by A. Mactier 1877. Bones stained very dark brown and broken or worn. The find was originally reported as "a pair of tibiae and metatarsi, together with a few phalanges" (Mactier 1878; see also Hutton 1892: 112). The four bones, now registered in two lots, are probably from the same bird. MNI = 1.

Maoro

Millener's site 107; sand-dune.

E. curtus. AIM unreg., coll. by E.G. Turbott 1940; missing, not found in collection by Millener or subsequently. MNI = 1.

D. novaezealandiae. AIM LB7102 (Moa 405, MOA3.15), coll. by E.G. Turbott 1940; partial bones: L&R tbt, L&R tmt, fragment of fem. MNI = 1.

09.07 Manukau Ecological District

Patumahoe

Millener's site 104; swamp.

E. curtus. AIM LB5996 (Moa 30, MOA8.2), coll. by W.E. Jones before 1969; L tmt.

MNI = 1. Millener (1981) recorded the site as 'Swamp'. There are no sand-dunes at this site, yet the bone is pale and sandy suggesting a dune origin and an erroneous location.

Homai, Manurewa

Geological context uncertain.

Moa (*Dinornithiformes*). AIM LB1917 (99/34), pres. by A.K. Duthie 1934. Presumed gastroliths (6).

09.08 Hunua Ecological District

Clevedon

Millener's site 99; assigned archaeological site number R11/832 (N42/875) though not an archaeological site; swamp (Gill 2003).

This site was located at the foot of hills north or west of Clevedon. An archaeologist located what he believed to be this site in 1979 and gave a precise sketch-map in the NZAA site description form (Plowman and Eaves 2010). The bones were discovered by a farmer (T.L. Smith) while draining swampy land in 1912 and collected by local naturalist H.S. Munro. Thomas Cheeseman of Auckland Museum identified the bones in 1912 as comprising 34 individuals (Table 2). Oliver (1949: 14) reported that the site yielded about 900 bones, representing 40–50 birds, and, indeed, an old photograph of the collection arranged outside a house (Gill 2003, Fig. 1) shows large piles of bones. The collection came to Auckland Museum from the Munro family, probably around 1954. The bones were reassessed by Phil Millener in 1978 as comprising 33 individuals (Table 2). Currently, some 280 bones from the Clevedon site, representing at least 20 birds, are present in the AIM collection (Gill 2003, Table 2). This reduced number suggests that only a residue of the original collection was received from the Munro family. The absence of *Euryapteryx* in the current Clevedon collection suggests that another group of bones was lost between 1978 and 2002. A left femur from AIM LB7122 (eight bones of one individual), which had been attributed to *P. geranoides*, was confirmed as this species by DNA analysis (Huynen *et al.* 2010; Table S2).

Species numbers are taken from Millener's assessment (1981; Table 2):

A. didiformis. MNI = 20.

P. geranoides. MNI = 2.

E. curtus. MNI = 10.

D. novaezealandiae. MNI = 1.

APPENDIX 2. Moa Records from Coromandel Ecological Region

Region comprises seven Ecological Districts but there are no recorded moa remains from 10.01 (Little Barrier Ecological District), 10.05 (Thames Ecological District), 10.08 (Te Aroha Ecological District) and 10.09 Mayor Ecological District.

10.02 Great Barrier Ecological District

Te Ahumatā (Whitecliffs), Great Barrier Island

Geological context uncertain.

Moa (*Dinornithiformes*). AIM LB1885, coll. 1963; presumed gastroliths (8).

Central Great Barrier Island

Geological context uncertain.

Moa (*Dinornithiformes*). AIM LB1951, coll. before 1965; presumed gastroliths (>20).

Harataonga Bay, Great Barrier Island

Archaeological site T08/5 (N30/5); Millener's site 66; midden (Allen and Holdaway 2010; Law 1972).

E. curtus. NMNZ S34025, surface coll. by T.H. Worthy 1983, possibly from a natural source; fragments of vertebrae & ribs, 11 phalanges, quadrate. MNI = 1.

D. novaezealandiae. AUA unregistered, coll. by G. Law 1972; missing, bones not located in collection Dec. 2019. MNI = 1.

Moa (*Dinornithiformes*). AUA unregistered, collected by M. Allen 2000; undiagnostic fragment (1).

Awana River, Great Barrier Island

Millener's site 69; midden.

E. curtus. AIM LB6665 (Moa 147, MOA16.17), coll. by S. Weetman 1886; R fem, R tbt (immature). MNI = 1.

10.03 Colville Ecological District

Port Jackson

Midden & possibly sand-dune.

(a) AIM Archaeology collection; archaeological site S09/53 (N35/88, Foster 1983).

E. curtus. AIM 1995.47.6; L fem (Fig. 5). MNI = 1.

Small moa (Emeidae). AIM 1995.47.4; distal end of R fem, distal end of L tbt. AIM 1995.47.3; shaft of fem, distal ends of 5L&1R tbt, phalanges, immature femoral shaft. AIM 1995.47.6; shaft of L fem, 1 proximal and 1 distal ends of R fem, proximal ends of 2L&1R tbt, whole R tmt (Fig. 5), proximal end of fibula. AIM 1995.47.2; proximal end of fem. AIM 1995.47.1; phalanges, fragment of distal end of L fem, proximal ends of 5 fibulae. AIM 2020.x.10; shaft of fem.

Eggshell fragments (>80, thin). MNI = 7.

D. novaezealandiae. AIM 1995.47.6; distal end of L tbt. MNI = 1.

Moa (Dinornithiformes). AIM 1995.47.2; 2 proximal ends of fibulae. AIM 1995.47.6; vertebrae, phalanges and ribs. AIM archaeology collection; undiagnostic fragments (1246).

(b) AUG collection; Fossil Record File No. S09/f001; Millener's site 71; coll. 1978 and 1981 by Gregory, Millener, Markham and Foley. Probably from S09/53.

A. didiformis. AUG 6109; two distal ends of L fem. MNI = 2.

P. geranoides. AUG 6107; proximal ends of L&R fem. AUG 7861; R fem. MNI = 2.

Small moa (Emeidae). AUG 6104; R fem. AUG 6105; proximal & distal ends of R fem, 4 proximal ends of tbt (sides not determined), distal ends of L&R tbt. AUG 6106; distal end of R fem, proximal end & 3 distal ends of L fem, proximal end of tbt (side not determined), 4 distal ends of L tbt. AUG 6107; proximal end of L fem, 4 proximal ends & 2 distal ends of R tbt, 2 distal ends of L tbt. AUG 6109; proximal & distal ends of L fem, proximal end & 2 distal ends of R tbt, proximal end & 2 distal ends of L tbt. AUG 6112; distal end of R fem, 2 distal ends of L fem, proximal & distal ends of L tbt. AUG 6115; L fem, L fem (immature), distal end of R tbt, proximal end of L tbt. AUG 7861; proximal & distal ends of R fem, 2 proximal ends & 2 distal ends of L tbt. MNI = 12.

D. novaezealandiae. AUG 6105; distal fragments of L&R fem, proximal end of R tbt, distal ends of L&R tbt. AUG 6115; proximal half of R fem, distal end of R tbt. MNI = 2.

(c) AIM Land Vertebrates collection. Probably from S09/53, but exact location of finds in relation to that site uncertain.

Small moa (Emeidae). LB14506, coll. by J.D. Osborne c. 1975; fragments (7) of L fem, 2L&1R tbt, fibulae. MNI = 2. LB14503, coll. by J.D. Osborne c. 1975; eggshell fragments (>1000, mostly thin). LB11741, coll. by B.J. Gill 2003; eggshell fragments (6, thin).

D. novaezealandiae. Coll. by J.D. Osborne c. 1975. LB14504; proximal end of L tbt. LB14505; proximal ends of L&R tbt. MNI = 2.

Fletcher Bay

From a clay bank.

Moa (Dinornithiformes). AIM LB14508, coll. by J.D. Osborne 1975; phalanx. MNI = 1.

Peninsula east of Port Charles

Geological context uncertain.

Moa (Dinornithiformes). AIM LB10376, coll. by D.J. Friend ca. 1970; presumed gastroliths (>100).

Waikawau Bay

Millener's site 72; sand-dune (Archey 1941: 93).

P. geranoides. AIM LB7110 (494/31), coll. by L.M. Cranwell 1929 from "Matamataharakeke", inland from Waikawau Bay; L&R mandibles. MNI = 1.

AIM LB6018 (Moa 49, MOA8.5), coll. by G. Archey 1932; almost complete skeleton (L tmt lacking) but condition poor, immature. MNI = 1.

Small moa (Emeidae). Record cited by Archey (1941: 44) as "*P. oweni*"; missing; bone not located by Millener. AUG, 4074.1, coll. by F. Moore 1971; eggshell fragments (c. 60; thin, worn). AIM LB11740, coll. by B.J. Gill 2003; eggshell fragments (5; thin, badly worn).

Papa Aroha

Millener's site 79; sand-dune.

P. geranoides. AIM LB6064 (Moa 395, MOA8.21), coll. by S.C.L. McCall 1926; almost complete skeleton (Fig. 2; skull also illustrated in Archey 1927: Figs. 1–4). MNI = 1. Site originally recorded as "sandhills at Amodeo Bay, Coromandel" (Archey 1927) but Millener (1981) thought it more likely to be the neighbouring bay (Papa Aroha). The McCall homestead was at Amodeo Bay (Clint Easton, pers. comm. to B.J.G.) and Archey may have assumed that to be the collecting locality.

Opito Bay

(a) Pōhutukawa Flaking Floor (Parker's Midden). Archaeological site T10/160 (N40/2); Millener's site 83; midden (Davidson 1979; Jolly and Murdoch 1973). AIM Archaeology site collection:

E. curtus. AIM 2013.x.30; parts of 2 L fem, 3L&1R tbt, 2 phalanges, cranium. AIM 2013.x.36; distal end of chick tmt. AIM AU1513; head of fem. MNI = 4.

Moa (Dinornithiformes). AIM archaeology collection; undiagnostic fragments (38).

CMC Vertebrates collection, coll. 1959, 1960:

P. geranoides. Av16664; distal part L fem. Av16667; proximal part L fem. MNI = 1.

E. curtus. Av16285; part skeleton. Av16672; proximal part L fem. Av16673; part L fem, part L fibula. Av16675; shaft of L tbt (immature). Av16915; L fem. MNI = 3.

Small moa (Emeidae). Av16665; distal part L fem. Av16666; proximal part L fem. Av16668; proximal fragment R fem. Av16669; parts L tbt. Av16670; proximal part R tbt. Av16671; proximal part L tbt. Av16676; proximal part R fem. Av16678; fragments of pelvis, vertebrae, ribs, leg bones etc. MNI = 2.

D. novaezealandiae. Av16674; 8 fragments of tbt, phalanx. MNI = 1.

(b) Opito Beach Midden. Archaeological site T10/161 (N40/3); Millener's site 80; midden (Boileau 1980). *E. curtus*. AIM 2014.80.781; distal end of L tbt. AIM 2014.80.780; part of distal end of tmt. MNI = 1. *D. novaezealandiae*. AIM 2014.80.782; part of distal end of R tbt. AIM 2014.80.783 (Fig. 6); proximal end of L tmt. MNI = 1. *Moa (Dinornithiformes)*. AIM archaeology collection; undiagnostic fragments (910).

(c) Arthur Black Midden. Archaeological site T10/164 (N40/6); midden (Green 1963). *E. curtus*. 2014.81.1; part of femur (shaft) identified by DNA analysis (McCallum et. al. 2013). MNI = 1. *Small moa (Emeidae)*. AIM 2014.81.1; parts of L&R tbt, L tmt, vertebra. *D. novaezealandiae*. 2014.81.1; fragment identified by DNA analysis (McCallum et. al. 2013). MNI = 1. *Moa (Dinornithiformes)*. AIM archaeological collection; undiagnostic fragments (5).

(d) Millener's site 82; location of finds in relation to above sites uncertain; probably mixed midden & sand-dune. *A. didiformis*. Natural History Museum (London) 32269; femur; record cited by Lydekker (1891), Hutton (1897), Millener (1981: 799). MNI = 1. AIM LB5644 (Moa 262, MOA1.83), coll. by L.W. Delph 1932; L&R fem, L&R tbt, L tmt. MNI = 1. *Small moa (Emeidae)*. AIM LB6694 (Moa 215, MOA16.30), coll. by L.W. Delph 1932, all in poor condition; 1L&2R fem (1 pair), L&R tbt (not a pair), L&R tmt (not a pair). MNI = 2. *D. novaezealandiae* (cited by Owen 1879, Hutton 1892). Missing, bones not found by Millener. MNI = 1.

Sarah's Gully, Opito

(a) Sarah's Gully Settlement. Archaeological site T10/167 (N40/9); Millener's site 81; midden (Davidson 2018, Table 10, identifications by T.H. Worthy). *P. geranoides*. AIM 2014.82.236; R tbt, likely to be natural deposit. AIM 2014.82.239; R tbt shaft fragment, natural deposit under midden. MNI = 2. *E. curtus*. CMC Av16663; distal part of R tbt. MNI = 1. *D. novaezealandiae*. AIM 2014.82.237; distal end of R tbt. MNI = 1. *Moa (Dinornithiformes)*. AIM 2014.82.238, AIM 2014.82.240–1; undiagnostic fragments (189).

(b) Sarah's Midden (Sarah's Flat). Archaeological site T10/171 (N40/13); midden (Davidson 2018, identifications by T.H. Worthy). *Small moa (Emeidae)*. AIM 2014.84.87; 2 phalanges. MNI = 1. *D. novaezealandiae*. AIM 2014.84.86; proximal end of L fibula. AIM 2014.84.85; distal end of L tbt, phalanx. MNI = 1 (Davidson 2018, Table 13). *Moa (Dinornithiformes)*. AIM 2014.84.87; tbt shaft fragment, fem shaft fragment. AIM 2014.84.88; undiagnostic fragments (35).

(c) Cross Creek. Archaeological site T10/399 (N40/260); midden & sand-dune (Sewell 1984). *D. novaezealandiae*. AIM AR7469.58; 3 vertebrae, 2 phalanges, quadrate, rib fragments, tracheal rings. MNI = 1. Probably from natural sand-dune deposit. *Moa (Dinornithiformes)*. AIM archaeology collection; undiagnostic fragments (52).

10.04 Mercury Islands Ecological District *Ahuahu Great Mercury Island*

Te Matakau site, Coralie Bay. Archaeological site T10/358 (N40/219); midden. *E. curtus*. AUA 118502; R tmt. MNI = 1. *Small moa (Emeidae)*. AUA 168052; distal end of R tbt. AUA 168053; R tmt. AIM 48835 distal end of L tbt. AIM 48939.1; proximal end of R tbt. AIM 48939.2; distal end of R tbt. Vertebrae, phalanges, tracheal rings (AUA and AIM). MNI = 2. *D. novaezealandiae*. AIM 48928; bone awl made from thick heavy bone (Fig. 7). MNI = 1. *Moa (Dinornithiformes)*. AIM 48912.7; eggshell fragments (264); surface-collected 1970s; thickness analysis (Gill in prep.) indicates at least 2 eggs, 1 small, 1 larger. AIM archaeology collection; undiagnostic fragments (7).

10.06 Tairua Ecological District *Hahei*

Archaeological site T11/326 (N44/97); Millener's site 86; midden (Edson and Brown 1977). *D. novaezealandiae*. AIM AR6058; section of shaft of large tbt(?). AIM archaeology collection; undiagnostic shaft fragments (6). MNI = 1. *Moa (Dinornithiformes)*. AIM AR6058; eggshell fragments (>50; most thin, a few thick), at least 2 eggs, 1 small, 1 larger.

Hot Water Beach

(a) Archaeological site T11/115 (N44/69); midden (Leahy 1974). *E. curtus*. AIM AR2590.1; part of R fem. AR2595.11; part of R fem. AR3292; fragment identified by DNA analysis (McCallum et. al. 2013). MNI = 2. *Small moa (Emeidae)*. AIM AR2508.12; part of phalanx. AIM AR2530.1; thoracic vertebra. AIM AR2530.2; 2 phalanges. AIM AR3156.1; 2 phalanges. *D. novaezealandiae*. AIM AR2964, AR3008; fragments identified by DNA analysis (McCallum et. al. 2013). MNI = 1. *Moa (Dinornithiformes)*. AIM archaeology collection; undiagnostic fragments (ca. 1340).

(b) Millener's site 96; location of finds in relation to above site uncertain. *P. geranoides*. AIM LB6253 (Moa 9, MOA16.3), coll. by V.F. Fisher 1934; R fem. MNI = 1. The identity of this bone was confirmed by DNA analysis (Huynen et al. 2010, Table S2). *Small moa (Emeidae)*. AIM LB6602 (Moa 8, MOA15.4), coll. by V.F. Fisher 1934; L&R fem (pair). MNI = 1. *D. novaezealandiae*. AIM LB6870 (Moa 98, MOA2.10), coll. by V.F. Fisher 1934; L tmt. MNI = 1.

Tairua

Archaeological site T11/62 (N44/2); Millener's site 100; midden (Smart and Green 1962, Rowland 1975). *P. geranoides*. CMC Av17153; L fem. CMC Av17172; proximal shaft fragment of R tbt. MNI = 1. *E. curtus*. CMC Av17156; distal part of L tbt. CMC Av17168; proximal part of L tbt. CMC Av17169; shaft fragment of L tbt. CMC Av17173; proximal part of L fem, distal part of R tbt. MNI = 1. **Small moa (Emeidae)**. AIM AU1947.16; parts of 2L fem. AIM AU1947.7; part of R fem. AIM AU1947.5; part of L fem. AIM AU1947.3; part of R tbt. AIM AU1947.7; phalanx. AIM AU1947.4; part of R tbt. AIM 2020.x.22; L fem (chick), distal end of L tbt. AIM AU1947.7; distal end of R fem. MNI = 3. CMC Av17155; proximal part of L fem. CMC Av17162; shaft of R fem. CMC Av17163; proximal part of L tbt. CMC Av17164; proximal part of L fem. MNI = 2. *D. novaezealandiae*. AIM AU1947.8; distal end of R tbt. AIM AU1947.27; proximal end of R fem. MNI = 1. CMC Av17154; proximal part of R fem. CMC Av17157; distal part of L tbt. CMC Av17158; vertebra. CMC Av17159; distal part of L tmt. CMC Av17160; distal part of L fem. CMC Av17161; 4 vertebrae. CMC Av17165; distal part of R tmt, 2 phalanges. MNI = 1. **Moa (Dinornithiformes)**. AIM archaeology collection; tracheal rings; undiagnostic fragments (97).

Opoutere

Millener's site 102; sand-dune. *P. geranoides*. AIM LB6023 (Moa 146, MOA8.10), coll. by R. Falla 1933; R tbt. MNI = 1. Labelled 'Wharekawa, Bay of Plenty' (= Wharekawa Harbour mouth, Opoutere).

Onemana

(a) Whitipiroua. Archaeological site T12/16 (N49/16); midden (Furey 1990; Jolly 1978). *D. novaezealandiae*. AIM AR158; fragment identified using DNA (McCallum *et. al.* 2013). MNI = 1. **Moa (Dinornithiformes)**. AIM archaeology collection; undiagnostic fragments (ca 352).

(b) Jolly's Site 3. Archaeological site T12/26 (N49/33); midden. **Moa (Dinornithiformes)**. AIM archaeology collection; undiagnostic fragments (59). MNI = 1.

Whangamata

(a) Whangamata Estuary. Dredged from sediments in harbour during marina construction; geological context uncertain.

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Small moa (Emeidae). *E. curtus* or *A. didiformis* (examined by BJG 2008), collected 2008, not in an institutional collection; L&R fem, part of tbt. MNI = 1.

(b) Whangamata Wharf. Archaeological site T12/2 (N49/2); Millener's site 105; midden (Allo 1972). *E. curtus*. AIM AR3757.1; part of L fem. MNI = 1. **Small moa (Emeidae)**. AIM AR2192; part of R fem. AIM AR3822; tmt (immature). AIM AR6344.5; part of R tbt. AIM 2018.x.268; L fem, 3 phalanges. CMC unnumbered, coll. by Durrant and Hockins 1961; undiagnostic bone fragments. MNI = 2. **Moa (Dinornithiformes)**. AIM archaeology collection; undiagnostic fragments (17).

(c) Cabana Lodge. Archaeological site T12/3; midden (James-Lee and Gumbley 2012; Gumbley 2014; Gumbley and Laumea 2019). **Moa (Dinornithiformes)**. AIM archaeology collection; undiagnostic fragments (61). MNI = 1.

Slipper Island

Archaeological sites U12/5 (N49/43), U12/9 (N49/48); midden (Rowland 1978). **Moa (Dinornithiformes)**. AIM archaeology collection; undiagnostic fragments (6). MNI = 1.

10.07 Waihi Ecological District**Whiritoa**

(a) Archaeological site T12/500 (N53/4); Millener's site 106; midden (Foreman and Jolly 1965). *P. geranoides*. CMC Av20453, coll. by Jolly 1964; missing 2017. MNI = 1. *E. curtus*. CMC Av20454, coll. by Jolly 1964; shaft of fem. MNI = 1. **Small moa (Emeidae)**. CMC Av 20452, coll. by Jolly 1964; fragments of 1L&2R fem, 2L&1R tbt. MNI = 2. *D. novaezealandiae*. CMC Av20450; distal part of R fem. Av20451; distal part L tbt. Av20457, coll. by Jolly 1964; fragmentary tbt. AIM AU1745/1; fragment identified by DNA analysis (McCallum *et. al.* 2013). MNI = 2. **Moa (Dinornithiformes)**. AIM archaeology collection; undiagnostic fragments (31).

(b) Archaeological site T12/497 (N53/1); midden (Crosby 1977). **Moa (Dinornithiformes)**. AIM archaeology collection; undiagnostic fragments (23). MNI = 1.

Waitekauri

Millener's site 109; surface find. **Moa (Dinornithiformes)**. AUG 7890, coll. by Mr Diamond 1979; presumed gastroliths (18).

Fossil and Recent molluscan types in the Auckland War Memorial Museum. Part 4: Gastropoda (Caenogastropoda – Neocyclotidae to Epitoniidae). [Cyclophoroidea, Cerithioidea, Littorinimorpha]

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Abstract

The Marine Department of Auckland War Memorial Museum has an actively growing type collection with currently 1,777 primary types and a further 1,835 paratypes and paralectotypes. The majority are molluscan and this fourth part of a catalogue of these collections reviews the types for 498 Caenogastropoda species and subspecies. It deals with 355 primary types and 388 secondary type lots, which are split between 357 Recent taxa and 141 fossil taxa. Fifteen of the primary types reviewed here are illustrated for the first time.

Keywords

Auckland Museum; name-bearing types; Mollusca; Caenogastropoda; Architaenioglossa; Sorbeoconcha; Littorinimorpha.

INTRODUCTION

The Marine Department of Auckland War Memorial Museum (Auckland Museum) currently holds 1,777 lots of name-bearing types, in the form of holotypes, neotypes, syntypes and lectotypes, and a further 1,835 paratypes and paralectotypes. These are spread across several phyla, but the great majority are Mollusca. They include terrestrial Mollusca as well as marine species, and fossil as well as extant taxa.

The first list of biological primary types in the Auckland Museum collection which included the molluscs, was published by Powell (1941a), followed by a supplement in 1949 (Powell 1949). The present publication is Part 4 of an updated and expanded catalogue of molluscan type material held by Auckland Museum. Part 1 of this catalogue dealt with the Bivalvia (Blom 2016), Part 2 with the Polyplacophora and Scaphopoda (Blom 2017) and Part 3 with Patellogastropoda and Vetigastropoda (Blom 2019).

The present contribution, Part 4 of the catalogue, covers the Caenogastropoda (Cyclophoroidea, Cerithioidea and Littorinimorpha), including 355 primary types and 388 secondary type lots representing 498 caenogastropod species. These are split between Recent (357) and fossil (141) taxa. The majority are from New Zealand (480), but there are also species from Antarctica (1), Australia (3), Cuba (3), Israel (1), Jamaica (1), Madeira (1), Northern Pacific (1), Papua New Guinea (1), Samoa (1), South Atlantic (2), South Orkney Islands (1) and the United States of America (2).

METHODS

Within the currently accepted family placement, taxa are listed alphabetically under their original combination first by genus and then by species.

For Recent New Zealand species the taxonomic order, family placements and current names follow Spencer *et al.* (2018) and MolluscaBase (2020). The latter, accessed through World Register of Marine Species (WoRMS 2020), was also the main reference for taxonomic placement of foreign species. Taxonomic placement, current names and ages of New Zealand Cenozoic fossil taxa are taken from a combination of Beu & Maxwell (1990), Maxwell (in Spencer *et al.* 2009), Beu & Raine (2009) and MolluscaBase (2020).

All specimens listed in the entries below were sighted, and cross-checked by the author against original publications, apart from three holotypes and six paratypes. Despite exhaustive searches by the author and colleagues in existing Auckland Museum collections and records these have not been located and are assumed to be missing. These specimens are marked with an asterisk (*) as well as the year in which they were first recorded as missing. Fossil taxa are indicated by a dagger (†) and their ages have been included as international units followed by the equivalent New Zealand stage in parentheses. Geochronological subdivisions used in original papers have in many cases been superseded by new nomenclature and their boundaries revised. For the currently accepted New Zealand timescale and formats see Raine *et al.* (2015).



Figure 1. *a, b* *Magnatica (Spelaenacca) parilis* Finlay 1930, holotype (MA70431), apertural and abapertural views; *c, d* *Natica inexpectata* Finlay 1924, holotype (MA70514), apertural and abapertural views; *e, f* *Natica praeconsors* Finlay, 1924, holotype (MA71287), apertural and abapertural views; *g* *Badenia zebina* Finlay, 1930, holotype (MA70090) apertural view; *h* *Notosetia prisca paroeca* Finlay, 1924, holotype (MA70541) apertural view; *i* *Rissoina larochei* Finlay, 1930, holotype (MA70677), apertural view; *j, k* *Pelicularia marwicki* Finlay, 1931, holotype (MA70613), apertural view; *l, m* *Struthiolaria calcar* Hutton, 1886, neotype (MA70735), apertural and abapertural views. Unless otherwise stated, scale bars 5 mm.

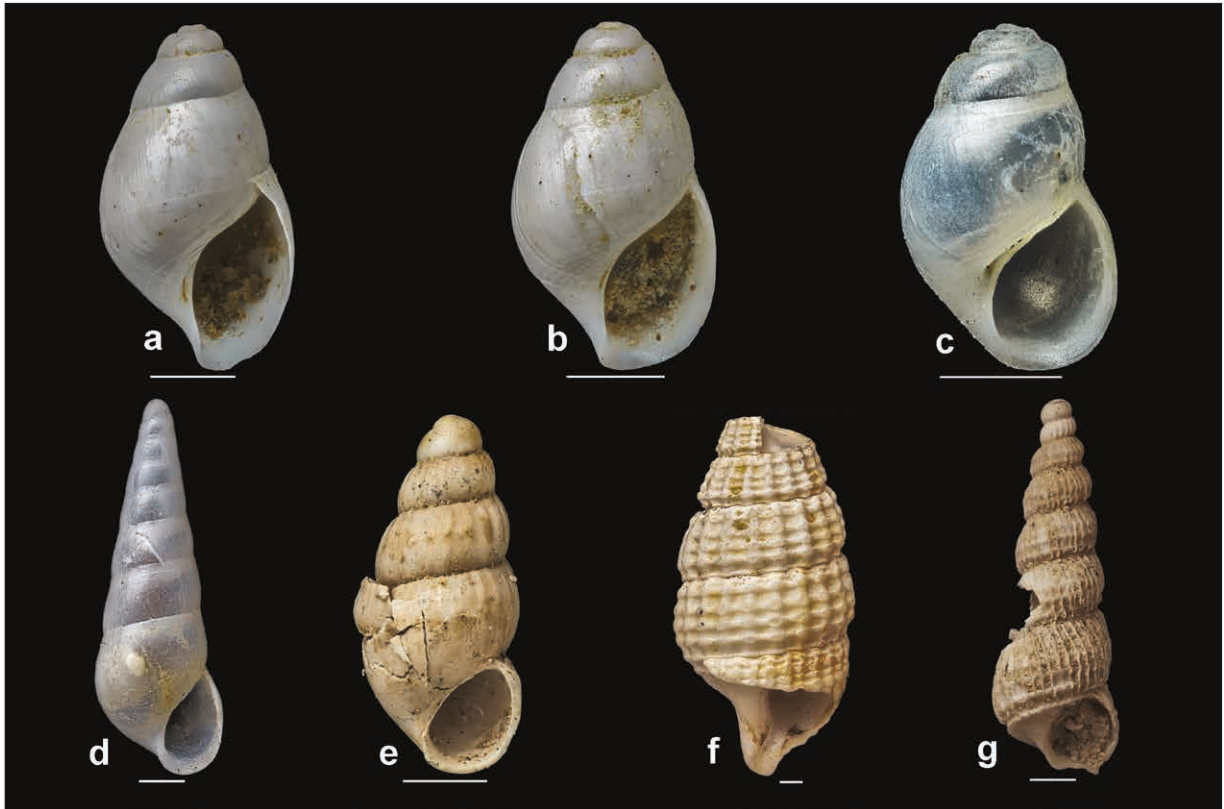


Figure 2 a, b *Nozeba candida effusa* Finlay, 1924, syntypes (MA70549), apertural views; c *Nozeba mica* Finlay, 1930, holotype (MA70550) apertural view; d *Eulima archeyi* Finlay, 1928, holotype (MA70288), apertural view; e *Rissopsis castlecliffensis* Finlay, 1930, holotype (MA70680), apertural view; f *Cerithium pyramidale robustum* Finlay, 1924, holotype (MA70054), apertural view; g *Murdochella tertia* Finlay, 1930, holotype (MA70496), apertural view. Scale bars 0.5 mm.

Type definitions are those used by the International Code of Zoological Nomenclature (ICZN 2019).

Paratypes have been included in this catalogue, because in some instances the name-bearing type is not readily available (for example, because it is missing, affected by glass disease, or held outside New Zealand). It is therefore useful to know that some of the type series is available within New Zealand.

Geographical locations are those used on specimen labels and published data, but in some cases locations are updated to current place names which are in square brackets [], e.g., Otago Heads [Taiaroa Head]. Informal names which are commonly used in publications are placed in inverted commas, e.g., ‘Rifle Butts’. Dual Māori/English names used are as gazetted in the New Zealand Gazetteer (2020). This includes the use of a solidus / to separate dual names, as recommended by the New Zealand Geographic Board (Dyer 2017: 8). The Māori name is usually first in the New Zealand Gazetteer to reflect rights of first discovery, e.g., Piwhane / Spirits Bay, but this is by no means consistent, e.g., Stewart Island / Rakiura. The use of the solidus reflects that names have equal status, regardless of their order. The Gazetteer also has instances where Māori names are placed in parentheses (), e.g., Great Barrier Island (Aotea Island). As there is no clear ruling on the equivalence of

their status, these combinations have not been used here.

Primary type material of 15 species is illustrated here for the first time with high-resolution images, created with automontage focus stacking techniques. High-resolution images for many of the other primary types may be accessed through Auckland Museum’s Collections Online (<http://www.aucklandmuseum.com/collections-research/collections>).

Additional data not shown here may be held with each accession record (e.g., precise site details).

Abbreviations

MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA.
MONZ	Museum of New Zealand, Te Papa Tongarewa, Wellington, New Zealand.
AM	Auckland War Memorial Museum.
NHM	Natural History Museum, London, United Kingdom.
GNS	GNS Science, Wellington, New Zealand.
CM	Canterbury Museum, Christchurch, New Zealand.
B.M.	Bernice Pauahi Bishop Museum, Honolulu, Hawaii, USA.
TAU	Tel Aviv University, Israel.

- USNM United States National Museum of Natural History, Smithsonian Institution, Washington (D.C.) USA.
 MCAS Museum of the California Academy of Sciences, San Francisco, California, USA.
 MCZR Museo Civico Zoologia Roma, Rome, Italy.

Class GASTROPODA
Subclass CAENOGASTROPODA
Superfamily CYCLOPHOROIDEA

Family NEOCYCLOTIDAE

- Poteria caribaea* Clench, W.J. & C.G. Aguayo, 1935**
 Clench, W.J. & Aguayo, C.G., 1935, p. 51, pl. 3, fig. 5 (holotype), fig. 6 (paratypes).
Holotype: MCZ 109264
Paratypes: MA73550, five specimens, collected by B.W. Arnold in April 1932 from Spring Mount, Saint James, Jamaica.
Remarks: The specimens were exchanged with the MCZ.
Current name: *Cyclopilsbrya caribaea* (Clench & Aguayo, 1935) – de la Torre *et al.* (1942: 77); MolluscaBase (2020).

Family PUPINIDAE

- Cytora brooki* B.A. Marshall & Barker, 2007**
 Marshall, B.A. & G.M. Barker, 2007, p. 59, figs 4E (holotype), 6E, F (paratype), 1E.
Holotype: MONZ M.179665
Paratype: MA73289, one specimen, collected by G.R. Parrish on 19 March 1988, from the type locality, Tapotupotu Bush, southeast of Cape Reinga, Northland, New Zealand.
Current name: *Cytora brooki* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

- Cytora depressa* Gardner, 1968**
 Gardner, N.W. 1968, pp. 159, 160, pl. 1, fig. 1.
Holotype: MA71315, collected by N.W. Gardner in January 1967, from leaf mould amongst rocky outcrops, the west side of Takaka Hill, Tasman, New Zealand.
Paratypes: MA71841, three specimens from the type locality.
Current name: *Cytora depressa* Gardner, 1968 – Spencer *et al.* (2018).

- Cytora gardneri* B.A. Marshall & Barker, 2007**
 Marshall, B.A. & G.M. Barker, 2007, pp. 68, 69, figs 7I, J (holotype), 4K (paratype), 11A.
Holotype: MONZ M.179667
Paratype: MA73290, one specimen, collected by C.C. Ogle in November 1986, from the type locality, northeast of Waitiki Landing, Northland, New Zealand.
Current name: *Cytora gardneri* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

- Cytora hazelwoodi* B.A. Marshall & Barker, 2007**
 Marshall, B.A. & G.M. Barker, 2007, p. 71, figs 10C, D (holotype), 9A (paratype), 11D.

- Holotype:** MONZ M.179668
Paratype: MA73291, one specimen, collected by P.C. Mayhill in August 1980, southwest of Coroglen, Coromandel Peninsula, New Zealand.
Remarks: Paratype was published by B.A. Marshall & Barker (2007: 71) as lodged at Auckland Museum. It remained at MONZ and was registered as M.169121/1. It will be deaccessioned and lodged with AM retrospectively.
Current name: *Cytora hazelwoodi* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

- Cytora hispida* Gardner, 1967**
 Gardner, N.W. 1967, pp. 215, 216, pl. 1, fig. 1.
Holotype: MA71293, collected by N.W. Gardner in April 1965, from a small bush remnant, Tapotupotu Bay, Northland, New Zealand.
Paratypes: MA71809, 11 specimens from the type locality.
Current name: *Cytora hispida* Gardner, 1967 – Spencer *et al.* (2018).

- Cytora houhora* B.A. Marshall & Barker, 2007**
 Marshall, B.A. & G.M. Barker, 2007, pp. 76, 77, figs 9B, 10G, H (holotype), 13B.
Holotype: MONZ M.179669
Paratype: MA73292, one specimen, collected by B.F. Hazelwood on 4 January 1976, from Mt Camel, Houhora, Northland, New Zealand.
Current name: *Cytora houhora* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

- Cytora jamiesoni* B.A. Marshall & Barker, 2007**
 Marshall, B.A. & G.M. Barker, 2007, pp. 77, 79, figs 10K (holotype), 9E, 10L (paratypes), 13C.
Holotype: MONZ M.179670
Paratypes: MA73293, two specimens, collected by P.R. Jamieson on 8 March 1976, at the mouth of the Swan Burn Creek, southern end of Heaphy Track, South Island, New Zealand.
Current name: *Cytora jamiesoni* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

- Cytora kahurangi* B.A. Marshall & Barker, 2007**
 Marshall, B.A. & G.M. Barker, 2007, p. 79, figs 9C (holotype), 12A, B (paratypes), 13D.
Holotype: MONZ M.179671
Paratypes: MA73294, two specimens, collected by D.J. Roscoe on 2 February 1993, from gully at end of beach, Fossil Point, north of Collingwood, Tasman, New Zealand.
Current name: *Cytora kahurangi* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

- Cytora kamura* B.A. Marshall & Barker, 2007**
 Marshall, B.A. & G.M. Barker, 2007, pp. 81–83, figs 2B, 9F (holotype), 11F, 12E, F (paratypes).
Holotype: MONZ M.179672
Paratype: MA73295, one specimen, collected by P.C. Mayhill in February 1981 from Curious Cove, Queen Charlotte Sound, Marlborough, New Zealand.
Current name: *Cytora kamura* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora kerrana* Gardner, 1968**

Gardner, W.H. 1968, p. 160, pl. 1, figs 2, 3.

Holotype: MA71316, collected by N.W. Gardner in January 1966, from under stunted scrub on coastal cliff, Ngā Atua Tātā / Kerr Point, Northland, New Zealand.

Paratypes: MA71838, eight specimens collected from the type locality.

Current name: *Cytora kerrana* Gardner, 1968 – Spencer *et al.* (2018).

***Cytora malleata* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, pp. 85, 87, figs 9I (holotype), 12K, L (paratypes), 13F.

Holotype: MONZ M.179673

Paratypes: MA73296, two specimens, collected by P.C. Mayhill in November 1988, from Ngaitonga, Te Ringa Track, northwest of Whangaruru, Northland, New Zealand.

Current name: *Cytora malleata* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora maui* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, pp. 87–89, figs 9J (paratype), 14A (paratype), 14B (holotype), 15A.

Holotype: MONZ M.183065

Paratypes: MA73297, two specimens, collected by C. Broomfield in 1979, from Waituhi Kuratau Scenic Reserve, Pureora Forest, New Zealand.

Current name: *Cytora maui* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora mayhillae* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, pp. 89, 90, figs 9K (holotype), 14C, D (holotype), 15B.

Holotype: MONZ M.146093

Paratype: MA73298, one specimen, collected by P.C. Mayhill in February 1985, from Old Doubtful Sound Track, Deep Cove, Doubtful Sound, New Zealand.

Current name: *Cytora mayhillae* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora minor* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, pp. 90, 91, figs 9L (holotype), 14E, F (holotype), 15C.

Holotype: MONZ M.082612

Paratype: MA73299, one specimen, collected by Department of Conservation on 21 November 1991, from Herangi Range, northeast of Awakino, Waikato, New Zealand.

Current name: *Cytora minor* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora motu* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, p. 91, 9M (holotype), 14G, H (paratypes), 15D.

Holotype: MONZ M.179674

Paratypes: MA73300, five specimens, collected by J.A. Bartle on 15 January 1978, from Puweto Valley, Aorangi Island, Poor Knights Islands, Northland, New Zealand.

Current name: *Cytora motu* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora paparaoa* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, pp. 97, 98, figs 2G, 16E (paratype), 17E, 18C, D (paratype).

Holotype: MONZ M.179675

Paratype: MA73301, one specimen, collected by F.M. Climo and K. Mahlfeld, on 23 December 1992, from Fox River, north northeast of Punakaiki, West Coast, New Zealand.

Current name: *Cytora paparaoa* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora parrishi* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, pp. 99, 100, figs 16B (holotype), 17D, 18E, F (paratypes).

Holotype: MONZ M.179676

Paratypes: MA73302, two specimens, collected by F.J. Brook, K.J. Burch and B.A. Marshall on 28 November 2003, from south of Waihapurua Stream, Whatuwhiwhi, Karikari Peninsula, Northland, New Zealand.

Current name: *Cytora parrishi* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora rakiura* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, p. 100, figs 16C (holotype), 17F, 18G, H (paratype).

Holotype: MONZ M.030684

Paratype: MA73303, one specimen, collected by R.K. Dell and B.A. Holloway on 22 January 1955, from island in Seal Creek, east of Port Pegasus, Stewart Island / Rakiura, New Zealand.

Current name: *Cytora rakiura* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora tawhiti* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, p. 105, figs 19C, 20C, D (paratype).

Holotype: MONZ M.146024

Paratype: MA73304, one specimen, collected by P.C. Mayhill in December 1983, from Rose Island, Auckland Islands, New Zealand.

Current name: *Cytora tawhiti* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora tepakiensis* Gardner, 1967**

Gardner, N.W. 1967, p. 216, pl. 1, fig. 2.

Holotype: MA71294, collected by N.W. Gardner in April 1965, from small bush remnant, Tapotupotu Bay, Northland, New Zealand.

Paratypes: MA71834, seven specimens, from the type locality.

Current name: *Cytora tepakiensis* Gardner, 1967 – Spencer *et al.* (2018).

***Cytora tokerau* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, pp. 106, 107, figs 16H (paratype), 19B, 20G (holotype), 20H (paratype).

Holotype: MONZ M.179678

Paratype: MA73305, one specimen, collected by P.C. Mayhill in November 1989, from Waipapa Track, Puketū Forest, south of Kaeo, Northland, New Zealand.

Remarks: The above locality details for MA73305 are

those as published by B.A. Marshall & Barker (2007: 106). The label information with the specimen is for an additional paratype lot, M.97910, collected by P.C. Mayhill in November 1987, from Waiare Road, southeast of Kaeo.

Current name: *Cytora tokerau* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Cytora tuarua* B.A. Marshall & Barker, 2007**

Marshall, B.A. & G.M. Barker, 2007, pp. 108–110, figs 16J (holotype), 19F, 20K, L (paratypes).

Holotype: MONZ M.179688

Paratypes: MA73306, two specimens, collected by I. Millar on 19 June 1986, from Big Bush, northwest of St. Arnaud, Tasman, New Zealand.

Current name: *Cytora tuarua* B.A. Marshall & Barker, 2007 – Spencer *et al.* (2018).

***Lagochilus fasciatum* Suter, 1894**

Suter, H., 1894, p. 133, pl. 19, figs 30, 31.

Holotype: MA73001, collected by R. Murdoch, near Manaia, Waimate Plain, Taranaki, New Zealand.

Current name: *Cytora fasciata* (Suter, 1894) – Spencer *et al.* (2018).

***Liarea aupouria aupouria* Powell, 1954**

Powell, A.W.B., 1954b, pp. 286, 287, pl. 44, fig. 2 (holotype), pl. 48, fig. 33 (holotype), fig. 33a.

Holotype: MA71204, collected by A.W.B. Powell, from 259–274 m (850–900 ft), Unuwahao, Piwhane / Spirits Bay, Northland, New Zealand.

Current name: *Liarea aupouria aupouria* Powell, 1954 – Spencer *et al.* (2018).

***Liarea aupouria tara* Powell, 1954**

Powell, A.W.B., 1954b, pp. 287, 288, pl. 48, fig. 34 (holotype).

Holotype: MA71205, collected by A.W.B. Powell on 23 March 1949 from Ngā Atua Tātā / Kerr Point herb field, Northland, New Zealand.

Paratypes: MA73016, 25 specimens from the type locality.

Current name: *Liarea aupouria tara* Powell, 1954 – Spencer *et al.* (2018).

***Liarea egea tessellata* Powell, 1954**

Powell, A.W.B., 1954b, p. 286, pl. 44, fig. 5 (holotype), pl. 47, fig. 24 (holotype), figs 25, 26.

Holotype: MA71203, collected by W. La Roche, from Opononi, Northland, New Zealand.

Paratypes: MA71495, 48 specimens, from the type locality.

Current name: *Liarea egea tessellata* Powell, 1954 – Spencer *et al.* (2018).

***Liarea hochstetteri alta* Powell, 1954**

Powell, A.W.B., 1954b, pp. 280, 281, pl. 45, figs 13 (holotype), fig. 14.

Holotype: MA71201, collected by A.W.B. Powell on 27 March 1949, from the west side of the railway track

between Waiotira and Tauraroa, Northland, New Zealand.

Paratypes: MA71993, 12 specimens from the type locality.

Current name: *Liarea hochstetteri alta* Powell, 1954 – Spencer *et al.* (2018).

***Liarea ornata* Powell, 1954**

Powell, A.W.B., 1954b, pp. 282, 283, pl. 48, fig. 37 (holotype).

Holotype: MA71202, collected by A.W.B. Powell and N.W. Gardner in January 1952, ‘in reserve near bridge, main highway’, 5 km (3 miles) south of Wellsford, Auckland, New Zealand.

Paratypes: MA71566, 16 specimens from the type locality.

Current name: *Liarea ornata* Powell, 1954 – Spencer *et al.* (2018).

***Liarea turriculata partula* Powell, 1954**

Powell, A.W.B., 1954b, pp. 291, 292, pl. 48, fig. 35 (holotype).

Holotype: MA71207, collected by N.W. Gardner on 28 March 1948, 2.5 km (1.5 miles) south of Pukapuka Rd, Warkworth, Auckland, New Zealand.

Paratypes: MA71496, eight specimens from the type locality.

Remarks: A hand-written scrap of paper with the paratypes has the locality as ‘1.5m Nth Pukapuka Xrds’, which suggests that the published locality of 1.5 miles south of Pukapuka Road is 5.4 km (3 miles) south of the actual locality.

Current name: *Liarea turriculata partula* Powell, 1954 – Spencer *et al.* (2018).

***Liarea turriculata waipoua* Powell, 1954**

Powell, A.W.B., 1954b, p. 291, pl. 44, fig. 3, pl. 48, fig. 36 (holotype).

Holotype: MA71206, collected by N.W. Gardner on 2 January 1950, Waipoua Forest, Northland, New Zealand.

Current name: *Liarea turriculata waipoua* Powell, 1954 – Spencer *et al.* (2018).

***Murdochia ampla* Powell, 1941**

Powell, A.W.B., 1941b, p. 260, pl. 51, fig. 10 (holotype).

Holotype: MA70497, collected by A.W.B. Powell in 1932, from 244–274 m (800–900 ft), Unuwahao, Piwhane / Spirits Bay, Northland, New Zealand.

Current name: *Cytora lignaria* (Pfeiffer, 1857) – Spencer *et al.* (2018).

***Murdochia annectens* Powell, 1948**

Powell, A.W.B., 1948, p. 274, pl. 53, fig. 3 (holotype).

Holotype: MA71046, collected live, 800 m (0.5 miles) northeast from South East landing, on underside of decaying wood in leaf mould, kanuka (*Leptospermum ericoides* [= *Kunzea triregensis*]) scrub, Manawatāwhi / Great Island, Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Cytora annectens* (Powell, 1948) – Spencer *et al.* (2018).

***Murdochia aranea* Powell, 1928**

Powell, A.W.B., 1928a, p. 365, pl. 54, fig. 1.

Holotype: MA72099, collected by W. La Roche in April 1928, from under decaying leaves in native bush, Opononi, Northland, New Zealand.

Paratypes: MA71478, six specimens from the type locality.

Current name: *Cytora aranea* (Powell, 1928) – Spencer *et al.* (2018).

***Murdochia filicosta* Powell, 1948**

Powell, A.W.B., 1948, p. 274, pl. 53, fig. 4 (holotype).

Holotype: MA71047, collected by Major G.A. Buddle in January 1948 from leaf mould, Oromaki / North East Island, Manawatāwhi / Three Kings Islands, New Zealand.

Paratypes: MA71475, 98 specimens from the type locality.

Remarks: Includes three punctid specimens.

Current name: *Cytora filicosta* (Powell, 1948) – Spencer *et al.* (2018).

***Murdochia hirsutissima* Powell, 1951**

Powell, A.W.B., 1951a, pp. 132, 133, pl. 27, fig. 6 (holotype).

Holotype: MA71170, collected by A.W.B. Powell on 6 October 1948, from the site of a *Basileostylus bollonsi* colony, in leaf mould amongst large boulders under *Streblus smithii* and *Brachyglottis arborescens*, at ca 213 m (700 ft) elevation on southwest coast Manawatāwhi / Great Island, Manawatāwhi / Three Kings Islands, New Zealand.

Paratypes: MA71489, eight specimens from the type locality.

Current name: *Cytora hirsutissima* (Powell, 1951) – Spencer *et al.* (2018).

***Murdochia solitaria* Powell, 1935**

Powell, A.W.B., 1935a, p. 244, pl. 26, figs 1, 2.

Holotype: MA70498, collected by A.W.B. Powell in February 1935, 164 m (150 yards) up the valley southwest of the provision depot, Manawatāwhi / Great Island, Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Cytora solitaria* (Powell, 1935) – Spencer *et al.* (2018).

Superfamily CERITHIOIDEA**Family CERITHIIDAE****†*Taxonia tesserata* Marwick, 1948**

Marwick, J., 1948, p. 28, pl. 7, fig. 1 (holotype).

Holotype: MA71228, collected from the late Pliocene (Waipipian) of the Kaawa Formation 25–30 m (84–98 ft) below the surface in the Waitemata Brewery well, Otahuhu, Auckland, New Zealand.

Current name: *Taxonia tesserata* Marwick, 1948 – Maxwell in: Spencer *et al.* (2009: 241).

***Zebittium editum* Powell, 1930**

Powell, A.W.B., 1930a, p. 541, pl. 61, fig. 16 (holotype).

Holotype: MA70868, dredged by J. Bollons, from 110 m (60 fathoms), off Poor Knights Islands, Northland, New Zealand.

Paratypes: MA71397, four specimens, from the type locality.

Current name: *Zebittium editum* Powell, 1930 – Spencer *et al.* (2018).

***Zebittium laevicordatum* Powell, 1937**

Powell, A.W.B., 1937, p. 204, pl. 54, fig. 3 (holotype).

Holotype: NHM 19621037

Paratypes: MA71916, two specimens collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m and off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Zebittium laevicordatum* Powell, 1937 – Spencer *et al.* (2018).

†*Zefallacia benesulcata* Powell & Bartrum, 1929

Powell, A.W.B. & J.A. Bartrum, 1929, pp. 416, 417, pl. 37, figs 29, 30 (holotype), figs 27, 28, 31 (paratypes).

Holotype: MA72173, from the early Miocene (Otaian) Tipakuri Formation of ‘Double U Bay’, approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Paratypes: MA71695, two specimens collected from the type locality.

Current name: *Zefallacia benesulcata* Powell & Bartrum, 1929 – Maxwell in: Spencer *et al.* (2009: 241).

†*Zefallacia lawsi* Marwick, 1948

Marwick, J., 1948, p. 29, pl. 7, figs 2, 3 (holotype).

Holotype: GNS TM1333

Paratypes: MA72678, two specimens collected from the type locality, from the late Pliocene (Waipipian) of the Kaawa Formation 25–30 m (84–98 ft) below the surface in the Waitemata Brewery well, Otahuhu, Auckland, New Zealand.

Current name: *Zefallacia lawsi* Marwick, 1948 – Maxwell in: Spencer *et al.* (2009: 241).

Family POTAMIDIDAE**†*Bittiscala communis* Finlay & Marwick, 1937**

Finlay, H.J. & J. Marwick, 1937, p. 45, pl. 5, fig. 9 (holotype).

Holotype: MA73341, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Paratypes: MA71539, 20 specimens, collected from the type locality.

Current name: *Bittiscala communis* Finlay & Marwick, 1937 – Maxwell in: Spencer *et al.* (2009: 241).

†*Pyrazus consobrinus* Powell & Bartrum, 1929

Powell, A.W.B. & J.A. Bartrum, 1929, pp. 417, 418, pl. 37, fig. 32 (holotype), fig. 33 (paratype).

Holotype: MA72124, from the early Miocene (Otaian)

Tipakuri Formation of ‘Double U Bay’, approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Paratypes: MA71696, two near-complete specimens and one small fragment, from the type locality.

Current name: *Terebralia consobrina* (Powell & Bartrum, 1929) – Beu (2004: 204).

†***Pyrazus waitemataensis* Powell & Bartrum, 1929**

Powell, A.W.B. & J.A. Bartrum, 1929, p. 418, pl. 37, fig. 34 (holotype).

Holotype: MA72125, from the early Miocene (Otaian) Tipakuri Formation of ‘Double U Bay’, approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Paratypes: MA71697, two specimens from the type locality.

Current name: *Terebralia waitemataensis* (Powell & Bartrum, 1929) – Beu (2004: 204).

Family SILIQUARIIDAE

***Siliquaria maoria* Powell, 1940**

Powell, A.W.B., 1940, pp. 231, 232, pl. 33, figs 3, 4, 5 (holotype).

Holotype: MA72142, collected off Manawatāwhi / Three Kings Islands, New Zealand.

Paratypes: MA73601, three specimens collected from the type locality.

Remarks: The three paratype specimens were previously included with the holotype lot, but Powell (1940) specifically mentions the figured specimen, representing the early compacted whorls, as the holotype. The additional three specimens are mentioned as part of the type description, as representative of specimens which show that ‘later the shell meanders and then straightens out’, and are therefore redesignated as paratypes.

Current name: *Tenagodus maoria* (Powell, 1940) – Spencer *et al.* (2018).

Family TURRITELLIDAE

†***Colposigma mesalia* Finlay & Marwick, 1937**

Finlay, H.J. & J. Marwick, 1937, p. 40, pl. 5, fig. 7 (holotype), fig. 8 (paratype).

Holotype: GNS TM5376

Paratypes: MA72866, two specimens collected from the Palaeocene (Teurian) Wangaloa Formation at Wangaloa, Otago, New Zealand; MA72867, two specimens, collected from the type locality, early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Current name: *Colposigma mesalia* Finlay & Marwick, 1937 – Maxwell in: Spencer *et al.* (2009: 241).

***Gazameda maoria* Powell, 1940**

Powell, A.W.B., 1940, p. 230, pl. 33, fig. 7 (holotype).

Holotype: MA72064, collected by J. Bollons from 91 m (50 fathoms), between Piwhane / Spirits Bay, Northland and Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Stiracolpus pagoda* (Reeve, 1849) – Spencer *et al.* (2018).

***Maoricolpus finlayi* Powell, 1940**

Powell, A.W.B., 1940, p. 229, pl. 33, fig. 11 (holotype).

Holotype: MA71569, collected from 59 m (32 fathoms), off Piwhane / Spirits Bay, Northland, New Zealand.

Current name: *Maoricolpus finlayi* Powell, 1940 – Spencer *et al.* (2018).

***Maoricolpus roseus manukauensis* Powell, 1931**

Powell, A.W.B., 1931a, pp. 99–101, pl. 10, fig. 9 (holotype), fig. 10 (paratype).

Holotype: MA70436, collected from mud flats between Cornwallis Wharf and Big Muddy Creek, Manukau Harbour, Auckland, New Zealand.

Current name: *Maoricolpus roseus* (Quoy & Gaimard, 1834) – Spencer *et al.* (2018).

†***Pareora incincta* Marwick, 1931**

Marwick, J., 1931, pp. 94, 95, pl. 9, fig. 155 (holotype).

Holotype: GNS TM5873

Paratypes: MA72928, five specimens, collected from the type locality, from the Miocene (Clifdenian) Ihungia Formation at ‘Muddy Creek’, near the headwaters of the Waipaoa River, East Coast, New Zealand.

Current name: *Pareora incincta* Marwick, 1931 – Maxwell in: Spencer *et al.* (2009: 241).

†***Stiracolpus kaawaensis* Laws, 1936**

Laws, C.R., 1936, pp. 108, 109, pl. 16, fig. 65 (holotype).

Holotype: MA70729, collected from the early Pliocene (Opoitian) of the Kaawa Formation at Kaawa Creek, south of Port Waikato, Waikato, New Zealand.

Paratypes: MA72698, 26 specimens, from the type locality.

Current name: *Stiracolpus kaawaensis* Laws, 1936 – Beu (2010: 93).

†***Tropicolpus (Amplicolpus) healyi* Marwick, 1971**

Marwick, J., 1971, pp. 40, 41 pl. 10, fig. 2 (holotype); pl. 4, figs 8, 9 (paratypes); pl. 5, fig. 9; pl. 9, fig. 12 (paratype).

Holotype: GNS TM4416

Paratypes: MA72890, two specimens, collected from late Oligocene (Dunroonian) Chatton Formation, Chatton, Southland, New Zealand.

Current name: *Tropicolpus (Amplicolpus) healyi* Marwick, 1971 – MolluscaBase (2020).

†***Turritella (Maoricolpus) gittosina* Powell & Bartrum, 1929**

Powell, A.W.B. & J.A. Bartrum, 1929, p. 419, pl. 36, fig. 20 (holotype).

Holotype: MA72159, from the early Miocene (Otaian) Tipakuri Formation of ‘Double U Bay’, approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Current name: *Tropicolpus gittosinus* (Powell & Bartrum, 1929) – MolluscaBase (2020).

†***Turritella (Maoricolpus) waitemataensis* Powell & Bartrum, 1929**

Powell, A.W.B. & J.A. Bartrum, 1929, pp. 419, 420, pl. 36, fig. 19 (holotype).

Holotype: MA72160, from the early Miocene (Otaian) Tipakuri Formation of 'Double U Bay', approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Paratype: MA71699, one specimen from the type locality.

Current name: *Maoricolpus waitemataensis* Powell & Bartrum, 1929 – Maxwell in: Spencer *et al.* (2009: 241).

***Turritella (Zeacolpus) ahiparana* Powell, 1927**

Powell, A.W.B., 1927c, p. 297, pl. 34, fig. 4 (holotype).

Holotype: MA72158, dredged by D. Crawford of the steam trawler *Serfib* in July 1925, from 42 m (23 fathoms), Ahipara Bay, Northland, New Zealand.

Paratypes: MA71417, 11 specimens from the type locality.

Current name: *Stiracolpus ahiparanus* (Powell, 1927) – Spencer *et al.* (2018).

***Vermicularia maoriana* Powell, 1937**

Powell, A.W.B., 1937, p. 207, pl. 55, figs 9, 10 (holotype).

Holotype: NHM 19621042

Paratypes: MA71917, seven specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand; MA72285, one specimen, collected by A.W.B. Powell on 16 August 1932 from station 929, R.R.S. Discovery II cruise, in 59 m off Piwhane / Spirits Bay, Northland, New Zealand.

Current name: Taxon inquirendum (polychaete) – MolluscaBase (2020).

†***Zeacolpus chattonensis* Marwick, 1929**

Marwick, J., 1929, pp. 916, 917, fig. 47 (paratype), fig. 49 (holotype).

Holotype: GNS TM4474

Paratypes: MA72933, five partial specimens; MA73603, two partial specimens, all collected from the type locality, the late Oligocene (Dunroonian) Chatton Formation, Chatton, Southland, New Zealand.

Current name: *Tropicolpus chattonensis* (Marwick, 1929) – Maxwell in: Spencer *et al.* (2009: 241).

†***Zeacolpus huttoni ohopeus* Marwick, 1957**

Marwick, J., 1957, p. 36, pl. 2, fig. 7 (holotype); pl. 5, fig. 8 (paratype).

Holotype: GNS TM1668

Paratype: MA72640, one specimen, collected by A.W.B. Powell in August 1933 from the late Pleistocene (Haweran) Te Piki Member, Waipaoa Formation, from a road-cutting approximately 6 km east of Whangaparaoa (Cape Runaway), East Coast, New Zealand.

Current name: *Stiracolpus huttoni* (Cossmann, 1912) – Maxwell in: Spencer *et al.* (2009: 241).

***Zeacolpus mixtus* Finlay, 1930**

Finlay, H.J., 1930b, pp. 230, 231, pl. 45, fig. 42 (holotype).

Holotype: MA70859, collected from 110 m (60 fathoms) off Poor Knights Islands, Northland, New Zealand.

Paratypes: MA72587, ten specimens from the type locality.

Current name: *Stiracolpus pagoda* (Reeve, 1849) – Spencer *et al.* (2018).

†***Zeacolpus nissenii* Marwick, 1971**

Marwick, J., 1971, pp. 25, 26, pl. 7, fig. 12 (holotype); pl. 2, fig. 12 (paratype).

Holotype: MA71312, collected by K.I. Nissen, from middle Miocene (Waiauian) Nissen Shellbeds 2–6, [Finlay's bed 8A (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Paratype: MA72942, one specimen, from the type locality.

Current name: *Zeacolpus nissenii* Marwick, 1971 – Maxwell in: Spencer *et al.* (2009: 241).

***Zeacolpus (Stiracolpus) delli* Marwick, 1957**

Marwick, J., 1957, pp. 31, 32, pl. 3, fig. 15 (holotype), fig. 14; pl. 4, fig. 12 (holotype), fig. 11.

Holotype: MONZ M.011395

Paratypes: MA71689, five specimens, collected by A.W.B. Powell, from 31 m, Anita Bay, Milford Sound, Fiordland [Southland], New Zealand.

Current name: *Stiracolpus pagoda* (Reeve, 1849) – Spencer *et al.* (2018).

†***Zeacolpus (Stiracolpus) haweraensis* Powell, 1931**

Powell, A.W.B., 1931a, p. 101, pl. 10, fig. 7 (holotype).

Holotype: MA70858, collected by A.W.B. Powell in January 1931 from from late Pliocene (Waipipian) Tangahoe Formation, on the coast near the mouth of Waihi Stream, Hawera, Taranaki, New Zealand.

Paratypes: MA43840, three specimens; MA71674, five fragments, all from the type locality.

Current name: *Stiracolpus huttoni* (Cossmann, 1912) – Beu & Raine (2009).

***Zeacolpus (Stiracolpus) pagoda powelli* Marwick, 1957**

Marwick, J., 1957, pp. 41, 42, pl. 2, fig. 2 (holotype), pl. 5, fig. 3 (holotype).

Holotype: MA71276, collected from 46 m (25 fathoms), off Hen and Chickens Islands, Northland, New Zealand.

Paratypes: MA72636, 34 specimens from the type locality.

Current name: *Stiracolpus pagoda* (Reeve, 1849) – Spencer *et al.* (2018).

Order LITTORINIMORPHA

Family CALYPTRAEIDAE

†***Maoricrypta salebrosa* Marwick, 1929**

Marwick, J., 1929, p. 918, figs 50, 51 (holotype).

Holotype: MONZ M.001632

Paratype: MA72934, one specimen, collected from the type locality, late Oligocene (Dunroonian) Chatton Formation, Shell Gully, Chatton, Southland, New Zealand.

Current name: *Grandicrepidula salebrosa* (Marwick, 1929) – Maxwell in: Spencer *et al.* (2009: 243).

***Maoricrypta youngi* Powell, 1940**

Powell, A.W.B., 1940, pp. 232, 233, pl. 33, fig. 12 (holotype), fig. 13 (paratype).

Holotype: MA70437, collected by F. Young from beach drift, Cape Maria van Diemen, Northland, New Zealand.

Paratype: MA71570, one specimen from the type locality.

Current name: *Maoricrypta youngi* Powell, 1940 – Spencer *et al.* (2018).

†*Sigapatella patulosa* Powell & Bartrum, 1929

Powell, A.W.B. & J.A. Bartrum, 1929, p. 422, pl. 40, fig. 43 (holotype).

Holotype: MA72141, from the early Miocene (Otaian) Tipakuri Formation of ‘Double U Bay’, approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Current name: *Sigapatella patulosa* Powell & Bartrum, 1929 – Maxwell in: Spencer *et al.* (2009: 243).

†*Spirogalerus lamellaria* Finlay & Marwick, 1937

Finlay, H.J. & J. Marwick, 1937, p. 46, pl. 7, figs 1–4 (holotype).

Holotype: MA70721, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Paratypes: MA72860, four specimens from the type locality.

Current name: *Sigapatella lamellaria* (Finlay & Marwick, 1937) – Maxwell in: Spencer *et al.* (2009: 243).

***Trochita georgiana* Powell, 1951**

Powell, A.W.B., 1951b, pp. 127, 128, pl. 7, fig. 22 (holotype).

Holotype: NHM 1961469

Paratypes: MA71933, four specimens, collected from the type locality, on 7 February 1927, station 160, Discovery Investigations, in 127 m near Shag Rocks, west of South Georgia, British Overseas Territory.

Current name: *Trochita pileolus* (d’Orbigny, 1841) – MolluscaBase (2020).

†*Zegalerus peramplus* Powell & Bartrum, 1929

Powell, A.W.B. & J.A. Bartrum, 1929, p. 422, pl. 40, fig. 45 (holotype).

Holotype: MA72174, from the early Miocene (Otaian) Tipakuri Formation of ‘Double U Bay’, approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Current name: *Sigapatella perampla* (Powell & Bartrum, 1929) – Maxwell in: Spencer *et al.* (2009: 243).

***Zegalerus tumens* Finlay, 1930**

Finlay, H.J., 1930b, p. 231, not figured.

Holotype: MA70871, collected from Cape Maria van Diemen, Northland, New Zealand.

Current name: *Sigapatella terraenovae* Peile, 1924 – Powell (1979:149); MolluscaBase (2020).

Family CAPULIDAE**†*Trichosirius finlayi* Laws, 1935**

Laws, C.R., 1935c, p. 34, pl. 5, fig. 9 (holotype), fig. 31.

Holotype: MA70771, collected from the middle to late Oligocene (Waitakian) of Otiake, Waitaki Valley, Otago, New Zealand.

Current name: *Trichosirius (Miplioderma) finlayi* Laws, 1935 – Maxwell in: Spencer *et al.* (2009: 243).

***Trichosirius inornatus chathamensis* Finlay, 1928**

Finlay, H.J., 1928, pp. 244, 245, pl. 41, fig. 40 (holotype).

Holotype: MA70772, presumed to have been collected in early 1924 by a member of the Otago Institute Expedition, Chatham Islands, New Zealand.

Paratypes: MA72553, five specimens from the type locality.

Current name: *Trichosirius inornatus* (Hutton, 1873) – Powell (1979: 147); MolluscaBase (2020).

Family CINGULOPSIDAE***Dardanula minutula* Powell, 1937**

Powell, A.W.B., 1937, p. 204, pl. 53, fig. 14 (holotype).

Holotype: NHM 19621035

Paratypes: MA72274, five specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Tubbreva minutula* (Powell, 1937) – Spencer *et al.* (2018).

***Eatonina (Saginofusca) maculosa* Ponder, 1965**

Ponder, W.F., 1965b, p. 123, pl. 15, fig. 13 (holotype), figs 14, 15.

Holotype: MA71267, collected by W.F. Ponder on 4 April 1964 from the underside of masses of the vermetid *Novastoa lamellosa* (Hutton, 1873), Poor Knights Islands, Northland, New Zealand.

Paratypes: MA72816, 43 specimens from the type locality.

Current name: *Eatonina maculosa* Ponder, 1965 – Spencer *et al.* (2018).

***Estea crassicarinata* Powell, 1937**

Powell, A.W.B., 1937, pp. 196, 197, pl. 53, fig. 4 (holotype).

Holotype: NHM 19621012

Paratypes: MA72244, four specimens; MA72323, two specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Eatonina (Captitonia) crassicarinata* (Powell, 1937) – Ponder & Yoo (1981: 27); Spencer *et al.* (2018).

***Notosetia atomaria* Powell, 1933**

Powell, A.W.B., 1933a, pp. 198, 199, pl. 34, fig. 9 (holotype).

Holotype: MA70536, collected by A.W.B. Powell in

February 1933, from shell sand, Waitangi, Chatham Islands, New Zealand.

Paratypes: MA71533, four specimens from the type locality.

Current name: *Eatonina atomaria* (Powell, 1933) – Spencer *et al.* (2018).

***Notosetia exaltata* Powell, 1933**

Powell, A.W.B., 1933a, p. 199, pl. 34, fig. 6 (holotype).

Holotype: MA70538, collected by A.W.B. Powell and/or C.A. Fleming in February 1933, from 18 m (10 fathoms) off Owenga Beach, Chatham Islands, New Zealand.

Paratypes: MA71534, 46 specimens from the type locality.

Current name: *Tubbreva exaltata exaltata* (Powell, 1933) – Spencer *et al.* (2018).

***Notosetia sorenseni* Powell, 1955**

Powell, A.W.B., 1955, p. 87, pl. 3, fig. 20.

Holotype: MA71220, collected by J.H. Sorensen in 1943, during the ‘Cape Expedition’, Campbell Island / Motu Ihupuku, New Zealand.

Paratypes: MA72431, 24 specimens from the type locality.

Current name: *Tubbreva exaltata sorenseni* (Powell, 1955) – Spencer *et al.* (2018).

***Rissoia micans* Webster, 1905**

Webster, W.H., 1905, p. 277, fig. 4.

Holotype: MA70669, collected from Takapuna Beach, Auckland, New Zealand.

Paratypes: MA72887, 32 specimens from the type locality.

Current name: *Eatonina micans* (Webster, 1905) – Spencer *et al.* (2018).

***Rufodardanula (Rufodardanula) spadix* Ponder, 1965**

Ponder, W.F., 1965b, pp. 124, 125 pl. 16, fig. 1 (holotype), figs 2–4.

Holotype: MA71268*, collected by W.F. Ponder on 1 January 1964, from *Corallina*, Te Hāwera-a-Maki / Goat Island Bay, Leigh, Auckland, New Zealand.

Paratypes: MA72836, three specimens from the type locality.

Remarks: The holotype specimen has not been found since 1996.

Current name: *Skenella (Rufodardanula) spadix* (Ponder, 1965) – Spencer *et al.* (2018).

***Rufodardanula (Tubbreva) exigua* Ponder, 1965**

Ponder, W.F., 1965b, pp. 125, 126, pl. 16, fig. 5 (holotype), fig. 6.

Holotype: MA71269, collected by W.R.B. Oliver on 4 September 1910 from fine brown seaweed in rock pools between tides, east of Purau, Lyttelton Harbour, Canterbury, New Zealand.

Paratypes: MA72837, 83 specimens from the type locality.

Current name: *Tubbreva exigua* (Ponder, 1965) – Spencer *et al.* (2018).

Family EATONIELLIDAE

***Crassitoniella carinata* Ponder, 1965**

Ponder, W.F., 1965a, pp. 93, 94, pl. 10, fig. 2 (holotype), figs 3–5.

Holotype: MA71264, collected by K. Hipkins in April 1951, from shell sand, Piwhane / Spirits Bay, Northland, New Zealand.

Paratype: MA72829, one specimen from the type locality.

Current name: *Crassitoniella carinata* Ponder, 1965 – Spencer *et al.* (2018).

***Dardanula bollonsi* Powell, 1955**

Powell, A.W.B., 1955, p. 88, pl. 3, fig. 25 (holotype).

Holotype: MA71222, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Paratypes: MA71609, 40 specimens from the type locality.

Current name: *Eatoniella verecunda* (Suter, 1908) – Ponder (1967: 91); Spencer *et al.* (2018).

***Dardanula obtusispira* Powell, 1955**

Powell, A.W.B., 1955, pp. 88, 89, pl. 3, fig. 23 (holotype).

Holotype: MA71224, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Paratype: MA71987, one specimen, from the type locality.

Current name: *Eatoniella obtusispira* (Powell, 1955) – Spencer *et al.* (2018).

***Dardanula pallida* Powell, 1937**

Powell, A.W.B., 1937, p. 203, pl. 53, fig. 16 (holotype).

Holotype: NHM 19621034

Paratypes: MA72260, two specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Remarks: One specimen badly affected by glass disease.

Current name: *Eatoniella pallida* (Powell, 1937) – Spencer *et al.* (2018).

†*Dardanula rivertonensis* Finlay, 1924

Finlay, H.J., 1924b, p. 491, fig. 13.

Holotype: MA70239, collected from the early Miocene (Altonian) at ‘Pourakino’, north west of present-day Riverton, Southland, New Zealand.

Paratypes: MA72501, 52 specimens from the type locality.

Current name: *Eatoniella rivertonensis* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 241).

***Dardanula roseola lacteola* Powell, 1955**

Powell, A.W.B., 1955, p. 88, pl. 3, fig. 24 (holotype).

Holotype: MA71221, collected from 174 m, 22.5 km (14 miles) north, Auckland Islands, New Zealand.

Paratypes: MA71610, six specimens; MA73212, eight specimens, from the type locality.

Current name: *Eatoniella roseola* (Iredale, 1915) – Powell (1979: 93); Spencer *et al.* (2018).

***Dardanula roseospira* Powell, 1937**

Powell, A.W.B., 1937, p. 203, pl. 53, fig. 13 (holotype).

Holotype: NHM 19621032

Paratypes: MA72259, three specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 934, R.R.S. Discovery II cruise, in 92 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Eatoniella roseospira* (Powell, 1937) – Spencer *et al.* (2018).

***Dardanula tenella* Powell, 1937**

Powell, A.W.B., 1937, p. 203, pl. 53, fig. 15 (holotype).

Holotype: NHM 19621033

Paratypes: MA72258, three specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 934, R.R.S. Discovery II cruise, in 92 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Eatoniella tenella* (Powell, 1937) – Spencer *et al.* (2018).

***Eatoniella (Abscindostoma) albocolumella* Ponder, 1965**

Ponder, W.F., 1965a, pp. 58, 59, pl. 9, fig. 15 (holotype), figs 16–18.

Holotype: MA71246, collected by W.J. Ballantine, on 16 February 1964, on coralline algae at Cape Campbell, Marlborough, New Zealand.

Paratypes: MA72810, 46 specimens, from the type locality.

Current name: *Eatoniella albocolumella* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Albitoniella) thola* Ponder, 1965**

Ponder, W.F., 1965a, pp. 60, 61, pl. 6, fig. 19 (holotype).

Holotype: NIWA 7407 (NZOI type registration H-21).

Paratypes: MA72811, seven specimens, collected by staff of the New Zealand Oceanographic Institute from the type locality, N.Z.O.I. Station C.760, on 18 February 1962, in 80 m (44 fathoms) off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Crassitoniella thola* (Ponder, 1965) – Spencer *et al.* (2018).

***Eatoniella (Albosabula) rakiura* Ponder, 1965**

Ponder, W.F., 1965a, p. 63, pl. 10, fig. 10 (holotype).

Holotype: MA71247, collected by on 4 November, 1956, from 46 m (25 fathoms), on bryozoans, Ruggedy, Stewart Island / Rakiura, New Zealand.

Paratypes: MA72812, 55 specimens, from the type locality.

Current name: *Eatoniella (Albosabula) rakiura* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Caveatoniella) perforata* Ponder, 1965**

Ponder, W.F., 1965a, pp. 64, 65, pl. 10, fig. 19 (holotype).

Holotype: MA71249, collected by W. La Roche, from 22 m (12 fathoms), Doubtless Bay, Northland, New Zealand.

Paratypes: MA72814, seven specimens, from the type locality.

Current name: *Eatoniella (Caveatoniella) perforata* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Caveatoniella) puniceomacer* Ponder, 1965**

Ponder, W.F., 1965a, pp. 63, 64, pl. 10, fig. 16 (holotype), figs 17, 18.

Holotype: MA71248*, collected from Tryphena Bay, Aotea/Great Barrier Island, Auckland, New Zealand.

Paratypes: MA72813, 100 specimens, from the type locality.

Remarks: The holotype specimen has not been found since 1996.

Current name: *Eatoniella (Caveatoniella) puniceomacer* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Cerostraca) bathamae* Ponder, 1965**

Ponder, W.F., 1965a, pp. 65, 66, pl. 9, fig. 9 (holotype), 10.

Holotype: MA71250, collected by W.F. Ponder, on gelatinous red algae, on 5 September 1963, from Little Papanui Beach, Dunedin, Otago, New Zealand.

Paratypes: MA72808, 22 specimens, from the type locality.

Current name: *Eatoniella bathamae* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Cerostraca) delli* Ponder, 1965**

Ponder, W.F., 1965a, pp. 66, 67, pl. 9, fig. 2 (holotype), figs 3–6.

Holotype: MA71251, collected by W.F. Ponder, on *Corallina* sp., on 21 August 1963, Bream Tail, Auckland, New Zealand.

Paratypes: MA72815, 20 specimens, from the type locality.

Current name: *Eatoniella delli* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Cerostraca) maculosa* Ponder, 1965**

Ponder, W.F., 1965a, pp. 68, 69, pl. 9, fig. 7 (holotype).

Holotype: MA71252, collected by W.F. Ponder, on various algae, on 22 May 1963, McGregors Bay, Whangarei Heads, Northland, New Zealand.

Paratypes: MA72828, 11 specimens, from the type locality.

Current name: *Eatoniella notata* Ponder & Yoo, 1978 – Spencer *et al.* (2018).

***Eatoniella (Dardaniopsis?) atervisceralis* Ponder, 1965**

Ponder, W.F., 1965a, pp. 74, 75, pl. 8 fig. 12 (holotype), fig. 13 (paratype), figs 14, 15.

Holotype: MA71257, collected by E.C. Smith in October 1951, in coralline algae at low tide, Lonneker's Bay, Stewart Island / Rakiura, New Zealand.

Paratypes: MA72822, 108 specimens, from the type locality.

Current name: *Eatoniella atervisceralis* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Dardaniopsis) globosa* Ponder, 1965**

Ponder, W.F., 1965a, p. 71, pl. 8, fig. 8 (holotype).

Holotype: MA71254, collected by K. Hipkins in 1949, Piwhane / Spirits Bay, Northland, New Zealand.

Paratypes: MA72827, three specimens, from the type locality.

Current name: *Eatoniella globosa* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Dardaniopsis) notalabia* Ponder, 1965**

Ponder, W.F., 1965a, pp. 70, 71, pl. 8, fig. 1 (holotype), figs 2–4.

Holotype: MA71253, collected by W.F. Ponder on 1 January 1964, on *Carpophyllum plumosum*, Te Hāwera-a-Maki / Goat Island Bay, Leigh, Auckland, New Zealand.

Paratypes: MA72817, eight specimens from the type locality.

Current name: *Eatoniella notalabia* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Dardaniopsis) pullmitra* Ponder, 1965**

Ponder, W.F., 1965a, pp. 72, 73, pl. 8, fig. 9 (holotype), figs 10, 11.

Holotype: MA71255, collected by W.F. Ponder on 4 September 1964, on soft brown algae, shipping channel side of Quarantine Island, Otago Harbour, Dunedin, Otago, New Zealand.

Paratypes: MA72820, 21 specimens, from the type locality.

Current name: *Eatoniella pullmitra* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Dardaniopsis) varicolor* Ponder, 1965**

Ponder, W.F., 1965a, pp. 73, 74, pl. 8, fig. 5 (holotype), figs 6, 7.

Holotype: MA71256, collected by W. F. Ponder on 27 March 1963, on *Carpophyllum plumosum* in rock pools, Narrow Neck Reef, Auckland, New Zealand.

Paratypes: MA72821, 64 specimens from the type locality.

Current name: *Eatoniella varicolor* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Dardanula) fossa* Ponder, 1965**

Ponder, W.F., 1965a, pp. 79, 80, pl. 7, fig. 21 (holotype).

Holotype: MA71258, collected from 40 m (22 fathoms), 600 m (0.5 miles) to the west of Stephenson's Island, Whangaroa Bay, Northland, New Zealand.

Paratypes: MA72823, five specimens from the type locality.

Current name: *Eatoniella fossa* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Dardanula) fuscobucula* Ponder, 1965**

Ponder, W.F., 1965a, p. 80, pl. 7, fig. 10 (holotype), figs 11, 12.

Holotype: MA71259, collected by E.C. Smith in January 1950, Thule Bay, Paterson Inlet, Stewart Island / Rakiura, New Zealand.

Paratypes: MA72824, 40 specimens from the type locality.

Current name: *Eatoniella fuscobucula* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Dardanula) latebricola* Ponder, 1965**

Ponder, W.F., 1965a, pp. 81, 82, pl. 7, fig. 3 (holotype), figs 4–6.

Holotype: MA71260, collected by W.F. Ponder on 19 August 1963, from under *Durvillea* [sic = now

Durvillea] holdfasts, south end of Muriwai, west Auckland, New Zealand.

Paratypes: MA72825, 26 specimens from the type locality.

Current name: *Eatoniella latebricola* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Dardanula) minutocrassa* Ponder, 1965**

Ponder, W.F., 1965a, pp. 84, 85, pl. 6, fig. 13 (holotype), figs 14, 15.

Holotype: MA71261*, collected by W.F. Ponder on 1 January 1964, in *Corallina*, Te Hāwera-a-Maki / Goat Island Bay, Leigh, Auckland, New Zealand.

Paratypes: MA72826, 18 specimens from the type locality.

Remarks: The holotype specimen has not been found since 1996.

Current name: *Eatoniella atropurpurea* (Frauenfeld, 1867) – Spencer *et al.* (2018).

***Eatoniella (Dardanula) mortoni* Ponder, 1965**

Ponder, W.F., 1965a, pp. 85, 86, pl. 7, fig. 16 (holotype), figs 17–20.

Holotype: MA71262, collected by W.F. Ponder on 11 December 1961, south side of Days Bay, Wellington, New Zealand.

Paratypes: MA72830, 46 specimens, from the type locality.

Current name: *Eatoniella mortoni* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Dardanula) smithae* Ponder, 1965**

Ponder, W.F., 1965a, pp. 90, 91, pl. 5, fig. 8 (holotype), fig. 9.

Holotype: MA71263, collected by E.C. Smith in September 1947, from Halfmoon Bay, Stewart Island / Rakiura, New Zealand.

Paratypes: MA72831, 49 specimens, from the type locality.

Current name: *Eatoniella smithae* Ponder, 1965 – Spencer *et al.* (2018).

***Eatoniella (Eatoniella) stewartiana* Ponder, 1965**

Ponder, W.F., 1965a, p. 55, pl. 4, fig. 9 (holotype), fig. 10.

Holotype: MA71272, collected by E.C. Smith in September 1962, from *Bostrychia* near high tide, Ocean Beach, Stewart Island / Rakiura, New Zealand.

Paratypes: MA72809, 50 specimens, from the type locality.

Current name: *Eatoniella stewartiana* Ponder, 1965 – Spencer *et al.* (2018).

***Estea gracilispira* Powell, 1933**

Powell, A.W.B., 1933a, p. 201, pl. 34, fig. 4 (holotype).

Holotype: MA70276, collected by A.W.B. Powell and/or C.A. Fleming in February 1933, from 18 m (10 fathoms) off Owenga Beach, Chatham Islands, New Zealand.

Paratypes: MA73214, four specimens, from the type locality.

Current name: *Pupatonia gracilispira* (Powell, 1933) – Spencer *et al.* (2018).

***Estea minutula* Powell, 1933**

Powell, A.W.B., 1933b, pp. 37, 38, pl. 6, fig. 6 (holotype).

Holotype: CM M5315

Paratypes: MA72373, two specimens, collected from the type locality by J. Fairchild on 1 June 1893, from 311 m (170 fathoms), Bounty Islands, New Zealand.

Current name: *Pupatonia minutula* (Powell, 1933) – Spencer *et al.* (2018).

***Liratoriella bicarinata* Ponder, 1965**

Ponder, W.F., 1965a, pp. 94, 95, pl. 11, fig. 1 (holotype), figs 2, 3.

Holotype: NIWA 225.

Paratypes: MA72832, two specimens, collected by staff of the New Zealand Oceanographic Institute from the type locality, N.Z.O.I. Station C.760, on 18 February 1962, from bryozoan substrate in 80 m (44 fathoms), off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Liratoriella bicarinata* Ponder, 1965 – Spencer *et al.* (2018).

***Notosetia dilatata* Powell, 1955**

Powell, A.W.B., 1955, pp. 86, 87, pl. 3, fig. 21 (holotype).

Holotype: MA71219, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Paratypes: MA71608, 13 specimens, from the type locality.

Current name: *Eatoniella dilatata* (Powell, 1955) – Spencer *et al.* (2018).

***Pupatonia atoma* Ponder, 1965**

Ponder, W.F., 1965a, p. 96, pl. 10, fig. 15 (holotype).

Holotype: NIWA 316.

Paratypes: MA72833, two specimens, collected by staff of the New Zealand Oceanographic Institute from the type locality, N.Z.O.I. Station A.739, on 9 November 1962, from Bounty Islands, New Zealand.

Current name: *Pupatonia atoma* Ponder, 1965 – Spencer *et al.* (2018).

***Rissoa (Cingula) lampra* Suter, 1908**

Suter, H., 1908, p. 29, pl. 2, fig. 25.

Lectotype: GNS TM700

Paralectotype: MA72786, one specimen, collected by M. Mestayer, from the type locality, Titahi Bay, Wellington, New Zealand.

Remarks: Lectotypification of this species is unclear. Suter (1913: 209) stated ‘*Type* in my collection.’ Powell (1931: 198) wrote that ‘[the] holotype is a larger shell, but it is slightly abnormal in coiling.’ He also referred to paratypes. However, Boreham (1959: 35) listed ‘Lectotype (TM 700) and 3 paralectotypes (TM 701–703)’. She then wrote ‘Suter’s measured and figured *type* [my italics] is slightly abnormal in coiling.’ As both Powell and Boreham specifically mention the slight abnormality of the type it suggests strongly that they are referring to the same specimen, which in Powell’s estimation was the same as Suter’s holotype.

Current name: *Eatoniella (Albosabula) lampra* (Suter, 1908) – Ponder (1965a: 61); Spencer *et al.* (2018).

***Rissoa (Cingula) roseocincta* Suter, 1908**

Suter, H., 1908, pp. 29, 30, pl. 2, fig. 26.

Lectotypification in Boreham, A., 1959, p.37.

Lectotype: GNS TM7543

Paralectotypes: MA72792, two specimens, collected by M. Mestayer, from the type locality, Titahi Bay, Wellington, New Zealand.

Current name: *Eatoniella roseocincta* (Suter, 1908) – (Ponder (1965a: 87); Spencer *et al.* (2018)).

***Rissoa (Setia) verecunda* Suter, 1908**

Suter, H., 1908, p. 30, pl. 2, fig. 28;

Lectotypification in Powell, A.W.B., 1933a, p. 198, pl. 34, fig. 11 (lectotype).

Lectotype: GNS TM739

Paralectotype: MA72780, collected from the type locality, 91 m (50 fathoms) off Snares Islands / Tini Heke Islands, New Zealand.

Current name: *Eatoniella verecunda* (Suter, 1908) – Ponder (1965a: 91); Spencer *et al.* (2018).

***Zeradina poutama* E.C. Smith, 1962**

Smith, E.C., 1962, p. 62, fig. 4 (holotype).

Holotype: MONZ M.020249

Paratypes: MA72959, two specimens from the type locality, collected by W. Hopkins in May 1955, from bryozoan shell sand, in 55 m (30 fathoms), off Poutama Island, west of South West Cape / Puhuiwaero, Stewart Island / Rakiura, New Zealand.

Current name: *Eatoniella (Albosabula) poutama* (E.C. Smith, 1962) – (Ponder (1965a: 62); Spencer *et al.* (2018)).

Family RASTODENTIDAE***Estea crassicordata* Powell, 1937**

Powell, A.W.B., 1937, p. 197, pl. 53, fig. 17 (holotype).

Holotype: NHM 19621015

Paratypes: MA72245, six specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Tridentifera crassicordata* (Powell, 1937) – Spencer *et al.* (2018).

***Rastodens pseudomarginata* Ponder, 1966**

Ponder, W.F., 1966a, pp. 180, 181 pl. 1, fig. 5 (holotype), figs 6–8.

Holotype: MA71275, collected by W. Hopkins in May 1955, from bryozoan shell sand, from 55 m (30 fathoms), off Poutama Island, west of South West Cape / Puhuiwaero, Stewart Island / Rakiura, New Zealand.

Paratypes: MA72842, 212 specimens, from the type locality.

Current name: *Rastodens pseudomarginata* Ponder, 1966 – Spencer *et al.* (2018).

***Rastodens puerilis* Ponder, 1966**

Ponder, W.F., 1966a, pp. 179, 180, pl. 1, fig. 1 (holotype), figs 2–4.

Holotype: MA71274, collected by W.F. Ponder on 15 May 1963, from 14 m (8 fathoms), off Emu Rock, Motuihe Channel, Hauraki Gulf, Auckland, New Zealand.
Paratypes: MA72841, 47 specimens, from the type locality.

Current name: *Rastodens puerilis* Ponder, 1966 – Spencer *et al.* (2018).

***Tridentifera roseoculma* Ponder, 1966**

Ponder, W.F., 1966a, p. 183, pl. 1, fig. 10 (holotype).

Holotype: NIWA 457.

Paratype: MA72843, one specimen, collected by staff of the New Zealand Oceanographic Institute from the type locality, N.Z.O.I. Station C.760, on 18 February 1962, in 80 m (44 fathoms) off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Tridentifera roseoculma* Ponder, 1966 – Spencer *et al.* (2018).

Family CYPRAEIDAE

†***Bernaya chathamensis* Cernohorsky, 1971**

Cernohorsky, W.O., 1971a, pp. 117, 118, fig. 13 (holotype).

Holotype: MA71325, collected by A. Watherspoon [Wotherspoon], from Palaeocene (Teurian) Red Bluff Tuff, Flower Pot Harbour, Pitt Island, Chatham Islands, New Zealand.

Current name: *Zoila chathamensis* (Cernohorsky, 1971) – Darragh (2011: 5).

***Cypraea mauiensis* Burgess, 1967**

Burgess, C.M., 1967, pp. 6–8, pl. 2 (holotype).

Holotype: B.M. 8916

Paratype: MA71590, one specimen, collected by C.M. Burgess in September 1963 from the type locality, a shallow reef, Olowalu, Maui, Hawaii, United States of America.

Remarks: Paratypes were deposited at a wide range of institutions, including AM (Burgess, 1967: 8).

Current name: *Pustularia mauiensis* (Burgess, 1967) – MolluscaBase (2020).

†***Notoluponia (Notadusta) clifdenensis***

Cernohorsky, 1971

Cernohorsky, W.O., 1971a, p. 123, fig. 17 (holotype), fig. 18 (paratype).

Holotype: MA71324, from early Miocene (Altonian) Long Beach Shellbed, [Finlay's bed 6B (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Paratype: MA71593, one specimen, from the type locality.

Current name: *Notadusta clifdenensis* (Cernohorsky, 1971) – Beu & Raine (2009); MolluscaBase (2020).

Family ERATOIDAE

†***Erato accola* Laws, 1935**

Laws, C.R., 1935a, pp. 18, 19, pl. 1, fig. 1 (holotype).

Holotype: MA70268, assumed to have been collected by C.R. Laws, from middle Eocene (Bortonian) Waihao Greensand at McCulloch's Bridge, Waihao, Canterbury,

New Zealand.

Current name: *Archierato accola* (Laws, 1935) – Maxwell in: Spencer *et al.* (2009: 243).

†***Erato clifdenensis* Laws, 1935**

Laws, C.R., 1935a, p. 20, pl. 1, fig. 3 (holotype).

Holotype: MA70269, collected from middle Miocene (Lillburnian) Lill Sand, [Finlay's bed 7A (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Current name: *Erato clifdenensis* Laws, 1935 – Maxwell in: Spencer *et al.* (2009: 243).

†***Erato pukeuriensis* Laws, 1935**

Laws, C.R., 1935a, p. 21, pl. 1, fig. 6 (holotype).

Holotype: MA70270, assumed to have been collected by C.R. Laws, from early Miocene (Altonian) Mount Harris Formation at Pukeuri (near Oamaru), Otago, New Zealand.

Current name: *Bellerato pukeuriensis* (Laws, 1935) – Maxwell in: Spencer *et al.* (2009: 243).

†***Erato sepositum* Laws, 1935**

Laws, C.R., 1935a, p. 22, pl. 1, fig. 8 (holotype).

Holotype: MA70271, assumed to have been collected by C.R. Laws, from middle Eocene (Bortonian) Waihao Greensand at McCulloch's Bridge, Waihao, Canterbury, New Zealand.

Current name: *Bellerato sepositum* (Laws, 1935) – Maxwell in: Spencer *et al.* (2009: 243).

†***Erato submorosa* Laws, 1935**

Laws, C.R., 1935a, p. 20, pl. 1, fig. 4 (holotype).

Holotype: MA70272, assumed to have been collected by C.R. Laws, from early Miocene (Altonian) Mount Harris Formation at Pukeuri (near Oamaru), Otago, New Zealand.

Paratypes: MA72668, two specimens from the type locality.

Remarks: The holotype specimen has partially disintegrated.

Current name: *Erato submorosa* Laws, 1935 – Maxwell in: Spencer *et al.* (2009: 243).

†***Erato tenuilabrum* Laws, 1935**

Laws, C.R., 1935a, p. 21, pl. 1, fig. 5 (holotype).

Holotype: MA70273, assumed to have been collected by C.R. Laws, from middle Miocene (Clifdenian) Slip Point Sandstone, [Finlay's bed 6C (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Paratypes: MA72669, nine specimens, from the type locality.

Current name: *Bellerato tenuilabrum* (Laws, 1935) – Maxwell in: Spencer *et al.* (2009: 243).

†***Erato waiiauensis* Laws, 1935**

Laws, C.R., 1935a, p. 22, pl. 1, fig. 7 (holotype).

Holotype: MA70274, assumed to have been collected by C.R. Laws, from middle Miocene (Clifdenian) Slip Point Sandstone, [Finlay's bed 6C (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Current name: *Proterato waiiauensis* (Laws, 1935) – Maxwell in: Spencer *et al.* (2009: 243).

†*Erato waitakiensis* Laws, 1935

Laws, C.R., 1935a, p. 20, pl. 1, fig. 2.

Holotype: MA70275, assumed to have been collected by C.R. Laws, collected from the middle to late Oligocene (Waitakian) of Otiake, Waitaki Valley, Otago, New Zealand.

Current name: *Erato waitakiensis* Laws, 1935 – Maxwell in: Spencer *et al.* (2009: 243).

Family OVULIDAE

Pedicularia maoria Powell, 1937

Powell, A.W.B., 1937, p. 208, pl. 54, figs 13, 14 (holotype).

Holotype: NHM 19621045

Paratypes: MA71918, three specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Pedicularia pacifica*, Pease, 1865 – Powell (1979: 153); Spencer *et al.* (2018).

Primovula eilatensis Cernohorsky, 1972

Cernohorsky, W.O. 1972, pp. 202, 203, fig. 14 (holotype), fig. 15 (paratype).

Holotype: MA71340, collected by L. Fishelson, from 15 m, Eilat, Gulf of Aqaba, Israel.

Remarks: According to Cernohorsky (1972: 202) the holotype (TAU NS-8899) and a juvenile paratype were kept at the Department of Zoology, University of Tel Aviv, Israel. As reported by Cernohorsky (1972), a second paratype was lodged with Auckland Museum, but none has been located at AM. However, the original labels with MA71340, the measurements of length 11.2 mm and width 3.3 mm and a comparison with fig. 14 (holotype) and fig. 15 (paratype) (Cernohorsky, 1972: 203) indicate that this is the holotype specimen, which may have been lodged with AM in error, instead of the larger of the two paratypes.

Current name: *Primovula eilatensis* Cernohorsky, 1972 – not verified.

†*Willungia maoria* Powell, 1938

Powell, A.W.B., 1938a, pp. 371, 372, pl. 39, fig. 8 (holotype), fig. 9.

Holotype: MA70849, from early Miocene (Altonian) Fouraye Siltstone, [Finlay's bed 4B (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Current name: *Willungia maoria* Powell, 1938 – Beu & Raine (2009).

†*Willungia tasmanica* Powell, 1938

Powell, A.W.B., 1938a, pp. 370, 371, pl. 39, fig. 4 (holotype).

Holotype: MA70850, collected from early Miocene (Longfordian) Fossil Bluff Sandstone at Fossil Bluff near Wynyard, Tasmania, Australia.

Paratype: MA73023, one specimen, from the type locality.

Current name: *Willungia tasmanica* Powell, 1938 – MolluscaBase (2020).

Family TRIVIIDAE

Triviella memorata Finlay, 1926

Finlay, H.J., 1926b, p. 396, pl. 21, fig. 73 (holotype).

Holotype: MA70775, collected from Ahipara Bay, Northland, New Zealand.

Paratypes: MA72529, five specimens from the type locality.

Current name: *Ellatrivia merces* (Iredale, 1924) – Powell (1979: 152); Spencer *et al.* (2018).

Family VELUTINIDAE

Lamellaria koto Schwengel, 1944

Schwengel, J.S., 1944, pp. 17, 18, pl. 1, figs 3–6, 6a.

Syntypes: AMNH 275633 (2 specimens).

Syntype: MA73234, one specimen, collected by A. Koto between January 11th and February 23rd 1944, from eel grass Bradenton Beach, Florida, United States of America.

Current name: *Lamellaria koto* Schwengel, 1944 – MolluscaBase (2020).

Mysticoncha harrisonae Powell, 1946

Powell, A.W.B., 1946, p. 144, pl. 11, fig. 6 (holotype).

Holotype: MA72188, collected by R.H. Harrison, Lowrys Beach, The Neck, Stewart Island / Rakiura, New Zealand.

Current name: *Mysticoncha harrisonae* Powell, 1946 – Spencer *et al.* (2018).

Family ANNULARIIDAE

Tudora (Aguayotudora) varicosa de la Torre & Bartsch, 1941

Torre, de la, C. & P. Bartsch, 1941, p. 274, pl. 27, fig. 8.

Holotype: USNM 493482

Paratypes: MA72736, two specimens, collected by M.L. Jaume, from the type locality, Sierra del Cachimbo, east of Sierra de Najasa, Camagüey Province, Cuba.

Current name: *Aguayotudora varicosa* de la Torre & Bartsch, 1941 – not verified.

Opisthosiphon (Bermudezsiphona) obtectum seibaboense de la Torre & Bartsch, 1941

Torre, de la, C. & P. Bartsch, 1941, pp. 178, 179, pl. 13, fig. 4.

Holotype: USNM 535452

Paratypes: MA72739, three specimens, collected by P.J. Bermudez, from Seibabo, Yaguajay, Santa Clara Province, Cuba.

Current name: *Opisthosiphon obtectum seibaboense* de la Torre & Bartsch, 1941 – not verified.

Adamsiella (Cubadamsiella) gratiosa de la Torre & Bartsch, 1941

Torre, de la, C. & P. Bartsch, 1941, pp. 241, 242, pl. 21, fig. 4.

Holotype: USNM 535339

Paratypes: MA72737, two specimens, collected by M.L. Jaume, from Yaguajay, Cuba.

Current name: *Adamsiella (Cubadamsiella) gratiosa* de la Torre & Bartsch, 1941 – not verified.

Family LITTORINIDAE

***Laevilitorina bifasciata* Suter, 1913**

Suter, H., 1913, p. 189, pl. 35, fig. 10.
Lectotypification in Boreham, A., 1959, p. 32.

Lectotype: GNS TM603

Paralectotype: MA125267, collected by J. Bollons from Antipodes Islands, New Zealand.

Remarks: Original label by Powell has this as a cotype (=syntype). The other syntypes were at GNS, one of which was designated lectotype. By this act all other syntypes, including the Auckland Museum specimen, automatically become paralectotypes.

Current name: *Laevilitorina bifasciata* Suter, 1913 – Spencer *et al.* (2018).

***Macquariella aucklandica* Powell, 1933**

Powell, A.W.B., 1933c, pp. 233, 234, pl. 20, fig. 6 (holotype).

Holotype: MONZ M.001808

Paratypes: MA72364, five specimens, collected by J. Bollons from the type locality, from beach drift, Faith Harbour [North Harbour], Auckland Islands, New Zealand.

Current name: *Laevilitorina* (*Macquariella*) *aucklandica* (Powell, 1933) – Spencer *et al.* (2018).

***Macquariella delli* Powell, 1955**

Powell, A.W.B., 1955, p. 75, pl. 1, fig. 10.

Holotype: MONZ M.008575

Paratype: MA72383* single specimen, collected by W.R.B. Oliver in April 1927, from the type locality, Antipodes Islands, New Zealand.

Remarks: This specimen has not been found since 1993.

Current name: *Laevilitorina* (*Macquariella*) *delli* (Powell, 1955) – Spencer *et al.* (2018).

***Melarhapse oliveri* Finlay, 1930**

Finlay, H.J., 1930b, pp. 224, 225, not figured.

Holotype: MA70456, collected, possibly by R.S. Allan, from Hampden, Otago, New Zealand.

Paratypes: MA72574, six specimens from the type locality.

Current name: *Austrolittorina antipodum* (Philippi, 1847) – Powell (1979: 87); Spencer *et al.* (2018).

***Melarhapse zelandiae* Finlay, 1926**

Finlay, H.J., 1926b, p. 375, pl. 18, fig. 18 (holotype), fig. 19.

Holotype: MA70457, collected from rocks at half and high tide level, Dunedin Harbour, Otago, New Zealand.

Paratypes: MA72526, three specimens, from the type locality.

Current name: *Austrolittorina cincta* (Quoy & Gaimard, 1833) – Powell (1979: 87); Spencer *et al.* (2018).

***Zelaxitas alta* Powell, 1940**

Powell, A.W.B., 1940, p. 224, text fig. 1b (holotype).

Holotype: MA70874, collected by A.W.B. Powell in 1932, from seaweed washings, Takapaukura/Tom Bowling Bay, Northland, New Zealand.

Current name: *Laevilitorina* (*Rissolittorina*) *alta* (Powell, 1940) – Spencer *et al.* (2018).

Family ZEROTULIDAE

***Zerotula nummaria* Powell, 1940**

Powell, A.W.B., 1940, p. 237, pl. 28, figs 14, 15 (holotype).

Holotype: 72179, dredged by W. La Roche from 22 m (12 fathoms) in Awanui [Rangaunu] Bay, Northland, New Zealand.

Paratypes: MA71572, three specimens, from the type locality.

Current name: *Zerotula nummaria* Powell, 1940 – Spencer *et al.* (2018).

***Zerotula triangulata* Powell, 1937**

Powell, A.W.B., 1937, p. 209, pl. 54, figs 15, 16 (holotype).

Holotype: NHM 19621048

Paratype: MA72288*, one specimen collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Remarks: The specimen has not been found since 1994.

Current name: *Zerotula triangulata* Powell, 1937 – Spencer *et al.* (2018).

Family NATICIDAE

†*Amauropsona teres* Marwick, 1924

Marwick, J., 1924b, p. 577, pl. 60, fig. 20 (holotype).

Holotype: MA70029, from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Current name: *Amauropsona teres* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

***Cochlis migratoria* Powell, 1927**

Powell, A.W.B., 1927b, pp. 560–562, pl. 33, fig. 3 (holotype), fig. 4 (paratype), figs 5, 6.

Holotype: MA72049, collected alive by W. La Roche in June 1925, Parengarenga Harbour, Northland, New Zealand.

Paratype: MA71415, one specimen; MA72434, two specimens, all from the type locality.

Remarks: MA71415 was presented to AM by W. La Roche in 1926 and MA72434 by E. Flinn in 1934. Based on original labels and Powell's (1927) type description these are assumed to have been part of the original type series.

Current name: *Notocochlis gualtieriana* (Récluz, 1844) – MolluscaBase (2020).

***Cochlis vafer* Finlay, 1930**

Finlay, H.J., 1930b, p. 232, not figured.

Holotype: MA70178, collected from Shellharbour, Illawarra, New South Wales, Australia.

Paratypes: MA72580, two specimens from the type locality.

Current name: *Notocochlis gualtieriana* (Récluz, 1844) – MolluscaBase (2020).

†***Globisinum crassiliratum* Finlay, 1926**

Finlay, H.J., 1926a, p. 230, pl. 60, fig. 6 (holotype).

Holotype: MA70344, collected from early Miocene (Waitakian) Otekaikē Limestone, 'Trig Z' (Fossil Record File I40/f9519), Otiakē, Waitaki Valley, New Zealand.

Current name: *Globisinum crassiliratum* Finlay, 1926 – Maxwell in: Spencer *et al.* (2009: 243).

†***Globisinum flemingi* Powell, 1931**

Powell, A.W.B., 1931a, pp. 98, 99, pl. 11, figs 10a, 10b (holotype).

Holotype: MA70345, collected by C.A. Fleming in January 1931 from late Pliocene (Waipipian) lower Waipipi Shellbed, Waipipi coast near Waverley, about 1.2 km west of the mouth of the Wairoa Stream, Manawatu-Wanganui, New Zealand.

Current name: *Globisinum drewi* (Murdoch, 1899) – Beu & Raine (2009).

†***Lunatia suturalis* Hutton, 1877**

Hutton, F.W., 1877, p. 597, pl. 16, fig. 11.

Neotypification in: Marwick, J., 1924b, p. 557, pl. 57, fig. 1 (neotype).

Neotype: MA71280, from middle Eocene (Bortonian) Waihao Greensand at McCulloch's Bridge, Waihao, Canterbury, New Zealand.

Current name: *Fraginatica suturalis* (Hutton, 1877) – Maxwell in: Spencer *et al.* (2009: 243).

†***Magnatica altior* Finlay, 1926**

Finlay, H.J., 1926a, pp. 228, 229, pl. 60, fig. 3 (holotype), fig. 4 (paratype).

Holotype: MA70428, collected from the late Oligocene (Duntroonian) Wharekuri Greensand, Wharekuri, true left bank of the Waitaki River, 1.6 km below Wharekuri (site now submerged beneath Lake Waitaki), north Otago, New Zealand.

Paratype: MA71658, one specimen, from the type locality.

Current name: *Magnatica (Spelaenacca) sutherlandi* (Marwick, 1924) – Beu & Raine (2009).

†***Magnatica clifdenensis* Finlay, 1926**

Finlay, H.J., 1926a, p. 229, pl. 60, fig. 2 (holotype).

Holotype: MA70429, collected from early Miocene (Altonian) Long Beach Shellbed, [Finlay's bed 6B (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Current name: *Magnatica (Spelaenacca) clifdenensis* Finlay, 1926 – Maxwell in: Spencer *et al.* (2009: 243).

†***Magnatica fons* Finlay, 1930**

Finlay, H.J., 1930a, p. 58, pl. 4, fig. 51 (holotype).

Holotype: MA70430, collected from the middle Eocene (Bortonian) Waihao Greensand at Waihao Downs, south Canterbury, New Zealand.

Paratypes: MA72452 three specimens, from the type locality.

Current name: *Magnatica fons* Finlay, 1930 – Maxwell in: Spencer *et al.* (2009: 243).

†***Magnatica powelli* Laws, 1932**

Laws, C.R. 1932, pp. 190, 191, pl. 31, fig. 39 (holotype), fig. 38 (paratype).

Holotype: MA70432, collected by C.R. Laws, from the early Miocene (Altonian) of the Mount Harris Formation at Ardgowan near Oamaru, Otago, New Zealand.

Paratype: MA73179, one specimen, from the type locality.

Current name: *Magnatica planispira* (Suter, 1917) – Beu & Raine (2009).

†***Magnatica rectilatera* Finlay, 1926**

Finlay, H.J., 1926a, p. 229, pl. 60, fig. 5 (holotype).

Holotype: MA70434, collected from the early Miocene (Altonian), Mount Harris Formation, Awamoa Creek, Oamaru, Otago, New Zealand.

Current name: *Magnatica (Spelaenacca) rectilatera* Finlay, 1926 – Maxwell in: Spencer *et al.* (2009: 243).

†***Magnatica (Spelaenacca) parilis* Finlay, 1930**

Finlay, H.J., 1930a, pp. 58, 59, not figured.

Holotype: MA70431, **Figures 1a, b**, from middle Eocene (Bortonian) Waihao Greensand at McCulloch's Bridge, Waihao, Canterbury, New Zealand.

Current name: *Magnatica (Spelaenacca) parilis* Finlay, 1930 – Maxwell in: Spencer *et al.* (2009: 243).

†***Magnatica (Spelaenacca) procera* Finlay & Marwick, 1937**

Finlay, H.J. & J. Marwick, 1937, p. 58, pl. 6, fig. 16 (holotype).

Holotype: MA73357, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Current name: *Magnatica (Spelaenacca) procera* Finlay & Marwick, 1937 – Maxwell in: Spencer *et al.* (2009: 243).

†***Magnatica (Spelaenacca) waitemataensis* Powell, 1938**

Powell, A.W.B., 1938a, p. 369, pl. 39, fig. 3 (holotype).

Holotype: MA70435, collected by A.W.B. Powell, from the early Miocene (Otaian) Tipakuri Formation at 'Fossil Bay' just south of Church Bay (sometimes known as Squadron Bay), Waiheke Island, Auckland, New Zealand.

Paratypes: MA71712, two specimens, from the type locality.

Current name: *Magnatica (Spelaenacca) waitemataensis* Powell, 1938 – Maxwell in: Spencer *et al.* (2009: 243).

†***Micreschara (Macromphalina) auriformis* Marwick, 1924**

Marwick, J., 1924b, p. 578, pl. 60, figs 5, 6 (holotype).

Holotype: MA70472, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Current name: *Eunaticina auriformis* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†*Natica consortis* Finlay, 1924

Finlay, H.J., 1924a, p. 451, pl. 49, fig. 1a (holotype), figs 1b, c.

Holotype: MA70513, collected from early Miocene (Altonian) Mount Harris Formation at Pukeuri (near Oamaru), Otago, New Zealand.

Paratypes: MA72477, three specimens, from the type locality.

Current name: *Tanea consortis* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†*Natica inexpectata* Finlay, 1924

Finlay, H.J., 1924a, p. 452, not figured.

Holotype: MA70514, **Figures 1c, d**, collected from the middle Miocene (Lillburnian) of the Park Bluff Sandstone, [Finlay's bed 7A (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Paratypes: MA72479, two specimens, from the type locality.

Current name: *Tanea inexpectata* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†*Natica notocenica* Finlay, 1924

Finlay, H.J., 1924a, p. 450, pl. 49, fig. 2a (holotype), figs 2b, c, d (paratypes).

Holotype: MA70515, collected from the early Miocene (Altonian), Mount Harris Formation, Awamoia Creek, Oamaru, Otago, New Zealand.

Paratypes: MA72920, four specimens, collected from early Miocene (Altonian) Mount Harris Formation at Pukeuri (near Oamaru), Otago, New Zealand.

Current name: *Taniella notocenica* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†*Natica praeconsors* Finlay, 1924

Finlay, H.J., 1924a, p. 451, not figured.

Holotype: MA71287, **Figures 1e, f**, from middle Eocene (Bortonian) Waihao Greensand at McCulloch's Bridge, Waihao, Canterbury, New Zealand.

Paratypes: MA72478, 36 specimens, from the type locality.

Current name: *Tanea praeconsors* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†*Natica (Carinacca) allani* Marwick, 1924

Marwick, J., 1924b, pp. 554, 555, pl. 56, fig. 4 (holotype).

Holotype: MA71281, collected from the middle Eocene (Bortonian) Waihao Greensand at Waihao Downs, south Canterbury, New Zealand.

Paratypes: MA72515, two specimens, from the type locality.

Current name: *Carinacca allani* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†*Natica (Carinacca) haasti* Marwick, 1924

Marwick, J., 1924b, p. 554, pl. 56, fig. 8 (holotype).

Holotype: MA71282, from middle Eocene (Bortonian) Waihao Greensand at McCulloch's Bridge, Waihao, Canterbury, New Zealand.

Paratypes: MA72516, 30 specimens, from the type locality.

Current name: *Tahunacca haasti* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

***Notocochlis sagittata hancockae* Powell, 1971**

Powell, A.W.B., 1971, p. 215, fig. 7 (holotype).

Holotype: MA71330, collected by M. Hancock, Urupukapuka Island, Northland, New Zealand.

Current name: *Notocochlis cernica* (Jousseume, 1874) – Spencer *et al.* (2018).

†*Polinices motutaraensis* Powell, 1935

Powell, A.W.B., 1935b, pp. 335, 336, pl. 78, figs 17, 18 (holotype).

Holotype: MA72119, collected from large fallen blocks of early Miocene (Altonian) Nihotupu Formation, southern end of Maukatia Bay, south of Muriwai Beach, west Auckland, New Zealand.

Paratypes: MA71386, five specimens, from the type locality.

Current name: *Taniella motutaraensis* (Powell, 1935) – Maxwell in: Spencer *et al.* (2009: 243).

†*Polinices parki* Finlay & Marwick, 1937

Finlay, H.J. & J. Marwick, 1937, p. 58, pl. 6, figs 11, 13 (holotype), fig. 9 (paratype).

Holotype: GNS TM7321

Paratypes: MA72861, three specimens, collected from the type locality, early Paleocene (lower Teurian), Wangaloa, coast between Mitchells Rocks and Measly Beach, Otago, New Zealand.

Current name: *Polinices parki* Finlay & Marwick, 1937 – Maxwell in: Spencer *et al.* (2009: 243).

†*Polinices pseudovitrea* Finlay, 1924

Finlay, H.J., 1924a, p. 452, pl. 49, fig. 3a (holotype), figs 3b, c, d (paratype).

Holotype: MA70635, the early Miocene (Altonian) of the Mount Harris Formation, 'Old Rifle Butts', coast south of Cape Wanbrow, Oamaru, Otago, New Zealand.

Current name: *Uberella pseudovitrea* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†*Polinices stanleyi* Marwick, 1948

Marwick, J. 1948, pp. 30, 31, pl. 6, fig. 9 (holotype), fig. 9 (holotype), figs 7, 12 (paratypes).

Holotype: MA71096, collected from the late Pliocene (Waipiian) of the Kaawa Formation 25–30 m (84–98 ft) below the surface in the Waitemata Brewery well, Otahuhu, Auckland, New Zealand.

Paratype: MA73021, one specimen from the type locality.

Current name: *Polinices waipiianensis* (Marwick, 1924) – Beu & Raine (2009).

***Polinices tawhitirahia* Powell, 1965**

Powell, A.W.B., 1965, pp. 163, 164, pl. 22, fig. 2 (holotype), figs 1, 3 (paratypes).

Holotype: MA71242, collected by members of the Whangarei Underwater Club in February 1965, from sand and rubble at the foot of a steep cliff face, in 36 m

(120 ft), northern tip of Tawhiti Rahi, Poor Knights Islands, Northland, New Zealand.

Paratypes: MA71470, three specimens; MA71961, two specimens, all from the same collection event.

Current name: *Polinices tawhitirahia* Powell, 1965 – Spencer *et al.* (2018).

†***Polinices (Polinella) fryei* Laws, 1933**

Laws, C.R., 1933, p. 321, pl. 32, fig. 30 (holotype).

Holotype: MA70634, collected by C.R. Laws from the early Miocene (Altonian) Southburn Sand at White Rock River, south Canterbury, New Zealand.

Current name: *Polinella fryei* (Laws, 1933) – Maxwell in: Spencer *et al.* (2009: 243).

†***Proxiuber anteaustrale* Powell, 1938**

Powell, A.W.B., 1938b, pp. 162–164, text fig. 3.

Holotype: MA72122, collected by A.W.B. Powell in 1924, from the early Pleistocene (Nukumaruian) Castlepoint Formation at the lighthouse reef, Castlepoint, Wairarapa, New Zealand.

Current name: *Proxiuber anteaustrale* Powell, 1938 – Maxwell in: Spencer *et al.* (2009: 243).

***Proxiuber hulmei* Powell, 1954**

Powell, A.W.B., 1954a, pp. 235, 236, text fig.

Holotype: MA71197, obtained from an Auckland trawler, exact location and station unknown, New Zealand.

Current name: *Proxiuber hulmei* Powell, 1954 – Spencer *et al.* (2018).

***Sinuber sculptum scotianum* Powell, 1951**

Powell, A.W.B., 1951b, pp. 120, 121, pl. 5, fig. 10 (holotype).

Holotype: NHM 1961418

Paratypes: MA71974, 19 specimens, collected on 20 February 1927, from the type locality, station 167, R.R.S. Discovery Expedition, from 244–344 m, off Signy Island, South Orkney Islands, Antarctic Treaty Administration.

Current name: *Sinuber sculptum scotianum* Powell, 1951 – MolluscaBase (2020).

†***Sinum infirmum* Marwick, 1924**

Marwick, J., 1924b, p. 572, pl. 60, figs 7, 8 (holotype).

Holotype: MA70711, from the early Miocene (Altonian) of the Mount Harris Formation near Ardgowan, northwest of Oamaru, Otago, New Zealand.

Current name: *Sinum infirmum* Marwick, 1924 – Maxwell in: Spencer *et al.* (2009: 243).

†***Sinum marwicki* Laws, 1930**

Laws, C.R., 1930, pp. 551, 552, pl. 89, figs 1, 4 (holotype).

Holotype: MA70712, collected by C.R. Laws from the early Miocene (Altonian) Southburn Sand at White Rock River, south Canterbury, New Zealand.

Current name: *Sinum marwicki* Laws, 1930 – Maxwell in: Spencer *et al.* (2009: 244).

†***Sulconacca compressa* Marwick, 1924**

Marwick, J., 1924b, p. 558, pl. 57, fig. 3 (holotype).

Holotype: MA70743, collected from the middle Miocene (Lillburnian) of the Park Bluff Sandstone, [Finlay's bed 7C (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Current name: *Friginatica compressa* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†***Sulconacca prisca* Marwick, 1924**

Marwick, J., 1924b, pp. 557, 558, pl. 57, fig. 2 (holotype).

Holotype: MA71279, collected from the middle Eocene (Bortonian) Waihao Greensand at Waihao Downs, south Canterbury, New Zealand.

Current name: *Friginatica prisca* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uber chattonensis* Marwick, 1924**

Marwick, J., 1924b, pp. 563, 564, pl. 58, fig. 3 (holotype).

Holotype: MA70809, collected from the late Oligocene (Duntroonian) Chatton Formation, Chatton, Southland, New Zealand.

Current name: *Polinices chattonensis* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uber finlayi* Marwick, 1924**

Marwick, J., 1924b, pp. 565, 566, pl. 57, fig. 12 (holotype), figs 8, 13 (paratypes).

Holotype: MA70810, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Paratypes: MA73372, three specimens, from the type locality.

Current name: *Polinella finlayi* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uber laxis* Finlay, 1926**

Finlay, H.J., 1926a, p. 229, pl. 60, fig. 1 (holotype).

Holotype: MA70814, collected from middle Miocene (Waiauan) Nissen Shellbeds, [Finlay's bed 8A (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Current name: *Polinices laxis* (Finlay, 1926) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uber senisculus* Marwick, 1924**

Marwick, J., 1924b, p. 566, pl. 57, fig. 6 (holotype).

Holotype: MA70816, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Paratypes: MA73370, five specimens, from the type locality.

Current name: *Taniella (Pristinacca) senisculus* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uber (Euspira) firmus* Marwick, 1924**

Marwick, J., 1924b, p. 569, pl. 59, fig. 3 (holotype), fig. 2.

Holotype: MA73360, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Paratypes: MA73374, three specimens, from the type locality.

Current name: *Magnatica (Spelaenacca) firma* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uber (Euspira) fyfei* Marwick, 1924**

Marwick, J., 1924b, p. 569, pl. 59, figs 8, 9 (holotype).
Holotype: MA70812, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Current name: *Euspira fyfei* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uber (Euspira) lateapertus* Marwick, 1924**

Marwick, J., 1924b, pp. 569, 570, pl. 59, fig. 4 (holotype), figs 5, 6 (paratypes).

Holotype: MA70813, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Paratypes: MA72932, four specimens, from the type locality.

Current name: *Euspira lateaperta* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uber (Euspira) pukeuriensis* Marwick, 1924**

Marwick, J., 1924b, p. 570, pl. 55, fig. 20 (holotype).

Holotype: MA70815, collected from early Miocene (Altonian) Mount Harris Formation at Pukeuri (near Oamaru), Otago, New Zealand.

Current name: *Uberella pukeuriensis* (Marwick, 1924) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uberella acerva* Laws, 1933**

Laws, C.R., 1933, pp. 321, 322, pl. 32, fig. 32 (holotype).

Holotype: MA70817, collected by C.R. Laws, from early Miocene (Otaian) Mount Harris Formation, Blue Cliffs, Otaio River, Canterbury, New Zealand.

Current name: *Tahunacca acerva* (Laws, 1933) – Maxwell in: Spencer *et al.* (2009: 243).

†***Uberella marwicki* Powell, 1935**

Powell, A.W.B., 1935b, p. 335, pl. 78, fig. 19 (holotype).

Holotype: MA72161, collected from large fallen blocks of early Miocene (Altonian) Nihotupu Formation, southern end of Maukatia Bay, south of Muriwai Beach, west Auckland, New Zealand.

Paratypes: MA71379, two specimens, from the type locality.

Current name: *Uberella marwicki* Powell, 1935 – Maxwell in: Spencer *et al.* (2009: 243).

Family BARLEEIIDAE

***Rissoia carnosa* Webster, 1905**

Webster, W.H., 1905, p. 278, fig. 6.

Holotype: MA70667, collected from Takapuna Beach, Auckland, New Zealand.

Paratypes: MA72608, 16 specimens, from the type locality.

Current name: *Fictonoba carnosa carnosa* (Webster, 1905) – Spencer *et al.* (2018).

***Austronoba martini* Finlay, 1928**

Finlay, H.J., 1928, p. 242, pl. 39, figs 12, 13 (holotype).

Holotype: MA70073, collected by members of the Otago Institute in January and February 1924, Chatham Islands, New Zealand.

Paratypes: MA72552, ten specimens, from the type locality.

Current name: *Fictonoba carnosa martini* (Finlay, 1928) – Spencer *et al.* (2018).

***Austronoba oliveri* Powell, 1927**

Powell, A.W.B., 1927a, pp. 542, 543, pl. 27, fig. 9.

Holotype: MA70075, dredged by R.S. Bell from 10–30 m, off Raoul Island, Kermadec Islands, New Zealand.

Paratypes: MA71522, 29 specimens collected from the type locality.

Current name: *Fictonoba oliveri* (Powell, 1927) – Spencer *et al.* (2018).

Family LIRONOBIDAE

***Lironoba matai* Dell, 1952**

Dell, R.K., 1952, pp. 416, 418, pl. 85, fig. 3 (holotype).

Holotype: MONZ M.005507

Paratypes: MA72770, two specimens, collected from the type locality, by the RV Matai on 6 November, 1936, from 95 m (52 fathoms), Mernoo Bank, Chatham Rise, New Zealand.

Current name: *Lironoba matai* Dell, 1952 – Spencer *et al.* (2018).

***Lironoba (Nobolira) anomala* Powell, 1940**

Powell, A.W.B., 1940, pp. 225, 226, pl. 30, fig. 3

Holotype: MA70411, collected by A.W.B. Powell in 1932, from shell sand, Takapaukura/Tom Bowling Bay, Northland, New Zealand.

Remarks: The specimen has been damaged by glass disease.

Current name: *Lironoba anomala* Powell, 1940 – Spencer *et al.* (2018).

†***Lironoba charassa* Finlay, 1924**

Finlay, H.J., 1924b, p. 486, fig. 7.

Holotype: MA70412, collected from ‘Nukumaru’, Whanganui, New Zealand.

Remarks: No further locality data is available, but based on later specimens found by Laws (1940), the specimen may have been collected from the early Pleistocene (Nukumaruan) Nukumaru Brown Sand, 7 km south east of Waiinu Beach, near the site of the former ‘Nukumaru boat-landing’, Manawatu-Whanganui, New Zealand.

Current name: *Attenuata charassa* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 242).

†***Lironoba polyvincta* Finlay, 1924**

Finlay, H.J., 1924b, pp. 485, 486, fig. 6.

Holotype: MA70413, collected from early Miocene (Altonian) Mount Harris Formation at Pukeuri (near Oamaru), Otago, New Zealand.

Paratypes: MA72498, three specimens, from the type locality.

Current name: *Attenuata polyvincta* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 242).

***Merelina cochleata* Powell, 1937**

Powell, A.W.B., 1937, p. 194, pl. 52, fig. 6 (holotype).

Holotype: NHM 19621005

Paratypes: MA72269, three specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Merelina cochleata* Powell, 1937 – Spencer *et al.* (2018).

***Merelina compacta* Powell, 1927**

Powell, A.W.B., 1927a, pp. 537, 538, pl. 26, figs 5, 5a.

Holotype: MA72093, dredged by W. La Roche in June 1924, from 11–18 m (6–10 fathoms), off the entrance to Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratypes: MA71516, three specimens, from the type locality.

Current name: *Merelina compacta* Powell, 1927 – Spencer *et al.* (2018).

***Merelina crassissima* Powell, 1937**

Powell, A.W.B., 1937, pp. 194, 195, pl. 52, fig. 9 (holotype).

Holotype: NHM 19621007

Paratypes: MA72270, five specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 934, R.R.S. Discovery II cruise, in 92 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Merelina crassissima* Powell, 1937 – Spencer *et al.* (2018).

***Merelina crispulata* Powell, 1937**

Powell, A.W.B., 1937, p. 194, pl. 52, fig. 7 (holotype).

Holotype: NHM 19621003

Paratypes: MA72268, 17 specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Merelina crispulata* Powell, 1937 – Spencer *et al.* (2018).

***Merelina gemmata* Powell, 1927**

Powell, A.W.B., 1927a, p. 537, pl. 26, fig. 1.

Holotype: MA72094, collected by R. Falla in December 1923, from shell sand, Maro Tiri, [Hen and Chicken Islands], Northland, New Zealand.

Remarks: The location is given as Maro Tiri (Chicken Island). Today Marotere refers to the group of six islands to the north of Taranga, the largest island. Powell (1927) most likely used the name for Lady Alice/Big Chicken.

Paratypes: MA71517, three specimens, from the type locality.

Current name: *Simulameralina gemmata* (Powell, 1927) – Spencer *et al.* (2018).

***Merelina harrisonae* Powell, 1939**

Powell, A.W.B., 1939, p. 231, pl. 49, fig. 2 (holotype).

Holotype: MA70459, collected by R.H. Harrison, from Ringaringa, Stewart Island / Rakiura, New Zealand.

Current name: *Merelina harrisonae* Powell, 1939 – Spencer *et al.* (2018).

†*Merelina kaawaensis* Laws, 1936

Laws, C.R., 1936, p. 106, pl. 16, figs 60, 61 (holotype).

Holotype: MA70460, collected from the early Pliocene (Opoitian) of the Kaawa Formation at Kaawa Creek, south of Port Waikato, Waikato, New Zealand.

Paratypes: MA72697, specimens, from the type locality.

Current name: *Merelina kaawaensis* Laws, 1936 – Maxwell in: Spencer *et al.* (2009: 242).

***Merelina manawatawhia* Powell, 1937**

Powell, A.W.B., 1937, pp. 193, 194, pl. 52, fig. 8 (holotype).

Holotype: NHM 19621000

Paratypes: MA72267, four specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Merelina manawatawhia* Powell, 1937 – Spencer *et al.* (2018).

***Merelina maoriana* Powell, 1939**

Powell, A.W.B., 1939, pp. 231, 232, pl. 49, fig. 1 (holotype).

Holotype: MA70461, collected from 5 m (3 fathoms), Otago Harbour, Dunedin, Otago, New Zealand.

Paratypes: MA71587, 41 specimens, from the type locality.

Current name: *Merelina maoriana* Powell, 1939 – Spencer *et al.* (2018).

***Merelina paupereques* Powell, 1937**

Powell, A.W.B., 1937, p. 193, pl. 52, fig. 10 (holotype).

Holotype: MA71292, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off the Manawatāwhi / Three Kings Islands, New Zealand.

Remarks: The original label records the type locality as ‘60 fath. Poor Knights’, which is an alternative collecting site for this species recorded by Powell (1937: 193), but not as the type locality, which is given as station 933. Almost all holotypes for species described in Powell (1937) were lodged with the NHM, but there is no record of any specimens of *Merelina paupereques* in the NHM online molluscan register of R.R.S. Discovery II cruise specimens (see <https://data.nhm.ac.uk/dataset/collection-specimens>). In addition, Powell (1937) states that ‘The writer is indebted to Dr H.J. Finlay for the opportunity of describing this species.’ This suggests Powell (1937) may have recorded station 933 in error as the type locality.

Current name: *Merelina paupereques* Powell, 1937 – Spencer *et al.* (2018).

***Merelina plaga* Finlay, 1926**

Finlay, H.J., 1926b, p. 378, pl. 19, fig. 37 (holotype), fig. 38.

Holotype: MA70462, collected from 91 m (50 fathoms), Snares Islands / Tini Heke Islands, New Zealand.

Paratype: MA72527, one specimen; MA73211, 24 specimens, all from the type locality.

Current name: *Merelina plaga* Finlay, 1926 – Spencer *et al.* (2018).

***Merelina rubiginosa* Ponder, 1967**

Ponder, W.F. 1967, pp. 213, 214, pl. 6, fig. 1 (holotype).

Holotype: MA72970, collected by K. Hipkins on 9 April 1955, from McGregors Bay, Whangarei Heads, Northland, New Zealand.

Paratypes: MA72971, 19 specimens, from the type locality.

Current name: *Merelina rubiginosa* Ponder, 1967 – Spencer *et al.* (2018).

***Merelina superba* Powell, 1927**

Powell, A.W.B., 1927a, p. 536, pl. 26, fig. 2.

Holotype: MA72095, collected by R. Falla in December 1923, from shell sand, Maro Tiri, [Hen and Chicken Islands], Northland, New Zealand.

Remarks: The location is given as Maro Tiri (Chicken Island). Today Marotere refers to the group of six islands to the north of Taranga, the largest island. Powell (1927c) most likely used the name for Lady Alice/Big Chicken.

Current name: *Merelina superba* Powell, 1927 – Spencer *et al.* (2018).

***Merelina taupoensis* Powell, 1939**

Powell, A.W.B., 1939, p. 232, pl. 49, fig. 3 (holotype).

Holotype: MA70463, collected by W. La Roche, from Taupo Bay, Whangaroa, Northland, New Zealand.

Paratypes: MA71588, 29 specimens, from the type locality.

Current name: *Merelina taupoensis* Powell, 1939 – Spencer *et al.* (2018).

***Merelina waitangiensis* Powell, 1933**

Powell, A.W.B., 1933a, p. 202, pl. 33, fig. 3 (holotype).

Holotype: MA70464, collected by A.W.B. Powell in February 1933, from shell sand, Waitangi, Chatham Islands, New Zealand.

Current name: *Merelina waitangiensis* Powell, 1933 – Spencer *et al.* (2018).

***Nobolira affinis* Powell, 1940**

Powell, A.W.B., 1940, p. 226, pl. 30, fig. 6 (holotype).

Holotype: MA70523, dredged from 27 m (15 fathoms), off Waikuku Beach, Northland, New Zealand.

Current name: *Attenuata affinis affinis* (Powell, 1940) – Spencer *et al.* (2018).

***Nobolira bollonsi* Powell, 1930**

Powell, A.W.B., 1930a, pp. 536, 537, pl. 60, fig. 7 (holotype).

Holotype: MA71394, dredged by J. Bollons, from 110 m (60 fathoms), off Poor Knights Islands, Northland, New Zealand.

Current name: *Attenuata bollonsi* (Powell, 1930) – Spencer *et al.* (2018).

***Nobolira cochlearella* Powell, 1937**

Powell, A.W.B., 1937, pp. 195, 196, pl. 52, fig. 15 (holotype).

Holotype: NHM 19621009

Paratypes: MA72246, eight specimens, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Attenuata cochlearella* (Powell, 1937) – Spencer *et al.* (2018).

***Nobolira contigua* Powell, 1940**

Powell, A.W.B., 1940, p. 226, pl. 30, fig. 5 (holotype).

Holotype: MA70524, collected by J. Bollons in 1914, from 183 m (100 fathoms) off Manawatāwhi / Great Island, Manawatāwhi / Three Kings Islands, New Zealand.

Remarks: Holotype specimen destroyed by glass disease.

Current name: *Attenuata contigua* (Powell, 1940) – Spencer *et al.* (2018).

***Nobolira manawatawhia* Powell, 1937**

Powell, A.W.B., 1937, p. 196, pl. 52, fig. 16 (holotype).

Holotype: NHM 19621011

Paratypes: MA72247, two specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 934, R.R.S. Discovery II cruise, in 92 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Attenuata manawatawhia* (Powell, 1937) – Spencer *et al.* (2018).

***Nobolira merelina* Dell, 1956**

Dell, R.K., 1956, p. 65, pl. 9, fig. 80 (holotype).

Holotype: MONZ M.009279

Paratype: MA72756, one specimen, collected from the type locality, by E.J. Batham, on the MV Alert, on 16 August 1955, from 549 m (300 fathoms), Taiaroa Canyon, off Otago Peninsula, New Zealand.

Current name: *Attenuata merelina* (Dell, 1956) – Spencer *et al.* (2018).

***Nobolira regis* Powell, 1940**

Powell, A.W.B., 1940, p. 226, pl. 30, fig. 4 (holotype).

Holotype: MA72105, collected from 91 m (50 fathoms) between Piwhane / Spirits Bay and Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Attenuata regis* (Powell, 1940) – Spencer *et al.* (2018).

***Nobolira (Adolphinoba) finlayi* Powell, 1930**

Powell, A.W.B., 1930a, pp. 537, 538, pl. 60, fig. 6 (holotype).

Holotype: MA70525, dredged by J. Bollons, from 110 m (60 fathoms), off Poor Knights Islands, Northland, New Zealand.

Paratypes: MA71998, four specimens, from the type locality.

Current name: *Attenuata finlayi* (Powell, 1930) – Spencer *et al.* (2018).

***Promerelina coronata* Powell, 1926**

Powell, A.W.B., 1926a, p. 594, fig. 1.

Holotype: MA72120, collected by R.A. Falla in December 1923 from shell sand, Maro Tiri, [Hen and Chicken Islands], Northland, New Zealand.

Remarks: The type locality is given as Maro Tiri (Chicken Island). Today Marotere refers to the group of six islands to the north of Taranga, the largest island. Powell (1926) most likely used the name for Lady Alice/Big Chicken.

Current name: *Merelina coronata* (Powell, 1926) – Spencer *et al.* (2018).

***Promerelina crosseaformis* Powell, 1926**

Powell, A.W.B., 1926a, p. 593, fig. 2.

Holotype: MA72121, collected by R.A. Falla in December 1923 from shell sand, Maro Tiri, [Hen and Chicken Islands], Northland, New Zealand.

Paratype: MA71408, one specimen, collected by W. La Roche in 1924, from Whangaroa Bay, Northland, New Zealand.

Remarks: The type locality is given as Maro Tiri (Chicken Island). Today Marotere refers to the group of six islands to the north of Taranga, the largest island. Powell (1926a) most likely used the name for Lady Alice/Big Chicken.

Current name: *Merelina crosseaformis* (Powell, 1926) – Spencer *et al.* (2018).

***Promerelina lacunosa* Powell, 1940**

Powell, A.W.B., 1940, p. 227, pl. 30, fig. 9 (holotype).

Holotype: MA70639, collected by A.W.B. Powell in 1932, from shell sand, Takapaukura/Tom Bowling Bay, Northland, New Zealand.

Paratypes: MA71567, 19 specimens, from the type locality.

Remarks: Powell (1940: 217) erroneously listed the locality as R.R.S. Discovery II Station 931 (his ‘Aupourian Dredge Station’ D7), instead of Tom Bowling Bay (his ‘Aupourian Shore Station’ 7). The type description (Powell, 1940: 227) and specimen labels have the latter as the type locality.

Current name: *Merelina lacunosa* (Powell, 1940) – Spencer *et al.* (2018).

***Promerelina tricarinata* Powell, 1937**

Powell, A.W.B., 1937, p. 195, pl. 52, fig. 11 (holotype).

Holotype: NHM 19621008

Paratypes: MA72271, five specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 934, R.R.S. Discovery II cruise, in 92 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Merelina tricarinata* (Powell, 1937) – Spencer *et al.* (2018).

Family RISSOIDAE***Austronoba iredalei* Powell, 1937**

Powell, A.W.B., 1937, pp. 192, 193, pl. 52, fig. 12 (holotype).

Holotype: NHM 19621001

Paratypes: MA72266, 15 specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Subonoba iredalei* (Powell, 1937) – Spencer *et al.* (2018).

***Austronoba kermadecensis* Powell, 1927**

Powell, A.W.B., 1927a, p. 542, pl. 27, fig. 8.

Holotype: MA70072, dredged by R.S. Bell from 10–30 m, off Raoul Island, Kermadec Islands, New Zealand.

Paratypes: MA71521, 21 specimens collected from the type locality.

Current name: *Subonoba kermadecensis* (Powell, 1927) – Spencer *et al.* (2018).

***Austronoba obliquata* Powell, 1940**

Powell, A.W.B., 1940, pp. 224, 225, pl. 30, fig. 1 (holotype).

Holotype: MA70074, collected by A.W.B. Powell in 1932, from shell sand, Takapaukura/Tom Bowling Bay, Northland, New Zealand.

Paratypes: MA73251, ten specimens, from the type locality.

Current name: *Subonoba obliquata* (Powell, 1940) – Spencer *et al.* (2018).

†*Badenia biangulata* Laws, 1936

Laws, C.R., 1936, p. 113, pl. 16, fig. 64 (holotype).

Holotype: MA70089, collected from the early Pliocene (Opoitian) of the Kaawa Formation at Kaawa Creek, south of Port Waikato, Waikato, New Zealand.

Current name: *Onoba biangulata* (Laws, 1936) – Spencer *et al.* (2018).

†*Badenia zebina* Finlay, 1930

Finlay, H.J., 1930a, p. 57, not figured.

Holotype: MA70090, **Figure 1g**, collected from the middle to late Oligocene (Waitakian) of Otiake, Waitaki Valley, Otago, New Zealand.

Paratypes: MA72450, 13 specimens, from the type locality.

Current name: *Onoba zebina* (Finlay, 1930) – MolluscaBase (2020).

***Dardanula convexispira* Powell, 1955**

Powell, A.W.B., 1955, p. 89, pl. 3, fig. 22 (holotype).

Holotype: MA71223, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Paratypes: MA71611, 35 specimens, from the type locality.

Current name: *Powellisetia porcellana* (Suter, 1908) – Powell (1979: 99); Spencer *et al.* (2018)

***Haurakia aupouria* Powell, 1937**

Powell, A.W.B., 1937, p. 191, pl. 52, fig. 4 (holotype).

Holotype: NHM 1962995

Paratype: MA72249, one specimen, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Alvania (Linemera) aupouria* (Powell, 1937) – Powell (1979: 96); Spencer *et al.* (2018).

***Haurakia bountyensis* Dell, 1950**

Dell, R.K., 1950, p. 24, fig. 5 (holotype).

Holotype: MONZ M.004724

Paratype: MA72772, one specimen, collected from the type locality, in 1907, Bounty Islands, New Zealand.

Current name: *Alvania (Linemera) bountyensis* (Dell, 1950) – Powell (1979: 96); Spencer *et al.* (2018).

***Haurakia crassicosta* Powell, 1955**

Powell, A.W.B., 1955, p. 80, pl. 3, fig. 27 (holotype).

Holotype: MA71216, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Paratypes: MA71605, 38 specimens, collected from the type locality.

Current name: *Haurakia crassicosta* Powell, 1955 – Spencer *et al.* (2018).

***Haurakia duplicata* Powell, 1937**

Powell, A.W.B., 1937, p. 191, pl. 52, fig. 2 (holotype).

Holotype: NHM 1962996

Paratypes: MA72251, three specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 932, R.R.S. Discovery II cruise, in 92 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Onoba (Ovirissoa) duplicata* (Powell, 1937) – Powell (1979: 114); Spencer *et al.* (2018).

***Haurakia duplicata exuta* Powell, 1937**

Powell, A.W.B., 1937, p. 191, pl. 52, fig. 3 (holotype).

Holotype: NHM 1962997

Paratype: MA72252, one specimen, collected by A.W.B. Powell on 17 August 1932 station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Onoba (Ovirissoa) exuta* (Powell, 1937) – Powell (1979: 114); Spencer *et al.* (2018).

***Haurakia finlayi* Powell, 1937**

Powell, A.W.B., 1937, p. 190, pl. 52, fig. 1 (holotype).

Holotype: NHM 1962994

Paratypes: MA72248, five specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Haurakia finlayi* Powell, 1937 – Spencer *et al.* (2018).

***Haurakia minuscula* Powell, 1955**

Powell, A.W.B., 1955, p. 95, pl. 3, fig. 26 (holotype).

Holotype: MA71217, collected from 174 m (95 fathoms), 23 km (14 miles) north of Auckland Islands, New Zealand.

Paratypes: MA71606, 60 specimens, from the type locality.

Current name: *Haurakia minuscula* Powell, 1955 – Spencer *et al.* (2018).

†*Haurakia oamarutica* Finlay, 1924

Finlay, H.J., 1924b, p. 483, fig. 2.

Holotype: MA70352, collected from the early Miocene (Altonian) Target Gully Shellbed, Mount Harris Formation, Glen Creek, Oamaru, Otago, New Zealand.

Paratypes: MA72492, nine specimens, from the type locality.

Current name: *Haurakia oamarutica* Finlay, 1924 – Spencer *et al.* (2018).

***Haurakia otagoensis* Dell, 1956**

Dell, R.K., 1956, p. 62, pl. 8, fig. 76 (holotype).

Holotype: MONZ M.009278

Paratype: MA72764, one specimen, collected from the type locality, by E.J. Batham, on the MV Alert, on 16 August 1955, from 549 m (300 fathoms), Taiaroa

Canyon, off Otago Peninsula, New Zealand.

Current name: *Haurakia otagoensis* Dell, 1956 – Spencer *et al.* (2018).

***Haurakia venusta* Powell, 1926**

Powell, A.W.B., 1926b, pp. 46, 47, pl. 5, fig. 3.

Syntypes: CM M5215; M5216

Syntypes: MA72338*, collected in 1907 by a New Zealand Government trawling expedition, from 183 m (100 fathoms), 97 km (60 miles) east of Lyttelton, Banks Peninsula, Canterbury, New Zealand.

Remarks: Lot MA72338 has not been found since 1993. CM M5215 has “holotype?” written on its container (C. Vink, pers comm. March 2020).

Current name: *Alvania (Linemera) venusta* (Powell, 1926) – Powell (1979: 97); Spencer *et al.* (2018).

***Haurakiopsis pellucida* Powell, 1937**

Powell, A.W.B., 1937, p. 192, pl. 52, fig. 5 (holotype).

Holotype: NHM 1962998

Paratypes: MA71982, four specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand; MA72250, eight specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 934, R.R.S. Discovery II cruise, in 92 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Haurakia pellucida* (Powell, 1937) – Powell (1979: 96); Spencer *et al.* (2018).

***Linemera abrupta* Dell, 1956**

Dell, R.K., 1956, p. 66, pl. 8, fig. 78 (holotype).

Holotype: MONZ M.009332

Paratype: MA72763, one specimen, collected from the type locality, by E.J. Batham, on the MV Alert, on 16 August 1955, from 549 m (300 fathoms), Taiaroa Canyon, off Otago Peninsula, New Zealand.

Current name: *Alvania (Linemera) abrupta* (Dell, 1956) – Spencer *et al.* (2018).

†*Linemera awamoensis* Finlay, 1924

Finlay, H.J., 1924b, p. 485, fig. 5.

Holotype: MA70401, collected from the early Miocene (Altonian), Mount Harris Formation, Awamo Creek, Oamaru, Otago, New Zealand.

Paratypes: MA72497, four specimens, from the type locality.

Current name: *Alvania (Linemera) awamoensis* (Finlay, 1924) – MolluscaBase (2020).

***Linemera gallinacea* Finlay, 1930**

Finlay, H.J., 1930b, pp. 225, 226, pl. 45, fig. 41 (paratype).

Holotype: MA70403, collected from 46 m (25 fathoms), off Hen and Chickens Islands, Northland, New Zealand.

Paratypes: MA72575, 74 specimens, from the type locality.

Current name: *Alvania (Linemera) gallinacea* (Finlay, 1930) – Spencer *et al.* (2018).

***Linemera gradatoides* Finlay, 1930**

Finlay, H.J., 1930b, p. 226, pl. 45, fig. 40 (paratype).

Holotype: MA70402, collected from 92 m (50 fathoms), off Oamaru, Otago, New Zealand.

Paratypes: MA72576, 40 specimens, from the type locality.

Current name: *Alvania* (*Linemera*) *gradatoides* (Finlay, 1930) – Spencer *et al.* (2018).

***Linemera maclurgi* Powell, 1933**

Powell, A.W.B., 1933a, p. 202, pl. 33, fig. 2 (holotype).

Holotype: MA70404, collected by A.W.B. Powell and/or C.A. Fleming in February 1933, from 18 m (10 fathoms) off Owenga Beach, Chatham Islands, New Zealand.

Paratype: MA71992, one specimen, from the type locality.

Current name: *Alvania* (*Linemera*) *maclurgi* (Powell, 1933) – Spencer *et al.* (2018).

†*Linemera minuta* Finlay, 1924

Finlay, H.J., 1924b, pp. 483, 484, fig. 3.

Holotype: MA70405, collected from the early Miocene (Altonian) of the Mount Harris Formation near Pukeuri (near Oamaru), Otago, New Zealand.

Paratypes: MA72495, two specimens, from the type locality.

Current name: *Alvania* (*Linemera*) *minuta* (Finlay, 1924) – MolluscaBase (2020).

***Linemera pinguoides* Powell, 1940**

Powell, A.W.B., 1940, p. 225, pl. 30, fig. 7 (holotype).

Holotype: MA70406, collected by J. Bollons in 1914, from 183 m (100 fathoms) off Manawatāwhi / Great Island, Manawatāwhi / Three Kings Islands, New Zealand.

Paratypes: MA73250, five specimens, from the type locality.

Current name: *Alvania* (*Linemera*) *pinguoides* (Powell, 1940) – Spencer *et al.* (2018).

†*Linemera pukeuriensis* Finlay, 1924

Finlay, H.J., 1924b, pp. 484, 485, fig. 4.

Holotype: MA70407, collected from the early Miocene (Altonian) of the Mount Harris Formation near Pukeuri (near Oamaru), Otago, New Zealand.

Paratypes: MA72496, 11 specimens, from the type locality.

Current name: *Alvania* (*Linemera*) *pukeuriensis* (Finlay, 1924) – MolluscaBase (2020).

***Manawatawhia analoga* Powell, 1937**

Powell, A.W.B., 1937, p. 199, pl. 52, fig. 14 (holotype).

Holotype: NHM 19621019

Paratypes: MA72261, seven specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Onoba* (*Manawatawhia*) *analoga* (Powell, 1937) – Spencer *et al.* (2018).

***Notosetia antipoda* Powell, 1955**

Powell, A.W.B., 1955, p. 86, pl. 3, fig. 19 (holotype).

Holotype: MA71218, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Paratypes: MA71607, eight specimens, from the type locality.

Current name: *Powellisetia microstriata* (Murdoch, 1905) – Powell (1979: 99); Spencer *et al.* (2018).

***Notosetia aupouria* Powell, 1937**

Powell, A.W.B., 1937, p. 201, pl. 53, fig. 12 (holotype).

Holotype: NHM 19621025

Paratypes: MA72275, 14 specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Haurakia aupouria* (Powell, 1937) – Powell (1979: 95); Spencer *et al.* (2018).

***Notosetia benthicola* Powell, 1927**

Powell, A.W.B., 1927d, p. 117, pl. 21, fig. 1.

Holotype: CM M5377

Paratypes: MA72342, six specimens, dredged from the type locality, by a private scientific party in December 1908, off the steamer 'Rakiura' in 183 m (100 fathoms) off Puysegur Point, Southland, New Zealand.

Current name: *Onoba* (*Ovirissoa*) *lubrica* (Suter, 1898) – Powell (1979: 100); Spencer *et al.* (2018).

***Notosetia crassilabrum* Powell, 1940**

Powell, A.W.B., 1940, p. 228, pl. 30, fig. 12 (holotype).

Holotype: MA70537, collected by A.W.B. Powell in 1932, from shell sand, Takapaukura/Tom Bowling Bay, Northland, New Zealand.

Paratypes: MA72428, two specimens, from the type locality.

Remarks: Holotype specimen destroyed by glass disease.

Current name: *Powellisetia crassilabrum* (Powell, 1940) – Spencer *et al.* (2018).

***Notosetia fairchildi* Powell, 1933**

Powell, A.W.B., 1933b, pp. 36, 37, text figs 2, 3.

Holotype: CM M5312

Paratypes: MA72371, three specimens, collected from the type locality by J. Fairchild on 1 June 1893, from 311 m (170 fathoms), Bounty Islands, New Zealand.

Current name: *Powellisetia gradata* (Suter, 1908) – Powell (1979: 99); Spencer *et al.* (2018).

***Notosetia foveauxana* E.C. Smith, 1962**

Smith, E.C., 1962, p. 53, fig. 9 (holotype).

Holotype: MONZ M.020248

Paratypes: MA72957, six specimens, collected from the type locality by W. Hopkins in May 1955, from 55 m (30 fathoms), off Poutama Island, Stewart Island / Rakiura, New Zealand.

Current name: *Powellisetia subtenuis* (Powell, 1937) – Powell (1979: 99, 100); Spencer *et al.* (2018).

***Notosetia lineata* E.C. Smith, 1962**

Smith, E.C., 1962, p. 55, fig. 13 (holotype).

Holotype: MONZ M.020253

Paratypes: MA72958, two specimens, from the type locality, collected by E.C. Smith, from seaweed washings, Halfmoon Bay, Stewart Island / Rakiura, New Zealand.

Current name: *Powellisetia lineata* (E.C. Smith, 1962) – Powell (1979: 99, 100); Spencer *et al.* (2018).

***Notosetia multilirata* Powell, 1940**

Powell, A.W.B., 1940, pp. 228, 229, pl. 31, fig. 10 (holotype).

Holotype: MA70539, collected by J. Bollons in 1914, from 183 m (100 fathoms) off Manawatāwhi / Great Island, Manawatāwhi / Three Kings Islands, New Zealand.

Paratypes: 72425, eight specimens, from the type locality.

Current name: *Powellisetia subtenuis* (Powell, 1937) – Powell (1979: 99, 100); Spencer *et al.* (2018).

***Notosetia porcellanoides* Powell, 1937**

Powell, A.W.B., 1937, pp. 200, 201, pl. 53, fig. 9 (holotype).

Holotype: NHM 19621023

Paratype: MA72262, one specimen, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Remarks: The specimen has been damaged by glass disease.

Current name: *Powellisetia porcellanoides* (Powell, 1937) – Spencer *et al.* (2018).

†*Notosetia prisca* Finlay, 1924

Finlay, H.J., 1924b, p. 488, fig. 9.

Holotype: MA70540, collected from the early Miocene (Altonian), ‘Pourakino’, northwest of Riverton, Southland, New Zealand.

Paratypes: MA72499, five specimens, from the type locality.

Current name: *Powellisetia prisca* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 242).

†*Notosetia prisca paroeca* Finlay, 1924

Finlay, H.J., 1924b, p. 488, not figured.

Holotype: MA70541, **Figure 1h**, collected from early Miocene (Altonian) Calamity Point Sandstone, [Finlay’s bed 6A (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Paratypes: MA72500, two specimens, from the type locality.

Current name: *Powellisetia paroeca* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 242).

***Notosetia retusa* Powell, 1927**

Powell, A.W.B., 1927d, p. 117, pl. 21, fig. 3.

Holotype: CM M5362

Paratypes: MA72343, three specimens, dredged from

the type locality by a private scientific party in December 1908, off the steamer ‘Rakiura’ in 311 m (170 fathoms) off Puysegur Point, Southland, New Zealand.

Current name: *Powellisetia retusa* (Powell, 1927) – Spencer *et al.* (2018).

***Notosetia subcarinata* Powell, 1940**

Powell, A.W.B., 1940, p. 228, pl. 30, fig. 11 (holotype).

Holotype: MA70542, collected by J. Bollons in 1914, from 183 m (100 fathoms) off Manawatāwhi / Great Island, Manawatāwhi / Three Kings Islands, New Zealand.

Paratypes: MA72429, 28 specimens, from the type locality.

Remarks: Holotype specimen destroyed by glass disease.

Current name: *Powellisetia subtenuis* (Powell, 1937) – Powell (1979: 99, 100); Spencer *et al.* (2018).

***Notosetia subgradata* Powell, 1937**

Powell, A.W.B., 1937, pp. 199, 200, pl. 53, fig. 10 (holotype).

Holotype: NHM 19621021

Paratypes: MA72273, two specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Powellisetia subgradata* (Powell, 1937) – Spencer *et al.* (2018).

***Notosetia subtenuis* Powell, 1937**

Powell, A.W.B., 1937, pp. 200, 201, pl. 53, fig. 8 (holotype).

Holotype: NHM 19621024

Paratype: MA72263, six specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Powellisetia subtenuis* (Powell, 1937) – Spencer *et al.* (2018).

***Notosetia tenuisculpta* Powell, 1933**

Powell, A.W.B., 1933b, p. 37, pl. 6, fig. 7 (holotype).

Holotype: CM M5313

Paratypes: MA72372, four specimens, collected from the type locality, by J. Fairchild on 1 June 1893, from 311 m (170 fathoms), Bounty Islands, New Zealand.

Current name: *Powellisetia tenuisculpta* (Powell, 1933) – Spencer *et al.* (2018).

***Notosetia unicarinata* Powell, 1930**

Powell, A.W.B., 1930a, pp. 543, 544, pl. 88, fig. 18 (holotype).

Holotype: MA70544, dredged by A.W.B. Powell in 1924, from 9–11 m (5–6 fathoms), Tryphena Bay, Aotea/ Great Barrier Island, New Zealand.

Paratypes: MA72426, six specimens, from the type locality.

Current name: *Powellisetia unicarinata* (Powell, 1930) – Spencer *et al.* (2018).

***Ovirissoa delli* Ponder, 1968**

Ponder, W.F., 1968, p. 115, text fig. B.

Holotype: MONZ M.021746

Paratypes: MA72972, two specimens, collected from the type locality, by M. Mestayer, from Lyall Bay, Wellington, New Zealand.

Current name: *Onoba (Ovirissoa) delli* (Ponder, 1968) – Spencer *et al.* (2018).

†*Powellia comes* Finlay, 1926

Finlay, H.J., 1926b, p. 404, pl. 19, fig. 45 (holotype), fig. 46.

Holotype: MA70636, collected from early Miocene (Altonian) Mount Harris Formation at Pukeuri (near Oamaru), Otago, New Zealand.

Paratypes: MA72532, one specimen; MA72533, 19 specimens, all from the type locality.

Current name: *Powellisetia comes* (Finlay, 1926) – Spencer *et al.* (2018).

†*Powellia lactea* Finlay, 1926

Finlay, H.J., 1926b, pp. 403, 404], pl. 19, fig. 47 (holotype), fig. 48.

Holotype: MA70637, collected from early Miocene (Altonian) Mount Harris Formation at Pukeuri (near Oamaru), Otago, New Zealand.

Paratypes: MA72531, two specimens; MA72944, 15 specimens, all from the type locality.

Current name: *Onoba (Ovirissoa) lactea* (Finlay, 1926) – Spencer *et al.* (2018).

***Powellia paupereques* Finlay, 1926**

Finlay, H.J., 1926b, p. 404, pl. 19, fig. 43 (holotype), fig. 44.

Holotype: MA70638, collected from 110 m (60 fathoms) off the Poor Knights Islands, Northland, New Zealand.

Paratypes: MA72534, three specimens, from the type locality.

Current name: *Onoba (Ovirissoa) paupereques* (Finlay, 1926) – Spencer *et al.* (2018).

***Powellisetia bilirata* Ponder, 1965**

Ponder, W.F., 1965b, p. 106, pl. 14, fig. 17 (holotype).

Holotype: MA71265, collected by K. Hipkins on 9 April 1955 from shell sand, McGregors Bay, Whangarei Heads, Northland, New Zealand.

Paratype: MA72845, one specimen, from the type locality.

Current name: *Powellisetia bilirata* Ponder, 1965 – Spencer *et al.* (2018).

***Rissoa (Haurakia) latiambita* Ponder, 1967**

Ponder, W.F., 1967, pp. 199, 200, pl. 2, fig. 2 (holotype).

Holotype: MA71306, collected by K. Hipkins on 9 April 1955, from shell sand, McGregors Bay, Whangarei Heads, Northland, New Zealand.

Paratypes: MA73128, three specimens, from the type locality.

Current name: *Hauraki latiambita* (Ponder, 1967) – Spencer *et al.* (2018).

***Rissoa (Haurakia) mobilicosta* Ponder, 1967**

Ponder, W.F., 1967, p. 200, pl. 1, fig. 8 (holotype), figs 9, 9a.

Holotype: MA71305, collected by W.F. Ponder on 21 August 1963, on *Corallina*, Bream Tail, Northland, New Zealand.

Paratypes: MA72966, five specimens, from the type locality.

Current name: *Haurakia mobilicosta* (Ponder, 1967) – Spencer *et al.* (2018).

***Rissoa (Haurakia) sinuastoma* Ponder, 1967**

Ponder, W.F., 1967, p. 199, pl. 2, fig. 1 (holotype).

Holotype: MA71307, collected by K. Hipkins, from shell sand, Piwhane / Spirits Bay, Northland, New Zealand.

Current name: *Haurakia sinuastoma* (Ponder, 1967) – Spencer *et al.* (2018).

***Rissoa (Setia) infecta* Suter, 1908**

Suter, H., 1908, p. 31, pl. 3, fig. 31.

Lectotypification in Powell, A.W.B., 1933a, p. 198, pl. 34, fig. 5.

Lectotype: GNS TM689

Paralectotypes: MA72782, two specimens, from the type locality, Lyall Bay, Wellington, New Zealand.

Current name: *Haurakia infecta* (Suter, 1908) – Spencer *et al.* (2018).

***Rissoa (Setia) porcellana* Suter, 1908**

Suter, H., 1908, pp. 30, 31, pl. 2, fig. 29.

Lectotypification in Boreham, A., 1959, p. 36

Lectotype: GNS TM715

Paralectotypes: MA72783, two specimens, collected from the type locality, by J. Bollons, in 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Current name: *Powellisetia porcellana* (Suter, 1908) – Spencer *et al.* (2018).

***Rissoa (Setia) stewartiana* Suter, 1908**

Suter, H., 1908, p. 31, pl. 3, fig. 30.

Lectotypification in Boreham, A., 1959, p. 36

Lectotype: GNS TM726

Paralectotypes: MA72787, seven specimens, collected by J. Bollons, from 33 m (18 fathoms), Port Pegasus, Stewart Island / Rakiura, New Zealand.

Current name: *Powellisetia porcellana* (Suter, 1908) – Spencer *et al.* (2018).

***Rissoia candidissima* Webster, 1905**

Webster, W.H., 1905, p. 278, fig. 7.

Holotype: MA70668, collected from Takapuna Beach, Auckland, New Zealand.

Paratype: MA73242, one specimen, from the type locality.

Current name: *Subonoba candidissima* (Webster, 1905) – Spencer *et al.* (2018).

†*Rissoina perplexa* Finlay, 1924

Finlay, H.J., 1924b, pp. 489, 490, fig. 11.

Holotype: MA70678, collected from Miocene Nga Pari

Formation, [Park's horizon 6 (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Current name: *Onoba perplexa* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 242).

***Rissopsis (Peringiella) elegans* Ponder, 1965**

Ponder, W.F., 1965b, p. 115, pl. 13, figs 3, 3a (holotype); pl. 12, figs 7, 8.

Holotype: MA71266, collected by K. Hipkins on 29 December 1953, from 40 m (22 fathoms), 0.8 km (0.5 miles) west of Stephenson Island, Whangaroa Bay, Northland, New Zealand.

Current name: *Onoba (Ovirissoa) elegans* (Ponder, 1965) – Spencer *et al.* (2018).

***Striatestea bountyensis* Powell, 1927**

Powell, A.W.B., 1927a, pp. 544, 545, pl. 28, fig. 18.

Holotype: MA72145, dredged by J. Fairchild in June 1893, from 311 m (170 fathoms), south of Bounty Island, New Zealand.

Current name: *Striatestea bountyensis* Powell, 1927 – Spencer *et al.* (2018).

***Striatestea eulima* Powell, 1940**

Powell, A.W.B., 1940, pp. 227, 228, pl. 30, fig. 2 (holotype).

Holotype: MA70732, collected by A.W.B. Powell in 1932, from shell sand, Takapaukura/Tom Bowling Bay, Northland, New Zealand.

Paratypes: MA71568, two specimens, from the type locality.

Remarks: Holotype specimen destroyed by glass disease.

Current name: *Striatestea eulima* Powell, 1940 – Spencer *et al.* (2018).

***Striatestea poutama* Ponder, 1967**

Ponder, W.F., 1967, p. 203, pl. 2, fig. 4 (holotype).

Holotype: MONZ M.021605

Paratype: MA72967, one specimen, collected by E.C. Smith, from the type locality in June 1955, from 55 m (30 fathoms), in bryozoan sand, off Poutama Island, west of South West Cape / Puihiwaero, Stewart Island / Rakiura, New Zealand.

Current name: *Striatestea poutama* Ponder, 1967 – Spencer *et al.* (2018).

***Subonoba alpha* Powell, 1955**

Powell, A.W.B., 1955, p. 77, pl. 2, fig. 13 (holotype).

Holotype: MA71210, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Paratypes: MA71598, 40 specimens, from the type locality.

Current name: *Subonoba alpha* Powell, 1955 – Spencer *et al.* (2018).

***Subonoba aupouria* Powell, 1940**

Powell, A.W.B., 1940, p. 225, pl. 30, fig. 8 (holotype).

Holotype: MA72147, collected by J. Bollons from

91 m (50 fathoms), between Piwhane / Spirits Bay and Manawatāwhi / Three Kings Islands, New Zealand.

Paratypes: MA73602, two specimens, from the type locality.

Remarks: MA72147 contained 3 specimens, but only one approached the length given by Powell for the holotype and this is retained as the holotype specimen. The two smaller specimens have been removed and given paratype status as MA73602.

Current name: *Subonoba aupouria* Powell, 1940 – Spencer *et al.* (2018).

***Subonoba beta* Powell, 1955**

Powell, A.W.B., 1955, p. 77, pl. 2, fig. 14 (holotype).

Holotype: MA71211, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Paratypes: MA71600, five specimens, from the type locality.

Current name: *Subonoba beta* Powell, 1955 – Spencer *et al.* (2018).

***Subonoba contigua* Powell, 1958**

Powell, A.W.B., 1958a, pp. 184, 185, pl. 1, fig. 8 (holotype).

Holotype: South Australian Museum, Adelaide

Paratypes: MA71956, three specimens from the type locality, BANZARE station 84, Commonwealth Bay, Antarctica.

Current name: *Subonoba gelida* (E.A. Smith, 1907) – MolluscaBase (2020).

***Subonoba delicatula* Powell, 1933**

Powell, A.W.B., 1933c, p. 235, fig. 3 (holotype).

Holotype: MONZ M.001678

Paratype: MA72365*, collected from the type locality by J. Bollons, from beach drift, Faith Harbour [North Harbour], Auckland Islands, New Zealand.

Remarks: The paratype lot has not been found since 1993.

Current name: *Subonoba delicatula* Powell, 1933 – Spencer *et al.* (2018).

***Subonoba delta* Powell, 1955**

Powell, A.W.B., 1955, p. 78, pl. 2, fig. 12 (holotype).

Holotype: MA71213, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.

Paratypes: MA71602, 11 specimens, from the type locality.

Current name: *Subonoba delta* Powell, 1955 – Spencer *et al.* (2018).

***Subonoba edita* Powell, 1939**

Powell, A.W.B., 1939, p. 231, pl. 49, fig. 6 (holotype).

Holotype: MA70739, collected by R.H. Harrison from shell sand, Rosa Island, Port Pegasus, Stewart Island / Rakiura, New Zealand.

Current name: *Subonoba edita* Powell, 1939 – Spencer *et al.* (2018).

***Subonoba fallai* Powell, 1955**

Powell, A.W.B., 1955, p. 78, 79, pl. 2, fig. 15 (holotype).
Holotype: MA71214, collected by R.A. Falla, 1941–1944, during the ‘Cape Expedition’ from Ewing Island, Port Ross, Auckland Islands, New Zealand.
Paratypes: MA71603, 14 specimens, from the type locality.
Current name: *Subonoba fallai* Powell, 1955 – Spencer *et al.* (2018).

***Subonoba gamma* Powell, 1955**

Powell, A.W.B., 1955, p. 77, pl. 2, fig. 17 (holotype).
Holotype: MA71212, collected by J. Bollons, from 91 m (50 fathoms), off Snares Islands / Tini Heke Islands, New Zealand.
Paratypes: MA71601, 13 specimens, from the type locality.
Current name: *Subonoba gamma* Powell, 1955 – Spencer *et al.* (2018).

***Subonoba inornata* Powell, 1933**

Powell, A.W.B., 1933a, pp. 202, 203, pl. 35, fig. 3 (holotype).
Holotype: MA70740, collected by A.W.B. Powell in February 1933, from seaweeds, Waitangi, Chatham Islands, New Zealand.
Paratype: MA71535, one specimen, from the type locality.
Current name: *Subonoba inornata* Powell, 1933 – Spencer *et al.* (2018).

***Subonoba morioria* Powell, 1933**

Powell, A.W.B., 1933a, pp. 203, 204, pl. 35, fig. 2 (holotype).
Holotype: MA70741, collected by A.W.B. Powell in February 1933, from shell sand, Waitangi, Chatham Islands, New Zealand.
Paratypes: MA71536, six specimens, from the type locality.
Current name: *Subonoba morioria* Powell, 1933 – Spencer *et al.* (2018).

***Subonoba oliveri* Powell, 1955**

Powell, A.W.B., 1955, pp. 79, 80, pl. 2, fig. 16 (holotype).
Syntypes: MA71215, two specimens, collected by R. Oliver on 5 November 1944 during the ‘Cape Expedition’, from 37 m (20 fathoms), Perseverance Harbour, Campbell Island / Motu Ihupuku, New Zealand.
Paratypes: MA71604, two specimens, from the type locality.
Current name: *Subonoba oliveri* Powell, 1955 – Spencer *et al.* (2018).

***Subonoba parvula* Powell, 1931**

Powell, A.W.B., 1931b, p. 375, pl. 51, fig. 7.
Holotype: MA72148, collected by W. La Roche in 1922, from 9 m (5 fathoms), off the entrance to Rangaunu Harbour, Rangaunu Bay, Northland, New Zealand.
Paratype: MA71472, one specimen, collected from the type locality.
Current name: *Subonoba parvula* Powell, 1931 – Spencer *et al.* (2018).

***Subonoba paucicostata* Powell, 1931**

Powell, A.W.B., 1931b, p. 375, pl. 51, fig. 3.
Holotype: CM M2849
Paratypes: MA72359, six specimens, collected from the type locality, from 91 m (50 fathoms), off the Bounty Islands, New Zealand.
Current name: *Subonoba paucicostata* Powell, 1931 – Spencer *et al.* (2018).

***Subonoba sorenseni* Powell, 1955**

Powell, A.W.B., 1955, pp. 76, 77, pl. 2, fig. 11 (holotype).
Holotype: MA71209, collected by J.H. Sorensen in 1943, during the ‘Cape Expedition’, Perseverance Harbour, Campbell Island / Motu Ihupuku, New Zealand.
Current name: *Subonoba sorenseni* Powell, 1955 – Spencer *et al.* (2018).

***Subonoba tenuistriata* Powell, 1933**

Powell, A.W.B., 1933c, p. 235, text fig. 4 (holotype).
Holotype: MONZ M.001679
Paratype: MA72366*, collected from the type locality by J. Bollons, from 174 m (95 fathoms), 23 km (14 miles) north of Auckland Islands, New Zealand.
Remarks: MA72366 has not been found since 1993.
Current name: *Subonoba tenuistriata* Powell, 1933 – Spencer *et al.* (2018).

Family RISSOINIDAE***Rissoina achatinoides* Powell, 1937**

Powell, A.W.B., 1937, p. 202, pl. 53, fig. 7 (holotype).
Holotype: NHM 19621030
Paratypes: MA72255, three specimens, collected by A.W.B. Powell on 16 August 1932 from the type locality, station 930, R.R.S. Discovery II cruise, in 29 m off Waikuku Beach, Northland, New Zealand.
Current name: *Rissoina achatinoides* Powell, 1937 – Spencer *et al.* (2018).

***Rissoina anguina* Finlay, 1926**

Finlay, H.J., 1926b, p. 379, pl. 19, fig. 39 (holotype), fig. 40.
Holotype: MA70673, specimen probably collected by W. La Roche, Whangaroa Harbour, Northland, New Zealand.
Paratypes: MA72528, two specimens, from the type locality.
Current name: *Rissoina anguina* Finlay, 1926 – Spencer *et al.* (2018).

***Rissoina aupouria* Powell, 1937**

Powell, A.W.B., 1937, pp. 201, 202, pl. 53, fig. 6 (holotype).
Holotype: NHM 19621018
Paratype: MA72256, one specimen, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.
Current name: *Rissoina aupouria* Powell, 1937 – Spencer *et al.* (2018).

***Rissoina ficator* Finlay, 1930**

Finlay, H.J., 1930b, pp. 227, 228, pl. 45, fig. 38 (holotype).

Holotype: MA70675, collected from 69 m (38 fathoms), off Cuvier Island, New Zealand.

Current name: *Rissoina ficator* Finlay, 1930 – Spencer *et al.* (2018).

***Rissoina fucosa* Finlay, 1930**

Finlay, H.J., 1930b, p. 228, pl. 45, fig. 43 (holotype).

Holotype: MA70676, collected from 69 m (38 fathoms), off Cuvier Island, New Zealand.

Current name: *Rissoina fucosa* Finlay, 1930 – Spencer *et al.* (2018).

***Rissoina larochei* Finlay, 1930**

Finlay, H.J., 1930b, p. 227, not figured.

Holotype: MA70677, **Figure 1i**, dredged by W. La Roche, from 22 m (12 fathoms), Doubtless Bay, Northland, New Zealand.

Paratype: MA72577, one specimen, from the type locality.

Current name: *Rissoina larochei* Finlay, 1930 – Spencer *et al.* (2018).

***Rissoina manawatawhia* Powell, 1937**

Powell, A.W.B., 1937, pp. 202, 203, pl. 53, fig. 5 (holotype).

Holotype: NHM 19621031

Paratypes: MA72257, 11 specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 934, R.R.S. Discovery II cruise, in 92 m off Manawātāwhi / Three Kings Islands, New Zealand.

Current name: *Rissoina manawatawhia* Powell, 1937 – Spencer *et al.* (2018).

***Rissoina powelli* Finlay, 1930**

Finlay, H.J., 1930b, p. 227, pl. 45, fig. 37 (holotype).

Holotype: MA70679, collected from 110 m (60 fathoms), off Poor Knights Islands, Northland, New Zealand.

Paratypes: MA72578, 13 specimens, from the type locality.

Current name: *Rissoina powelli* Finlay, 1930 – Spencer *et al.* (2018).

Family ZEBINIDAE***Rissoina porteri* Baker, Hanna & Strong, 1930**

Baker, F., *et al.*, 1930, p. 30, pl. 1, fig. 15 (holotype).

Holotype: MCAS TYX 43963; CatNum 66053

Paratypes: MA73239, seven specimens, collected by G.D. Porter in 1921, from the type locality, Gulf of California, Mexico.

Current name: *Pandalosia ephamilla* (R.B. Watson, 1886) – MolluscaBase (2020).

Family APORRHAIIDAE**†*Drepanocheilus (Tulocheilus) bensoni* Finlay & Marwick, 1937**

Finlay, H.J. & J. Marwick, 1937, p. 63, pl. 8, figs 3, 4 (holotype).

Holotype: MA70253, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago,

New Zealand.

Current name: *Drepanocheilus (Tulocheilus) bensoni* Finlay & Marwick, 1937 – Maxwell in: Spencer *et al.* (2009: 242).

Family STROMBIDAE***Euprotomus kiwi* Bozetti & Sargent, 2011**

Bozetti, L. & Sargent, D.M., 2011, pp. 23–27, pl. 1, (holotype and paratype), fig. 1.

Holotype: MA73377, collected from Raoul Island, Kermadec Islands, New Zealand.

Paratype: MA73378, one specimen, collected by F.J. Brook, June 1991, from 15m, on gravel, west side of Meyer Island, Kermadec Islands, New Zealand.

Current name: *Euprotomus vomer* (Röding, 1798) – Spencer *et al.* (2018).

***Strombus (Dolomena) kleckhamae* Cernohorsky, 1971**

Cernohorsky, W.O., 1971b, pp. 131–133, figs 1, 1a (holotype), figs 2, 3 (paratypes).

Holotype: MA71326, in pumice bank, 3 m (10 ft) above sealevel, Simpson Harbour, west side of Matupi Island, Rabaul, Papua New Guinea.

Paratypes: MA71591, one specimen, from the type locality; MA71592, one specimen, collected by A. Kuster, Rabaul, Papua New Guinea.

Current name: *Barneystrombus kleckhamae* (Cernohorsky, 1971) – MolluscaBase (2020).

Family STRUTHIOLARIIDAE**†*Conchothya expedita* Finlay & Marwick, 1937**

Finlay, H.J. & J. Marwick, 1937, p. 65, pl. 8, figs 1, 2 (holotype).

Holotype: MA70196, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Current name: *Conchothya australis* (P. Marshall, 1916) – Beu & Raine (2009).

†*Pellicaria marwicki* Finlay, 1931

Finlay, H.J., 1931a, pp. 17, 18, not figured.

Holotype: MA70613, **Figures 1j, k**, collected from the Pliocene Dry Creek Sands, at 122–152 m (400–500 ft) depth, Abattoirs Bore, Adelaide, South Australia, Australia.

Paratypes: MA72595, six specimens, collected from the type locality.

Current name: *Tylospira marwicki* (Finlay, 1931) – Darragh (1991: 162 ff.).

†*Struthiolaria calcar* Hutton, 1886

Hutton, F.W. 1886, p. 335, not figured.

Neotypification in: Marwick, J., 1924a, p. 176, pl. 11 fig. 11 (neotype), figs 8, 13 (Hutton's plastotype).

Neotype: MA70735, **Figures 1l, m**, from the early Miocene (Altonian) of the Mount Harris Formation near Ardgowan, northwest of Oamaru, Otago, New Zealand.

Current name: *Struthiolaria calcar* Hutton, 1886 – Beu & Raine (2009).

†*Struthiolaria firthi* Marwick, 1948

Marwick, J., 1948, p. 29, pl. 6, figs 2, 3 (holotype).

Holotype: GNS TM1260

Paratype: MA30020, one specimen, collected from the late Pliocene (Waipipian) of the Kaawa Formation 25–30 m (84–98 ft) below the surface in the Waitemata Brewery well, Otahuhu, Auckland, New Zealand.

Current name: *Struthiolaria firthi* Marwick, 1948 – Maxwell in: Spencer *et al.* (2009: 242).

†*Struthiolaria lawsi* Powell & Bartrum, 1929

Powell, A.W.B. & J.A. Bartrum, 1929, pp. 421, 422, pl. 35, figs 9, 11 (holotype), fig. 10 (paratype).

Holotype: MA72146, from the early Miocene (Otaian) Tipakuri Formation of ‘Double U Bay’, approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Paratypes: MA71700, one specimen; MA71701, two specimens, all from the type locality.

Current name: *Struthiolaria lawsi* Powell & Bartrum, 1929 – Maxwell in: Spencer *et al.* (2009: 242).

†*Struthiolaria prior* Finlay, 1926

Finlay, H.J., 1926a, p. 228, pl. 56, fig. 17 (holotype).

Holotype: MA70738, collected from the late Oligocene (Duntroonian) Chatton Formation, Waikaia, Southland, New Zealand.

Paratype: MA71657, one specimen, from the type locality.

Remarks: Beu & Raine (2009) consider that “the status of *S. prior* is uncertain, but it seems probable that it is not worth separating from *S. calcar* (= *S. subspinosa*). Finlay (1926b, p. 228) separated it from *S. calcar* on the basis of its lower-placed shoulder angulation, its finer spiral sculpture and its more coarsely nodulose peribasal angulation, but these alleged differences do not seem to be constant.”

Current name: *Struthiolaria* cf. “*prior* Finlay, 1926” – Beu & Raine (2009).

†*Struthiolaria (Callusaria) otaioica* Laws, 1935

Laws, C.R., 1935c, pp. 41, 42, pl. 7, fig. 27 (holotype).

Holotype: MA70737, from early Miocene (Otaian) Mount Harris Formation, Blue Cliffs, Otaio River, Canterbury, New Zealand.

Paratype: MA72685, one specimen, from the type locality.

Current name: *Struthiolaria (Callusaria) otaioica* Laws, 1935 – Maxwell in: Spencer *et al.* (2009: 242).

†*Struthiolaria (Pelicularia) incrassata* Powell, 1931

Powell, A.W.B., 1931a, pp. 101, 102, pl. 13, figs 30, 33 (paratypes).

Holotype: MA70736, collected by A.W.B. Powell in January 1931 from from late Pliocene (Waipipian) Tangahoe Formation, on the coast near the mouth of Waihi Stream, Hawera, Taranaki, New Zealand.

Paratypes: MA71641, two specimens, collected in January 1927 from the type locality.

Current name: *Struthiolaria incrassata* Powell, 1931 – Beu & Raine (2009).

Family CASSIDAE

†*Euspinacassis emilyae* Laws, 1932

Laws, C.R., 1932, pp. 189, 190, pl. 28, fig. 14, 15 (holotype).

Holotype: MA70303, from the early Miocene (Altonian) of the Mount Harris Formation near Ardgowan, northwest of Oamaru, Otago, New Zealand.

Current name: *Echinophoria emilyae* (Laws, 1932) – Maxwell in: Spencer *et al.* (2009: 244).

†*Euspinacassis multinodosa* Powell, 1928

Powell, A.W.B., 1928b, pp. 634, 635, pl. 76, fig. 31 (holotype), fig. 30 (paratype).

Holotype: MA72061, collected from large fallen blocks of early Miocene (Altonian) Nihotupu Formation, southern end of Maukatia Bay, south of Muriwai Beach, west Auckland, New Zealand.

Paratype: MA71418, one specimen, from the type locality.

Current name: *Echinophoria toreuma* (Powell, 1928) – Beu & Raine (2009).

†*Euspinacassis oneroaensis* Powell, 1938

Powell, A.W.B., 1938a, p. 374, pl. 39, fig. 10, 11 (holotype).

Holotype: MA72062, from the early Miocene (Otaian) Tipakuri Formation of ‘Double U Bay’, approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Paratype: MA71714, one specimen, from the type locality.

Current name: *Echinophoria oneroaensis* (Powell, 1938) – Maxwell in: Spencer *et al.* (2009: 244).

†*Euspinacassis pollens* Finlay, 1926

Finlay, H.J., 1926a, p. 230, pl. 55, fig. 11 (holotype), figs 10, 12 (paratypes).

Holotype: MA70304, from early Miocene (Altonian) Calamity Point Sandstone, [Finlay’s bed 6A (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Paratypes: MA71659, four specimens, from the type locality.

Current name: *Echinophoria pollens* (Finlay, 1926) – Beu & Raine (2009).

†*Taieria allani* Finlay & Marwick, 1937

Finlay, H.J. & J. Marwick, 1937, p. 68, pl. 9, figs 17, 20 (holotype), fig. 19 (paratype).

Holotype: MA70751, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Current name: *Galeodea allani* (Finlay & Marwick, 1937) – Beu & Raine (2009).

Xenogalea collectea Finlay, 1928

Finlay, H.J., 1928, pp. 246 not figured.

Holotype: MA70851, collected off Opotiki, Bay of Plenty, New Zealand.

Paratype: MA72554, one specimen, from the type locality.

Current name: *Semicassis labiata* (Perry, 1811) – Powell (1979: 159); Spencer *et al.* (2018).

***Xenogalea finlayi* Iredale, 1927**

Iredale, T. 1927, p. 342, figured in Finlay, 1924c, p. 525, pl. 52, figs 3a, b, c.

Holotype: MA70852, trawled from 37 m (20 fathoms), between Otago Heads [Taiaroa Head] and Waikouaiti, Otago, New Zealand.

Current name: *Semicassis pyrum* (Lamarck, 1822) – Powell (1979: 160).

***Xenogalea powelli* Finlay, 1928**

Finlay, H.J., 1928, p. 247 not figured.

Holotype: MA70853, collected by A.W.B. Powell from 73–91 m (40–50 fathoms), off Whakatane, Bay of Plenty, New Zealand.

Current name: *Semicassis pyrum* (Lamarck, 1822) – Powell (1979: 159).

***Xenophalium ericanum* Powell, 1928**

Powell, A.W.B., 1928b, pp. 639, 640, pl. 75, fig. 29 (holotype).

Holotype: MA72168, collected by E. Sanderson, from 46 m (25 fathoms), off Te Whatu/Berghan Point, Northland, New Zealand.

Current name: *Semicassis royana* (Iredale, 1914) – Spencer *et al.* (2018).

***Xenophalium hamiltoni* Powell, 1928**

Powell, A.W.B., 1928b, p. 639, pl. 75, fig. 26 (holotype), fig. 25 (holotype).

Holotype: MONZ M.001697

Paratypes: MA71419, three specimens, collected from the type locality by H. Hamilton from the S. T. [Steam Trawler] *Futurist*, in July 1925, from 110 m (60 fathoms) off Cape Campbell, Marlborough, New Zealand.

Current name: *Semicassis pyrum* (Lamarck, 1822) – Spencer *et al.* (2018).

***Xenophalium harrisonae* Powell, 1928**

Powell, A.W.B., 1928b, p. 640, pl. 75, fig. 27 (holotype), fig. 28 (paratype).

Holotype: MA72169, collected by R.H. Harrison in 1926, from Mason Bay, Stewart Island / Rakiura, New Zealand.

Paratypes: MA71420, one specimen; MA73084, four specimens, all from the type locality.

Current name: *Semicassis pyrum* (Lamarck, 1822) – Powell (1979: 159).

†***Xenophalium toreuma* Powell, 1928**

Powell, A.W.B., 1928b, p. 636, pl. 76, figs 33, 34 (holotype).

Holotype: MA72170, from early Miocene (Altonian) Nihotupu Formation, between Powell and Bartrum Bays, approximately 2 km south of Muriwai Beach, west Auckland, New Zealand.

Current name: *Echinophoria toreuma* (Powell, 1928) – Maxwell in: Spencer *et al.* (2009: 244).

***Xenophalium (Xenogalea) abernethyi* Dell, 1956**

Dell, R.K., 1956, pp. 87, 88, pl. 12, fig. 122 (holotype), fig. 119.

Holotype: MONZ M.009752

Paratype: MA72750, one specimen, collected from the type locality by F. Abernethy, in October 1953, from 73 m (40 fathoms), off Castlepoint, Wairarapa, New Zealand.

Current name: *Semicassis pyrum* (Lamarck, 1822) – Powell (1979: 159).

***Xenophalium (Xenogalea) matai* Powell, 1952**

Powell, A.W.B., 1952, p. 178, pl. 35, fig. 6 (holotype).

Holotype: MA71187, collected by A.W.B. Powell in November 1934, from intertidal mudflat, Beach Harbour, Breaksea Sound, Fiordland [Southland], New Zealand.

Paratype: MA71440, one specimen, from the type locality.

Current name: *Semicassis pyrum* (Lamarck, 1822) – Spencer *et al.* (2018).

Family CHARONIIDAE

***Charonia capax* Finlay, 1926**

Finlay, H.J., 1926b, pp. 397, 398, pl. 20, fig. 67 (holotype).

Holotype: MA70138, collected from 37 m (20 fathoms), off Otago Heads [Taiaroa] Head, Otago, New Zealand.

Current name: *Charonia lampas* (Linnaeus, 1758) – Spencer *et al.* (2018).

***Charonia capax euclioides* Finlay, 1926**

Finlay, H.J., 1926b, p. 398, pl. 20, fig. 68 (holotype).

Holotype: MA70139, collected from 73 m (40 fathoms), off Otago Heads [Taiaroa Head], Otago, New Zealand.

Current name: *Charonia lampas* (Linnaeus, 1758) – Spencer *et al.* (2018).

Family CYMATIIDAE

†***Austrotriton cyphoides* Finlay, 1924**

Finlay, H.J., 1924a, pp. 455, 456, pl. 51, figs 3a, 3b (holotype).

Holotype: MA70083, collected from late Eocene (Kaiatan), Waiareka Volcanics, Lorne [Whitstone, near the disused railway station], Otago, New Zealand.

Remarks: Labels with the specimen have the locality as “Kakanui Beach (tuffs below limestone)”, making the “Deborah Volcanic Formation (Whaingaroan) near Everett’s Quarry or Gee’s Point” the source lithology (Beu & Maxwell, 1990: 120). However, as reported by these authors “Maxwell (1968) showed that they (and several other species described by Finlay) are almost certainly from the green tuff (Waiareka Volcanic Formation) at Lorne, near Oamaru.”

Current name: *Austrosassia cyphoides* (Finlay, 1924) – Strong *et al.* (2019: 30).

†*Austrotriton maorium* Finlay, 1924

Finlay, H.J., 1924a, p. 453, pl. 48, figs 1a, b (holotype), figs 2a, b, c, 3a, b (paratypes), pl. 51, fig. 4 (paratype).

Holotype: MA70084, collected from the early Miocene (Altonian) Target Gully Shellbed, Mount Harris Formation, Glen Creek, Oamaru, Otago, New Zealand.

Paratypes: MA72480, two specimens, from the type locality; MA73191, two specimens, collected from early Miocene (Altonian) Long Beach Shellbed, [Finlay's bed 6B (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Current name: *Austrosassia maoria* (Finlay, 1924) – Strong *et al.* (2019: 30).

†*Austrotriton maorium insignitum* Finlay, 1924

Finlay, H.J., 1924a, p. 454, pl. 51, fig. 5 (holotype).

Holotype: MA70085, collected from the early Miocene (Altonian) Target Gully Shellbed, Mount Harris Formation, Glen Creek, Oamaru, Otago, New Zealand.

Paratypes: MA72481, 32 specimens, from the type locality.

Current name: *Austrosassia maoria* (Finlay, 1924) – Strong *et al.* (2019: 30).

†*Cabestana debilior* Finlay, 1930

Finlay, H.J., 1930a, p. 59, pl. 3, fig. 31 (holotype).

Holotype: MA70126, collected from the Pleistocene (Castlecliffian) at Castlecliff, Whanganui, New Zealand.

Current name: *Cabestana tabulata* (Menke, 1843) – Beu & Raine (2009).

Cabestana otagoensis Powell, 1954

Powell, A.W.B., 1954a, pp. 236, 237, pl. 39, fig. 1 (holotype).

Holotype: MA71198, collected by J. Black, from 82 m (45 fathoms), 16 km (10 miles) north of Moeraki, Otago, New Zealand.

Current name: *Cabestana tabulata* (Menke, 1843) – Beu & Raine (2009).

Cabestana waterhousei segregata Powell, 1933

Powell, A.W.B., 1933d, pp. 156, 157, pl. 23, fig. 3 (holotype).

Holotype: MA72036, collected by A.W.B. Powell on 6 November 1927, near Cornwallis, Manukau Harbour, Auckland, New Zealand.

Current name: *Cabestana tabulata* (Menke, 1843) – Beu & Raine (2009).

†*Charonia clifdenensis* Finlay, 1924

Finlay, H.J., 1924a, pp. 460, 461, pl. 48, fig. 9a (holotype); figs 9b, 9c (paratypes).

Holotype: MA70140, from early Miocene (Altonian) Calamity Point Sandstone, [Finlay's bed 6A (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Paratypes: MA72483, three specimens, from the type locality.

Current name: *Proxicharonia neozelanica* (P. Marshall & Murdoch, 1923) – Beu & Raine (2009); Strong *et al.* (2019: 30).

†*Charonia (Charoniella) arthritica* Powell & Bartrum, 1929

Powell, A.W.B. & J.A. Bartrum, 1929, pp. 427, 428, pl. 34, figs 1, 2 (holotype).

Holotype: MA72041, from the early Miocene (Otaian) Tipakuri Formation of 'Double U Bay', approximately 800 m north of Oneroa Beach, Waiheke Island, Auckland, New Zealand.

Current name: *Proxicharonia arthritica* (Powell & Bartrum, 1929) – Strong *et al.* (2019: 30).

†*Cymatium decagonium* Finlay, 1924

Finlay, H.J., 1924a, p. 460, pl. 48, fig. 4 (holotype).

Holotype: MA71288, collected from the middle Eocene (Bortonian) Waihao Greensand at Waihao Downs, south Canterbury, New Zealand.

Current name: *Sassia decagonia* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 244); MolluscaBase (2020).

†*Cymatium octoserratum* Finlay, 1924

Finlay, H.J., 1924a, p. 459, pl. 48, figs 6a, 6b (holotype).

Holotype: MA70235, collected from the early Miocene (Altonian) Target Gully Shellbed, Mount Harris Formation, Glen Creek, Oamaru, Otago, New Zealand.

Paratypes: MA72482, eight specimens, from the type locality.

Current name: *Sassia tortirostris* (Tate, 1888) – Maxwell in: Spencer *et al.* (2009: 244); MolluscaBase (2020).

†*Cymatium sculpturatum* Finlay, 1924

Finlay, H.J., 1924a, pp. 458, 459, pl. 48, fig. 7 (holotype).

Holotype: MA70237, collected from late Eocene (Kaiatan), Waiareka Volcanics, Lorne [Whitstone, near the disused railway station], Otago, New Zealand.

Paratypes: MA73475, seven specimens, from the type locality.

Remarks: See entry for MA70083.

Current name: *Haurokoa marwicki* (Finlay, 1924) – Beu & Raine (2009).

Fusitriton laudandum Finlay, 1926

Finlay, H.J., 1926b, p. 399, pl. 20, fig. 65 (holotype).

Holotype: MA70333, collected from 73 m (40 fathoms), off Otago Heads [Taiaroa Head], Otago, New Zealand.

Current name: *Fusitriton laudandus* Finlay, 1926 – MolluscaBase (2020).

†*Mayena bartrumi* Powell, 1938

Powell, A.W.B., 1938a, pp. 372, 373, pl. 39, fig. 12 (holotype).

Holotype: MA72090, collected by A.W.B. Powell, from the early Miocene (Otaian) Tipakuri Formation at Church Bay (sometimes known as Squadron Bay), Waiheke Island, Auckland, New Zealand.

Paratype: MA71713, one specimen, from the type locality.

Current name: *Haurokoa bartrumi* (Powell, 1938) – Maxwell in: Spencer *et al.* (2009: 244).

***Proxicharonia palmeri* Powell, 1967**

Powell, A.W.B. 1967, pp. 188, 189, pl. 36, figs 11, 12 (holotype).

Holotype: MA71300, collected by W. Palmer from 43 m (140 ft), 800 m (1 mile), north of Northern Reef, Poor Knights Islands, Northland, New Zealand.

Current name: *Proxicharonia palmeri* Powell, 1967 – Strong *et al.* (2019: 30).

Family RANELLIDAE**†*Cymatium kaiparaense* Finlay, 1924**

Finlay, H.J., 1924a, pp. 457, 458, pl. 48, fig. 8 (holotype).

Holotype: MA70234, collected from the early Miocene (Otaian – early Altonian) Pakaurangi Formation, Pakaurangi Point, Kaipara, Northland, New Zealand.

Current name: *Ranella kaiparaensis* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 244).

***Mayena australasia blacki* Powell, 1954**

Powell, A.W.B., 1954a, p. 237, pl. 39, fig. 2 (holotype).

Holotype: MA71199, collected by J. Black, from 110–128 m (60–70 fathoms), off eastern Otago, New Zealand.

Paratypes: MA71431, two specimens, from the type locality.

Current name: *Ranella australasia* (Perry, 1811) – Spencer *et al.* (2018).

***Mayena australasia vossi* Powell, 1952**

Powell, A.W.B., 1952, pp. 176, 177, pl. 35, fig. 4 (holotype).

Holotype: MA71186, collected by A.S. Voss on 27 April 1948, from 128 m (70 fathoms), 13 km (8 miles) east of Mayor Island, Bay of Plenty, New Zealand.

Current name: *Ranella australasia* (Perry, 1811) – Spencer *et al.* (2018).

***Mayena multinodosa* Bucknill, 1927**

Bucknill, C.E.R. 1927, p. 312, fig. 2 (holotype).

Holotype: MA70452, collected by E. Sanderson, from cray-fish pots, in 46 m (25 fathoms), Cavalli Islands, Northland, New Zealand.

Current name: *Ranella olearium* (Linnaeus, 1758) – Powell (1979:167); MolluscaBase (2020).

***Mayena zelandica* Finlay, 1926**

Finlay, H.J., 1926b, p. 400, pl. 20, fig. 66 (holotype).

Holotype: MA70453, collected off Tauranga, Bay of Plenty, New Zealand.

Paratype: MA72921, one specimen, from the type locality.

Current name: *Ranella australasia* (Perry, 1811) – Powell (1979:167); MolluscaBase (2020).

Family TONNIDAE***Tonna maoria* Powell, 1938**

Powell, A.W.B., 1938c, pp. 166, 167, pl. 40, figs 5, 6.

Holotype: MA72153, collected from Houhora Heads, Northland, New Zealand.

Current name: *Tonna cumingii* (Reeve, 1849) – Powell (1979: 161).

Family ANABATHRIDAE***Epigrus striatus* Powell, 1927**

Powell, A.W.B., 1927a, p. 545, pl. 28, fig. 16.

Holotype: MA72056, collected by W. La Roche in 1922, from 10–18 m (6–10 fathoms), off Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratype: MA72430, one specimen, from the type locality.

Current name: *Microdryas striatus* (Powell, 1927) – Powell (1979: 104); MolluscaBase (2020).

***Estea angustata* Powell, 1927**

Powell, A.W.B., 1927a, pp. 543, 544, pl. 28, fig. 10.

Holotype: MA72058, collected by W. La Roche in 1922, from 10–18 m (6–10 fathoms), off Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratypes: MA71525, two specimens, from the type locality.

Current name: *Pisinna angustata* (Powell, 1927) – Spencer *et al.* (2018).

***Estea guesti* Powell, 1933**

Powell, A.W.B., 1933a, p. 200, pl. 35, fig. 5 (holotype).

Holotype: MA70277, collected by A.W.B. Powell in February 1933, from shell sand, Waitangi, Chatham Islands, New Zealand.

Current name: *Pisinna subfusca* (Hutton, 1873) – Spencer *et al.* (2018); MolluscaBase (2020).

***Estea hipkinsi* Ponder, 1965**

Ponder, W.F., 1965c, p. 136, pl. 21, fig. 9 (holotype).

Holotype: MA71270, collected by R.S. Bird in June 1951 from Piwhane / Spirits Bay, Northland, New Zealand.

Paratypes: MA72838, two specimens, from the type locality.

Remarks: One paratype was collected by I. Worthy in 1949, the other by R.S. Bird in June 1951.

Current name: *Pisinna hipkinsi* (Ponder, 1965) – Spencer *et al.* (2018).

***Estea juddi* Ponder, 1968**

Ponder, W.F., 1968, p. 116, text fig. E

Holotype: MONZ M.021741

Paratype: MA72791, one specimen, collected by W. Judd, in 37 m (120 feet) off Whakaari/White Island, Bay of Plenty, New Zealand.

Current name: *Pisinna juddi* (Ponder, 1968) – Spencer *et al.* (2018).

***Estea manawatawhia* Powell, 1937**

Powell, A.W.B., 1937, p. 198, pl. 53, fig. 3 (holotype).

Holotype: NHM 19621017

Paratypes: MA72265, nine specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatawhi / Three Kings Islands, New Zealand.

Current name: *Pisinna manawatawhia* (Powell, 1937) – Spencer *et al.* (2018).

***Estea morioria* Powell, 1933**

Powell, A.W.B., 1933a, pp. 200, 201, pl. 35, fig. 6 (holotype).

Holotype: MA70278, collected by A.W.B. Powell and/or C.A. Fleming in February 1933, from 18 m (10 fathoms) off Owenga Beach, Chatham Islands, New Zealand.

Remarks: Specimen damaged by glass disease.

Current name: *Pisinna micronema morioria* (Powell, 1933) – Spencer *et al.* (2018).

***Estea porrecta* Powell, 1933**

Powell, A.W.B., 1933a, p. 201, pl. 35, fig. 8 (holotype).

Holotype: MA70279, collected by A.W.B. Powell in February 1933, from shell sand, Waitangi, Chatham Islands, New Zealand.

Current name: *Pisinna insulana porrecta* (Powell, 1933) – Spencer *et al.* (2018).

***Estea porrectoides* Powell, 1937**

Powell, A.W.B., 1937, p. 197, pl. 53, fig. 1 (holotype).

Holotype: NHM 19621014

Paratypes: MA72253, six specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Pisinna insulana porrectoides* (Powell, 1937) – Spencer *et al.* (2018).

***Estea praecidecosta* Ponder, 1965**

Ponder, W.F., 1965c, pp. 144, 145, pl. 21. Fig. 8 (holotype).

Holotype: NIWA 455.

Paratype: MA72840, one specimen, collected by staff of the New Zealand Oceanographic Institute from the type locality, N.Z.O.I. Station C.760, on 18 February 1962, from bryozoan substrate in 80 m (44 fathoms), off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Pisinna praecidecosta* (Ponder, 1965) – Spencer *et al.* (2018).

***Estea rekohuana* Powell, 1933**

Powell, A.W.B., 1933a, pp. 199, 200, pl. 35, fig. 9.

Holotype: MA70280, collected by A.W.B. Powell in February 1933, from undersides of stones, Waitangi, Chatham Islands, New Zealand.

Paratype: MA73190*, from the type locality.

Remarks: MA73190 has not been found since 2002.

Current name: *Pisinna rekohuana rekohuana* (Powell, 1933) – Spencer *et al.* (2018).

***Estea rekohuana lactorubra* Ponder, 1965**

Ponder, W.F., 1965c, pp. 147, 148, pl. 18, fig. 11 (holotype); pl. 17, figs 10, 11.

Holotype: MA71271, collected by W.F. Ponder on 6 May 1962, from under stones embedded in sand in rockpools at low tide, Smugglers Bay, Whangarei Heads, Northland, New Zealand.

Paratypes: MA72839, 34 specimens, from the type locality.

Current name: *Pisinna rekohuana lactorubra* (Ponder, 1965) – Spencer *et al.* (2018).

***Estea rufoapicata latior* Dell, 1956**

Dell, R.K., 1956, p. 63, pl. 9, fig. 82 (holotype).

Holotype: MONZ M.009083

Paratypes: MA72761, two specimens, collected by E.J. Batham, on board the M.V. Alert, from the type locality, on 16 August 1955, from 549 m (300 fathoms), Canyon C [Taiaroa Canyon], Otago, New Zealand.

Current name: *Pisinna rufoapicata* (Suter, 1908) – Spencer *et al.* (2018).

***Estea rugosa recens* Ponder, 1968**

Ponder, W.F., 1968, p. 116, text fig. D.

Holotype: MONZ M.021749

Paratype: MA72973, one specimen, collected by K. Hipkins, from the type locality, 59 m (32 fathoms) off the Karikari Peninsula, Northland, New Zealand.

Current name: *Pisinna rugosa recens* (Ponder, 1968) – Spencer *et al.* (2018).

***Estea sculpturata* Dell, 1956**

Dell, R.K., 1956, pp. 63, 64, pl. 9, fig. 81 (holotype).

Holotype: MONZ M.009088

Paratype: MA72790, one specimen, collected by E.J. Batham, on board the M.V. Alert, from the type locality, on 16 August 1955, from 549 m (300 fathoms), Canyon C [Taiaroa Canyon], Otago, New Zealand.

Current name: *Pisinna micronema micronema* (Suter, 1898) – Powell (1979: 102); Spencer *et al.* (2018).

***Estea semiplicata* Powell, 1927**

Powell, A.W.B., 1927a, p. 543, pl. 28, fig. 17.

Holotype: MA72059, collected by W. La Roche, from Taupo Bay, Northland, New Zealand.

Paratypes: MA71523, 18 specimens, from the type locality.

Current name: *Pisinna semiplicata* (Powell, 1927) – Spencer *et al.* (2018).

***Estea subrufa* Powell, 1937**

Powell, A.W.B., 1937, p. 197, pl. 53, fig. 2 (holotype).

Holotype: NHM 19621016

Paratypes: MA72264, 15 specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Pisinna subrufa* (Powell, 1937) – Spencer *et al.* (2018).

†*Haurakia mixta* Finlay, 1924

Finlay, H.J., 1924b, p. 482, fig. 1.

Holotype: Destroyed (see Remarks below).

Paratype: MA70351, one specimen, collected from the type locality, Pleistocene (Castlecliffian) at Castlecliff, Whanganui, New Zealand.

Remarks: A note in H.J. Finlay's hand with the paratype stated that he accidentally destroyed the holotype. At that stage he considered *H. mixta* to be conspecific with *Estea* [*Pisinna*] *impressa* and so did not select a neotype.

Current name: *Pisinna impressa* (Hutton, 1885) – MolluscaBase (2020)

***Notoscrobs ornata* Powell, 1927**

Powell, A.W.B., 1927a, p. 548, pl. 28, fig. 19.

Holotype: MA72106, dredged by W. La Roche in 1924, from 9–11 m, (5–6 fathoms), off the entrance to Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratypes: MA71528, nine specimens, from the type locality.

Current name: *Amphithalamus (Notoscrobs) ornatus* (Powell, 1927) – Spencer *et al.* (2018).

***Rissoia agrestis* Webster, 1905**

Webster, W.H., 1905, p. 279, figs 10a, b.

Holotype: MA70672, collected from Takapuna Beach, Auckland, New Zealand.

Paratypes: MA71586, two specimens, from the type locality.

Current name: *Pisinna impressa* (Hutton, 1885) – Powell (1979: 101); MolluscaBase (2020).

***Rissoia zosterophila* Webster, 1905**

Webster, W.H., 1905, pp. 277, 278, figs 5a, b.

Syntypes: MA70671, two specimens, collected from Devonport, Auckland, New Zealand.

Current name: *Pisinna zosterophila* (Webster, 1905) – Spencer *et al.* (2018).

***Scrobs crassiconus* Powell, 1933**

Powell, A.W.B., 1933e, p. 196, pl. 16, fig. 4 (holotype).

Holotype: MA72134, collected by A.W.B. Powell in January 1924, from 9–11 m (5–6 fathoms) Tryphena Bay, Aotea/Great Barrier Island, New Zealand.

Current name: *Pseudesteia crassiconus* (Powell, 1933) – Spencer *et al.* (2018).

***Scrobs elongata* Powell, 1927**

Powell, A.W.B., 1927a, p. 547, pl. 28, fig. 14.

Holotype: MA72135, dredged by W. La Roche in 1922, from 22 m (12 fathoms), off the entrance to Rangaunu Harbour, Rangaunu Bay, Northland, New Zealand.

Paratypes: MA71527, 14 specimens; MA71965, one specimen, all from the type locality.

Current name: *Anabathron (Scrobs) elongatum* (Powell, 1927) – Spencer *et al.* (2018).

***Scrobs excelsus* Powell, 1933**

Powell, A.W.B., 1933e, p. 196, pl. 16, fig. 5 (holotype).

Holotype: MA70703, dredged by W. La Roche in 1922, from 22 m (12 fathoms), Rangaunu Harbour, Rangaunu Bay, Northland, New Zealand.

Paratypes: MA71426, 11 specimens, from the type locality.

Current name: *Anabathron (Scrobs) excelsum* (Powell, 1933) – Spencer *et al.* (2018).

***Scrobs hedleyi angulata* Powell, 1927**

Powell, A.W.B., 1927a, p. 546, pl. 28, fig. 15.

Holotype: MA72136, dredged by W. La Roche, from 11–18 m (6–10 fathoms), off the entrance to Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratypes: MA73213, 18 specimens, from the type locality.

Current name: *Anabathron (Scrobs) angulatum* (Powell, 1927) – Spencer *et al.* (2018).

†*Scrobs kaawaensis* Laws, 1936

Laws, C.R., 1936, p. 107, pl. 16, fig. 62.

Holotype: MA70704, collected from the early Pliocene (Opoitian) of the Kaawa Formation at Kaawa Creek, south of Port Waikato, Waikato, New Zealand.

Current name: *Anabathron (Scrobs) kaawaensis* (Laws, 1936) – Maxwell in: Spencer *et al.* (2009: 241).

***Scrobs ovata* Powell, 1927**

Powell, A.W.B., 1927a, p. 546, pl. 28, fig. 20.

Holotype: MA72137, dredged by W. La Roche in 1922, from 22 m (12 fathoms), Rangaunu Harbour, Rangaunu Bay, Northland, New Zealand.

Paratypes: MA71526, 17 specimens, from the type locality.

Current name: *Anabathron (Scrobs) ovatum* (Powell, 1927) – Spencer *et al.* (2018).

***Scrobs trailli* Powell, 1939**

Powell, A.W.B., 1939, pp. 233, 234, pl. 49, fig. 4 (holotype).

Holotype: MA72138, collected from shell sand, Mason Bay, Stewart Island / Rakiura, New Zealand.

Current name: *Anabathron (Scrobs) trailli* (Powell, 1939) – Spencer *et al.* (2018).

***Scrobs (Nannoscrobs) rugulosa* Powell, 1930**

Powell, A.W.B., 1930b, pp. 542, 543, pl. 88, fig. 19 (holotype).

Holotype: MA70705, dredged by A.W.B. Powell in 1924, from 9–11 m (5–6 fathoms), Tryphena Bay, Aotea/Great Barrier Island, New Zealand.

Paratypes: MA71459, 17 specimens, from the type locality.

Current name: *Anabathron (Scrobs) rugulosum* (Powell, 1930) – Spencer *et al.* (2018).

Family ASSIMINEIDAE***Rissoia vulgaris* Webster, 1905**

Webster, W.H., 1905, p. 278, fig. 3.

Syntypes: MA70670, two specimens, assumed to have been collected by W.H. Webster, from Waipipi, north of Waiuku, Manukau Harbour, Auckland, New Zealand.

Current name: *Assiminea vulgaris* (Webster, 1905) – MolluscaBase (2020).

***Tatea hedleyi* Brookes, 1924**

Brookes, A.E., 1924, pp. 153, 154, pl. 7, figs 1–3.

Holotype: location of specimen unknown.

Paratypes: MA73004, 12 specimens, from the type locality, under decaying *Zostera*, near high-water mark, Rangitoto, Auckland, New Zealand.

Remarks: Brookes (1924) stated that ‘Holotype and paratypes in my collection, and paratypes also in the collection of the Australian Museum, Sydney.’ As his own paratypes were donated to AM, it may be that the holotype specimen was mixed with these.

Current name: *Assiminea vulgaris* (Webster, 1905) – Powell (1979: 125); MolluscaBase (2020).

Family CAECIDAE

†*Strebloceras hinemoa* Finlay, 1931

Finlay, H.J., 1931b, pp. 21, 22, text fig. 1 (holotype).

Syntypes: MA70730, two specimens, collected from early Miocene (Altonian) Mount Harris Formation at Pukeuri (near Oamaru), Otago, New Zealand.

Current name: *Strebloceras hinemoa* Finlay, 1931 – MolluscaBase (2020).

Family ELACHISINIDAE

†*Dolicrossea awamoana* Finlay, 1930

Finlay, H.J., 1930a, pp. 55, 56, pl. 1, fig. 10 (holotype).

Holotype: MA70241, collected from the early Miocene (Altonian), Mount Harris Formation, Awamoia Creek, Oamaru, Otago, New Zealand.

Current name: *Dolicrossea awamoana* Finlay, 1930 – Maxwell in: Spencer *et al.* (2009: 242).

†*Dolicrossea clifdenensis* Finlay, 1930

Finlay, H.J., 1930a, p. 56, pl. 3, fig. 26 (holotype), fig. 25 (paratype).

Holotype: MA70242, collected from middle Miocene (Clifdenian) Slip Point Sandstone, [Finlay's bed 6C (for correlation see Fleming *et al.*, 1969)], Clifden, Southland, New Zealand.

Paratypes: MA72445, one specimen; MA72446, 12 specimens, both from the type locality.

Current name: *Dolicrossea clifdenensis* Finlay, 1930 – Maxwell in: Spencer *et al.* (2009: 242).

Dolicrossea vesca Finlay, 1926

Finlay, H.J., 1926b, p. 403, pl. 19, fig. 32 (holotype).

Holotype: MA70243, collected from Lyall Bay, Wellington, New Zealand.

Paratype: MA72530, two specimens, from the type locality.

Current name: *Dolicrossea vesca* Finlay, 1926 – Maxwell in: Spencer *et al.* (2009: 242).

Laevilitorina iredalei Brookes, 1926

Brookes, A.E. 1926, pp. 589, 590, pl. 102, fig. 3.

Holotype: MA71289, collected by A.E. Brookes, from under loose boulders, partly embedded in sand, near Russell, Northland, New Zealand.

Current name: *Elachisina iredalei* (Brookes, 1926) – Spencer *et al.* (2018).

Family IRAVADIIDAE

Dipsotoma inflata Ponder, 1967

Ponder, W.F. 1967, p. 211, pl. 9, fig. 1 (holotype).

Holotype: MA72968, collected from Taupo Bay, Whangaroa, Northland, New Zealand.

Paratype: MA72969, one specimen, from the type locality.

Current name: *Pseudonoba inflata* (Ponder, 1967) – Spencer *et al.* (2018); MolluscaBase (2019).

†*Epigrus fossilis* Finlay, 1924

Finlay, H.J., 1924b, p. 489, fig. 10.

Holotype: MA70267, from the early Miocene (Altonian) of the Mount Harris Formation near Pukeuri (near Oamaru), Otago, New Zealand.

Current name: *Chevallieria fossilis* (Finlay, 1924) – Maxwell in: Spencer *et al.* (2009: 242).

†*Nozeba candida* Finlay, 1924

Finlay, H.J., 1924b, pp. 490, 491, fig. 12.

Holotype: MA70548, from the early Miocene (Altonian) of the Mount Harris Formation near Pukeuri (near Oamaru), Otago, New Zealand.

Paratypes: MA72509, 14 specimens, from the type locality.

Current name: *Nozeba candida* Finlay, 1924 – Maxwell in: Spencer *et al.* (2009: 242).

†*Nozeba candida effusa* Finlay, 1924

Finlay, H.J., 1924b, p. 491, not figured.

Syntypes: MA70549, **Figures 2a, b**, two specimens, from the early Miocene (Altonian) of the Mount Harris Formation near Pukeuri (near Oamaru), Otago, New Zealand.

Remarks: Finlay (1924a) designated a holotype and paratype specimen, but these were amalgamated at some time and are no longer distinguishable.

Current name: *Nozeba candida* Finlay, 1924 – Beu & Maxwell (1990: 382).

Nozeba mica Finlay, 1930

Finlay, H.J., 1930b, pp. 229, 230, not figured.

Holotype: MA70550, **Figure 2c**, collected from 46 m (25 fathoms), off Hen and Chickens Islands, Northland, New Zealand.

Paratypes: MA72579, four specimens, from the type locality.

Current name: *Nozeba mica* Finlay, 1930 – Spencer *et al.* (2018).

Rissoina coulthardi Webster, 1908

Webster, W.H., 1908, p. 258, pl. 21, figs 30–32.

Holotype: MA70674, dredged by the Rev. W.H. Webster, from 5.5 m (3 fathoms), Orua Bay, Manukau Harbour, Auckland, New Zealand.

Paratypes: MA71966, five specimens, from the type locality.

Current name: *Nozeba emarginata* (Hutton, 1885) – Powell (1979: 110); Spencer *et al.* (2018).

Family TATEIDAE

Catapyrgus fraterculus Haase, 2008

Haase, M., 2008, pp. 136, 137, figs 8B, 11L, M.

Holotype: MONZ M.174163

Paratypes: MA73047, six specimens, collected by G. Kuschel on 13 June 1973, from Wetneck Cave, north of Paturau, Tasman, New Zealand; MA73048, three specimens, collected by G. Kuschel on 12 June 1973, from Twinforks Cave, Paturau, Tasman, New Zealand.

Remarks: MA73047 is also a paratype lot of *Catapyrgus spelaeus* Climo, 1974. MA73048 originally contained six paratypes of *C. spelaeus* as allocated by Climo (1974). Three of these were retained by Haase (2008) as *C. spelaeus* while he designated three specimens as *C. fraterculatus*. Haase (2008: 136) published these as “AK[MA]73048 (2 *C. spelaeus*, 3 *C. fraterculus* sp. nov. → AK[MA]73257)”. However, hand-written identification labels with each of the specimen lots indicate that the numbers were switched by Haase and that MA73048 is *C. fraterculatus* and MA73257 is *C. spelaeus*.

Current name: *Catapyrgus fraterculus* Haase, 2008 – Spencer *et al.* (2018).

***Catapyrgus sororius* Haase, 2008**

Haase, M., 2008, pp. 137–139, figs 8C, 11N.

Holotype: MONZ M.174165

Paratypes: MA73046, six specimens, collected by G. Kuschel on 26 June 1973, from Ida Cave, Oparara River valley, Karamea, Buller, West Coast, New Zealand.

Remarks: These are also paratypes of *C. spelaeus* Climo, 1974 (see Haase (2008: 137)).

Current name: *Catapyrgus sororius* Haase, 2008 (five specimens); *Catapyrgus spelaeus* Climo, 1974 (one specimen) – Haase (2008: 136, 137).

***Catapyrgus spelaeus* Climo, 1974**

Climo, F.M., 1974, pp. 267, 268, figs 10A–I (F holotype), 14N, 15D.

Holotype: MONZ M.032459

Paratypes: MA73046, six specimens, collected by G. Kuschel on 26 June 1973, from Ida Cave, Oparara River valley, Karamea, Buller, West Coast, New Zealand.

Current name: *Catapyrgus sororius* Haase, 2008 (five specimens); *Catapyrgus spelaeus* Climo, 1974 (one specimen) – Haase (2008: 136, 137).

Paratypes: MA73047, six specimens, collected by G. Kuschel on 13 June 1973, from Wetneck Cave, north of Paturau, Tasman, New Zealand; MA73048, three specimens, collected by G. Kuschel on 12 June 1973, from Twinforks Cave, Paturau, Tasman, New Zealand

Remarks: see remarks above for *Catapyrgus fraterculatus*.

Current name: *Catapyrgus fraterculus* Haase, 2008 (MA73257) – Haase (2008: 136).

Paratypes: MA73049, six specimens, collected by G. Kuschel on 13 June 1973, from Bush Cave, Paturau, Tasman, New Zealand; MA73257, three specimens, collected by G. Kuschel on 12 June 1973, from Twinforks Cave, Paturau, Tasman, New Zealand.

Current name: *Catapyrgus spelaeus* Climo, 1974 – Haase (2008: 136).

***Hadopyrgus anops* Climo, 1974**

Climo, F.M., 1974, pp. 263, 264, figs 8A–M (A holotype), 10J, 15C.

Holotype: MONZ M.032540

Paratype: MA73034, one specimen, collected by G. Kuschel on 14 May 1972, from Eden’s Bore No. 1, near Waimea West [Brightwater], Tasman, New Zealand; MA73055, one specimen, collected by G. Kuschel on 1

July 1972, from ‘Livingston’s Well’, near Waimea West [Brightwater], Tasman, New Zealand.

Remarks: MA73034 was destroyed by glass disease.

Current name: *Hadopyrgus anops* Climo, 1974 – Spencer *et al.* (2018).

***Hadopyrgus brevis* Climo, 1974**

Climo, F.M., 1974, pp. 265, 266, figs 9N–U (N holotype), 10K, 15G.

Holotype: MONZ M.032466

Paratype: MA73035, one specimen, collected by G. Kuschel on 30 December 1972, from ‘Livingston’s Well’, near Waimea West [Brightwater], Tasman, New Zealand.

Current name: *Hadopyrgus brevis* Climo, 1974 – Spencer *et al.* (2018).

***Hadopyrgus expositus* Haase, 2008**

Haase, M., 2008, pp. 133, 134, fig. 7Q, fig. 11I.

Holotype: MA73256, collected by F.W. Worley in 1897, from ‘Maitai Valley and Tasman Hills’, Nelson, New Zealand.

Paratypes: MA96942, 222 specimens; MA96073, 61 specimens, all from the type localities.

Remarks: Paratype lot MA96073 was incorrectly published as MA69073 by Haase (2008: 134).

Current name: *Hadopyrgus expositus* Haase, 2008 – Spencer *et al.* (2018).

***Kuschelita mica* Climo, 1974**

Climo, F.M., 1974, p. 266, figs 4, 9C–M (C holotype), 10L–N, 15E.

Holotype: MONZ M.032467

Paratypes: MA73036 (8 July 1972); MA73037 (15 April 1972); MA73038 (9 June 1972); MA73039 (19 August 1972); MA73040 (6 February 1973); MA73041 (26 January 1973), all single specimens, collected from the type locality by G. Kuschel on the dates indicated, from ‘Livingston’s Well’, near Waimea West [Brightwater], Tasman, New Zealand.

Current name: *Kuschelita mica* Climo, 1974 – Spencer *et al.* (2018).

***Opacuincola caeca* Ponder, 1966**

Ponder, W.F., 1966b, pp. 35–37, pl. 4, fig. 1 (holotype), figs 2–4.

Holotype: MA71338, collected by B. Elliott in August 1964, from approx. 1.6 km (1 mile) inside Gorge Creek Cave, East Takaka, Tasman, New Zealand.

Paratypes: MA51550, 10 specimens, from the type locality.

Current name: *Opacuincola caeca* Ponder, 1966 – Spencer *et al.* (2018).

***Opacuincola kuscheli* Climo, 1974**

Climo, F.M., 1974, pp. 269, 270, figs 12A–F, 14E, 15F.

Holotype: MONZ M.032451

Paratypes: MA73043, two specimens, collected by G. Kuschel on 12 June 1973, from Twin Forks Cave, Paturau, Tasman, New Zealand; MA73044, two specimens, collected by G. Kuschel, 13 June 1973, from Wetneck Cave, north of Paturau, Tasman, New Zealand.

Current name: *Opacuincola kuscheli* Climo, 1974 – Haase (2008: 118).

Paratypes: MA73045, five specimens, collected by G. Kuschel on 26 Jun 1973, from Ida Cave, Oparara River valley, Karamea, Buller, West Coast, New Zealand.

Current name: *Opacuincola piriformis* Haase, 2008 – Haase (2008: 118).

Paratypes: MA73254, two specimens split from MA73044, collected by G. Kuschel, 13 June 1973, from Wetneck Cave, north of Paturau, Tasman, New Zealand.

Current name: *Opacuincola cervicesmadentes* Haase, 2008 – Haase (2008: 118).

Paratypes: MA73255, three specimens split from MA73045, collected by G. Kuschel on 26 June 1973, from Ida Cave, Oparara River valley, Karamea, Buller, West Coast, New Zealand.

Current name: *Opacuincola conosimilis* Haase, 2008 – Haase (2008: 118).

***Opacuincola troglodytes* Climo, 1974**

Climo, F.M., 1974, p. 269, figs 12G–H (G holotype).

Holotype: MONZ M.032446

Paratypes: MA73042, five specimens, collected from the type locality, by Mr Taylor in 1971, soda spring, off Wairoma Road, Aria, King Country, New Zealand.

Remarks: Climo (1974) gives the source as N. Gardner, but he was not the collector. Gardner (1973) credits ‘Mr Taylor, from Whangamata’, as the collector of material in 1970. The type locality is given by MONZ as Motukaramu Soda Spring (see also MapsPast 1929 series).

Current name: *Potamopyrgus troglodytes* (Climo, 1974) – Spencer *et al.* (2018).

***Paxillostium nanum* Gardner, 1970**

Gardner, N.W. 1970, pp. 181–184, figs 1–6.

Holotype: MA71336, collected by N.W. Gardner in January 1969, from seepage at the head of a bush stream, at c. 183 m (600 feet) elevation, 8 km (5 miles) south of Parakao, Northland, New Zealand.

Paratypes: MA71810, four specimens, from the type locality.

Current name: *Paxillostium nanum* Gardner, 1970 – Spencer *et al.* (2018).

***Potamopyrgus cresswelli* Climo, 1974**

Climo, F.M., 1974, pp. 260, 261, figs 7A–C (A holotype), 14F, G, 15B.

Holotype: MONZ M.032562

Paratypes: MA73032, 10 specimens, collected from the type locality by P. Cresswell on 18 January 1970, from a small seepage in coastal forest at head of streamlet entering western end of Golden Bay, northern coast, Stewart Island / Rakiura, New Zealand.

Current name: *Rakiurapyrgus cresswelli* (Climo, 1974) – Spencer *et al.* (2018).

***Potamopyrgus dawbini* Powell, 1955**

Powell, A.W.B., 1955, p. 90, pl. 3, fig. 28 (holotype).

Holotype: MA71225, collected by W.H. Dawbin on

March 1943, during the ‘Cape Expedition’, Coleridge Tarn, Auckland Islands, New Zealand.

Paratypes: MA71612, 13 specimens, collected from the type locality.

Current name: *Potamopyrgus dawbini* Powell, 1955 – Spencer *et al.* (2018).

***Potamopyrgus manningi* Climo 1974**

Climo, F.M., 1974, pp. 261, 262, figs 7D–N, 14I–M.

Holotype: MONZ M.032438

Paratypes: MA73033, three specimens, collected from the type locality by G. Manning in September 1971, from a dripping wet mossy bank, ‘Manning’s farm’, Waikaretu, Waikato, New Zealand.

Current name: *Leptopyrgus manningi* (Climo, 1974) – Spencer *et al.* (2018).

***Rakiurapyrgus micula* Haase, 2008**

Haase, M., 2008, pp. 153, 154, fig. 8N.

Holotype: MA48942, collected by E.C. Smith, from moss under waterfall, North Arm, Stewart Island / Rakiura, New Zealand.

Current name: *Rakiurapyrgus micula* Haase, 2008 – MolluscaBase (2020).

Family TORNIDAE

***Cochliolepis albiceratus* Ponder, 1966**

Ponder, W.F., 1966b, p. 38, pl. 5, fig. 5 (holotype), figs 6–8.

Holotype: MA71339, collected by W.F. Ponder on 24 December 1961, under stones in a mid-tidal pool containing *Hormosira*, halfway between Pukerua Bay and Paekakariki, Kapiti Coast, Wellington, New Zealand.

Current name: *Cochliolepis albiceratus* Ponder, 1966 – Spencer *et al.* (2018).

†*Elachorbis albolapis* Laws, 1930

Laws, C.R., 1930, pp. 549, 550, pl. 91, figs 10, 11 (holotype).

Holotype: MA70255, collected by C.R. Laws, from the early Miocene (Altonian) Southburn Sand at White Rock River, south Canterbury, New Zealand.

Current name: *Elachorbis albolapis* Laws, 1930 – Maxwell in: Spencer *et al.* (2009: 242).

***Elachorbis diaphana* Finlay, 1924**

Finlay, H.J., 1924c, p. 518, text fig. 1 (holotype).

Holotype: MA70256, collected from oyster scrapings, Bluff, Southland, New Zealand.

Current name: *Elachorbis diaphana* Finlay, 1924 – Spencer *et al.* (2018).

†*Elachorbis subedomita* Laws, 1936

Laws, C.R., 1936, p. 103, pl. 15, figs 52, 55 (holotype).

Holotype: MA70257, collected from the early Pliocene (Opoitian) of the Kaawa Formation at Kaawa Creek, south of Port Waikato, Waikato, New Zealand.

Paratypes: MA72695, four specimens, from the type locality.

Current name: *Elachorbis subedomita* Laws, 1936 – Maxwell in: Spencer *et al.* (2009: 242).

***Fossarus aupouria* Powell, 1937**

Powell, A.W.B., 1937, p. 190, pl. 49, figs 8, 9 (holotype).

Holotype: NHM 1962992

Paratypes: MA72283, four specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Tornus aupouria* (Powell, 1937) – Powell (1979: 121); Spencer *et al.* (2018).

***Fossarus maoria* Powell, 1937**

Powell, A.W.B., 1937, pp. 189, 190, pl. 49, fig. 12 (holotype).

Holotype: NHM 1962993

Paratype: MA72284, one specimen, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Tornus maoria* (Powell, 1937) – Powell (1979: 120); Spencer *et al.* (2018).

Family EULIMIDAE***Aclis maoria* Powell, 1937**

Powell, A.W.B., 1937, p. 209, pl. 56, fig. 12 (holotype).

Holotype: NHM 19621047

Paratype: MA72287, one specimen, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Aclis maoria* Powell, 1937 – Spencer *et al.* (2018).

***Aclis pseudopareora* Powell, 1940**

Powell, A.W.B., 1940, p. 236, pl. 31, fig. 6 (holotype).

Holotype: MA70005, dredged by W. La Roche, from 11 m (6 fathoms), off the entrance to Mangonui Harbour [Mangonui Heads], Doubtless Bay, Northland, New Zealand.

Current name: *Aclis pseudopareora* Powell, 1940 – Spencer *et al.* (2018).

***Awanuia dilatata* Powell, 1927**

Powell, A.W.B., 1927a, p. 539, pl. 26, fig 3.

Holotype: MA72014, dredged by W. La Roche, from 11–18 m (6–10 fathoms), off the entrance to Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratypes: MA71518, two specimens, from the type locality.

Current name: *Awanuia dilatata* Powell, 1927 – Spencer *et al.* (2018).

***Awanuia porcellana* Ponder, 1967**

Ponder, W.F. 1967, pp. 201, 202, pl. 2, fig. 3 (holotype).

Holotype: MA72965, collected by W. F. Ponder, from shell sand, Te Hāwēre-a-Maki / Goat Island Bay, Leigh, Auckland, New Zealand.

Current name: *Awanuia porcellana* Ponder, 1967 – Spencer *et al.* (2018).

†*Awanuia tenuis* Laws, 1936

Laws, C.R., 1936, p. 107, pl. 15, fig. 31 (holotype).

Holotype: MA70086, collected from the early Pliocene (Opoitian) of the Kaawa Formation at Kaawa Creek, south of Port Waikato, Waikato, New Zealand.

Paratype: MA72716, one specimen, from the type locality.

Current name: *Awanuia tenuis* Laws, 1936 – Maxwell in: Spencer *et al.* (2009: 244).

***Balcis aupouria* Powell, 1937**

Powell, A.W.B., 1937, p. 211, pl. 54, fig. 10 (holotype).

Holotype: NHM 19621052

Paratypes: MA72292, three specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Curveulima aupouria* (Powell, 1937) – Powell (1979: 141); Spencer *et al.* (2018).

***Balcis bollonsi* Powell, 1937**

Powell, A.W.B., 1937, p. 211, pl. 54, figs 11, 12 (holotype).

Holotype: MA71919, collected by J. Bollons, from 137 m (75 fathoms) north of North Cape, Northland, New Zealand.

Current name: *Curveulima bollonsi* (Powell, 1937) – Powell (1979: 141); Spencer *et al.* (2018).

†*Balcis geoffreyi* Laws, 1936

Laws, C.R., 1936, p. 112, pl. 16, fig. 67 (holotype).

Holotype: MA70091, collected from the early Pliocene (Opoitian) of the Kaawa Formation at Kaawa Creek, south of Port Waikato, Waikato, New Zealand.

Paratypes: MA72700, 18 specimens, from the type locality.

Current name: *Melanella geoffreyi* (Laws, 1936) – Maxwell in: Spencer *et al.* (2009: 245).

***Balcis maoria* Powell, 1940**

Powell, A.W.B., 1940, p. 234, pl. 31, fig. 2 (holotype).

Holotype: MA70092, collected from beach drift, Cape Maria van Diemen, Northland, New Zealand.

Current name: *Melanella maoria* (Powell, 1940) – Spencer *et al.* (2018).

***Balcis pervegrandis* Powell, 1940**

Powell, A.W.B., 1940, pp. 233, 234, pl. 31, fig. 1 (holotype).

Holotype: MA72015, collected by A.W.B. Powell in July 1925 from 42 m (23 fathoms) off Ahipara, Northland, New Zealand.

Paratypes: MA71571, three specimens, from the type locality.

Remarks: The collecting date is given as July 1925 on the labels and in Powell (1940: 233) but as 1927 by Powell (1940: 218, station D.29).

Current name: *Hypermastus bulbulus* (Murdoch & Suter, 1906) – Powell (1979: 141); Spencer *et al.* (2018).

“*Balcis*” *puhana* Dell, 1956

Dell, R.K., 1956, p. 81, pl. 10, fig. 93 (holotype).

Holotype: M.009683.

Paratype: MA72745, one specimen, collected by E.J. Batham, on the MV Alert, on 16 August 1955, from 549 m (300 fathoms), Canyon C [Taiaroa Canyon], off Otago Peninsula, New Zealand.

Current name: *Melanella puhana* (Dell, 1956) – Spencer *et al.* (2018).

***Chileutomia neozelanica* Powell, 1940**

Powell, A.W.B., 1940, p. 235, pl. 31, fig. 5 (holotype).

Holotype: MA72047, collected by J. Bollons from 91 m (50 fathoms), between Piwhane / Spirits Bay and Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Chileutomia neozelanica* Powell, 1940 – Spencer *et al.* (2018).

***Coenaculum secundum* Powell, 1937**

Powell, A.W.B., 1937, pp. 198, 199, pl. 52, fig. 13 (holotype).

Holotype: NHM 19621018

Paratypes: MA72254, three specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Coenaculum secundum* Powell, 1937 – Spencer *et al.* (2018).

***Eulima archeyi* Finlay, 1928**

Finlay, H.J., 1928, p. 261, not figured.

Holotype: MA70288, **Figure 2d**, presumed to have been collected in early 1924 by a member of the Otago Institute Expedition, Chatham Islands, New Zealand.

Paratype: MA72562, one specimen, from the type locality.

Remarks: Although label information does not explicitly confirm this, Finlay (1928) stated that most of the material on which the paper was based was collected by the *the Otago Institute party at the Chathams in the summer of 1924*.

Current name: *Melanella archeyi* (Finlay, 1928) – Spencer *et al.* (2018).

†*Eulima hampdenensis* Laws, 1935

Laws, C.R., 1935b, p. 25, pl. 4, fig.5 (holotype).

Holotype: MA70289, collected from the middle Eocene (Bortonian) Hampden Formation, near Kakaho Creek, Hampden Beach, Otago, New Zealand.

Paratype: MA72673, one specimen, from the type locality.

Current name: *Eulima hampdenensis* Laws, 1935 – Maxwell in: Spencer *et al.* (2009: 245).

***Eulima mangonuica* Powell, 1940**

Powell, A.W.B., 1940, pp. 235, 236, pl. 31, figs 3, 4 (holotype).

Holotype: MA70290, dredged by W. La Roche, from 11 m (6 fathoms), off the entrance to Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratypes: MA73185, 20 specimens, from the type locality.

Current name: *Fusceulima mangonuica* (Powell, 1940) – Powell (1979: 138, 139); Spencer *et al.* (2018).

†*Eulima otaioensis* Laws, 1933

Laws, C.R., 1933, p. 323, pl. 32, fig. 25 (holotype).

Holotype: MA70291, collected by C.R. Laws from early Miocene (Otaian) Mount Harris Formation, Blue Cliffs, Otaio River, Canterbury, New Zealand.

Current name: *Margineulima otaioensis* (Laws, 1933) – Maxwell in: Spencer *et al.* (2009: 245).

***Hypermastus bountyensis* Powell, 1933**

Powell, A.W.B., 1933c, pp. 235, 236, pl. 20, fig. 5 (holotype).

Holotype: MA72069, collected by J. Bollons in 1893, from 311 m (170 fathoms) off Bounty Islands, New Zealand.

Current name: *Pelseneeria bountyensis* (Powell, 1933) – Spencer *et al.* (2018).

***Icuncula terebra* Powell, 1930**

Powell, A.W.B., 1930a, p. 538, pl. 60, fig. 8 (holotype).

Holotype: MA72070, dredged by J. Bollons, from 110 m (60 fathoms), off Poor Knights Islands, Northland, New Zealand.

Current name: *Aclis terebra* (Powell, 1930) – Spencer *et al.* (2018).

***Larochella alta* Powell, 1927**

Powell, A.W.B., 1927a, p. 540, pl. 26, fig. 6.

Holotype: MA72075, dredged by W. La Roche, from 11–18, (6–10 fathoms), off the entrance to Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratypes: MA71520, three specimens, from the type locality.

Current name: *Larochella alta* Powell, 1927 – Spencer *et al.* (2018); MolluscaBase (2020).

***Larochella toreuma* Powell, 1927**

Powell, A.W.B., 1927a, p. 540, pl. 26, fig. 4.

Holotype: MA72076, collected by A.W.B. Powell in May 1925, from seaweed washings, Houghton Bay, Wellington, New Zealand.

Paratypes: MA71519, two specimens, from the type locality.

Current name: *Larochella toreuma* Powell, 1927 – Spencer *et al.* (2018); MolluscaBase (2020).

†*Melanella lautoides* Finlay & Marwick, 1937

Finlay, H.J. & J. Marwick, 1937, p. 66, pl. 5, fig. 11 (holotype).

Holotype: MA73344, collected from the early Paleocene (lower Teurian) at Boulder Hill, near Dunedin, Otago, New Zealand.

Current name: *Melanella lautoides* Finlay & Marwick, 1937 – Maxwell in: Spencer *et al.* (2009: 245).

†*Rissopsis castlecliffensis* Finlay, 1930

Finlay, H.J., 1930a, p. 58, not figured.

Holotype: MA70680, **Figure 2e**, collected from the Pleistocene (Castlecliffian) at Castlecliff, Whanganui, New Zealand.

Paratypes: MA72451, five specimens, from the type locality.

Current name: *Austrorissopsis castlecliffensis* (Finlay, 1930) – Maxwell in: Spencer *et al.* (2009: 244).

***Rissopsis expansa* Powell, 1930**

Powell, A.W.B., 1930b, p. 544, pl. 88, figs 20, 21 (holotype).

Holotype: MA72129, dredged by W. La Roche in 1922, from 11–18 m (6–10 fathoms), off the entrance to Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratype: MA71460, one specimen, from the type locality.

Current name: *Aclis expansa* (Powell, 1930) – Spencer *et al.* (2018).

†*Rissopsis fricta* Finlay, 1930

Finlay, H.J., 1930a, p. 58, not figured.

Syntypes: MA70681, five specimens, collected from the early Miocene (Altonian) Target Gully Shellbed, Mount Harris Formation, Glen Creek, Oamaru, Otago, New Zealand.

Remarks: Finlay (1930: 58) gave the shell height as 1.8 mm and diameter as 0.7 mm, but did not apply this to any specimen in particular. None of the five specimens conforms exactly to these measurements, and as he also did not figure the type, it is not possible to determine the original holotype.

Current name: *Austrorissopsis fricta* (Finlay, 1930) – Maxwell in: Spencer *et al.* (2009: 244).

***Scalarnoba secunda* Powell, 1940**

Powell, A.W.B., 1940, p. 227, pl. 30, fig. 10 (holotype).

Holotype: MA72131, collected from 256 m (140 fathoms) north of North Cape, Northland, New Zealand.

Current name: *Scalarnoba secunda* Powell, 1940 – Spencer *et al.* (2018).

***Teretianax pagoda* Powell, 1926**

Powell, A.W.B., 1926a, p. 596, fig. 3.

Holotype: MA72150, collected by A.W.B. Powell in January 1924 from shell sand, Tryphena Bay, Aotea/ Great Barrier Island, New Zealand.

Current name: *Pyramidelloides pagoda* (Powell, 1926) – Spencer *et al.* (2018); MolluscaBase (2020).

***Venustilifer secunda* Powell, 1940**

Powell, A.W.B., 1940, p. 235, pl. 29, fig. 6 (holotype).

Holotype: MA72163, dredged from 256 m (140 fathoms), off Manawatāwhi / Three Kings, Northland, New Zealand.

Current name: *Pelseneeria secunda* (Powell, 1940) – Spencer *et al.* (2018).

Family HIPPONICIDAE**†*Cheilea plumea* Laws, 1932**

Laws, C.R. 1932, p. 188, pl. 30, figs 34, 35 (holotype).

Holotype: MA70142, collected by F.J. Turner from middle Miocene (Waiauian) of the Park Bluff Sandstone, from “New road cutting about half a mile behind racecourse” [now the golf course], Clifden, Southland, New Zealand.

Current name: *Cheilea plumea* Laws, 1932 – Maxwell in: Spencer *et al.* (2009: 242).

†*Cheilea postera* Laws, 1936

Laws, C.R., 1936, pp. 109, 110, pl. 16, figs 68, 70 (holotype).

Holotype: MA70143, collected from the early Pliocene (Opoitian) of the Kaawa Formation at Kaawa Creek, south of Port Waikato, Waikato, New Zealand.

Paratype: MA72699, one specimen, from the type locality.

Current name: *Cheilea postera* Laws, 1936 – Maxwell in: Spencer *et al.* (2009: 242).

†*Neojanacus wharekuriensis* Laws, 1935

Laws, C.R., 1935c, pp. 33, 34, pl. 6, fig. 8 (holotype).

Holotype: MA70520, collected from the late Oligocene (Duntroonian) Wharekuri Greensand, Wharekuri, true left bank of the Waitaki River, 1.6 km below Wharekuri (site now submerged beneath Lake Waitaki), north Otago, New Zealand.

Current name: *Leptonotis perplexus* (Suter, 1907) – MolluscaBase (2020).

***Sabia wyattae* Powell, 1958**

Powell, A.W.B., 1958b, pp. 90, 91, pl. 12, figs 3, 4 (holotype).

Holotype: MA71238, collected by J. Wyatt in 1957, attached to a dead shell of *Penion sulcatus* in beach drift, Tutukaka, Northland, New Zealand.

Paratype: MA71471, one specimen, from the type locality.

Current name: *Sabia conica* (Schumacher, 1817) – MolluscaBase (2020).

Family VANIKORIDAE***Naricava (Tropidorbis) neozelanica* Powell, 1940**

Powell, A.W.B., 1940, pp. 223, 224, pl. 29, figs 10, 11 (holotype).

Holotype: MA72104, collected by A.W.B. Powell in 1932, from shell sand, Takapaukura/Tom Bowling Bay, Northland, New Zealand.

Current name: *Naricava neozelanica* Powell, 1940 – Spencer *et al.* (2018).

***Zeradina odhneri* Powell, 1927**

Powell, A.W.B., 1927c, p. 297, pl. 34, fig. 1 (holotype).

Holotype: MA72177, dredged by D. Crawford of the steam trawler *Serfib* in July 1925, from 42 m (23 fathoms), Ahipara Bay, Northland, New Zealand.

Paratypes: MA71416, five specimens, from the type locality.

Current name: *Zeradina odhneri* Powell, 1927 – Spencer *et al.* (2018).

***Zeradina (Radinista) scalarina* Powell, 1940**

Powell, A.W.B., 1940, p. 229, pl. 31, fig. 9 (holotype).

Holotype: MA72178, collected by J. Bollons from 91 m (50 fathoms), between Piwhane / Spirits Bay and Manawatāwhi / Three Kings Islands, New Zealand.

Paratype: MA73604, one specimen from the type locality.

Current name: *Radinista scalarina* (Powell, 1940) – Spencer *et al.* (2018).

Family VERMETIDAE***Serpulorbis aotearoicus* J.E. Morton, 1951**

Morton, J.E. 1951, pp. 5, 6, figs 19–24.

Holotype: MA71730, collected by J.E. Morton, from the outer reef fringe of Milford Reef, Auckland, New Zealand.

Paratypes: MA71731, three specimens, on the same piece of rock as the holotype; MA71901, six specimens, 2 shells and 4 radulae, all from the type locality.

Current name: *Thylacodes aotearoicus* (J.E. Morton, 1951) – Spencer *et al.* (2018).

Family XENOPHORIDAE**†*Onustus prognatus* Finlay, 1926**

Finlay, H.J., 1926a, p. 228, pl. 59, fig. 15 (holotype), fig. 16 (paratype).

Holotype: MA70575, collected from the Oligocene (Duntroonian) Kekenodon Group, Wharekuri, Otago, New Zealand.

Remarks: MA70575 is figured by Finlay (1926) as the paratype, but original Finlay labels, as well as A.W.B. Powell's later ones, show this is the holotype.

Current name: *Xenophora prognata* (Finlay, 1926) – Maxwell in: Spencer *et al.* (2009: 243)

Unassigned Caenogastropoda (Order)**Family NEWTONIELLIDAE****†*Ataxocerithium nodicingulatum* Finlay, 1924**

Finlay, H.J., 1924a, pp. 475, 476, pl. 51, fig. 8a (holotype), figs 8b, c, d (paratypes).

Holotype: MA70052, collected from the early Miocene (Altonian) Target Gully Shellbed, Mount Harris Formation, Glen Creek, Oamaru, Otago, New Zealand.

Paratypes: MA72494, 15 partial and whole specimens, from the type locality.

Current name: *Ataxocerithium pyramidale* Finlay, 1924 – MolluscaBase (2020).

†*Ataxocerithium pyramidale* Finlay, 1924

Finlay, H.J., 1924a, p. 475, pl. 51, fig. 7a (holotype); figs 7b, c (paratypes).

Holotype: MA70053, collected from the early Miocene (Altonian) Target Gully Shellbed, Mount Harris Formation, Glen Creek, Oamaru, Otago, New Zealand.

Paratypes: MA72493, 14 specimens, from the type locality.

Current name: *Ataxocerithium pyramidale* Finlay, 1924 – Maxwell in: Spencer *et al.* (2009: 244).

†*Ataxocerithium pyramidale robustum* Finlay, 1924

Finlay, H.J., 1924a, p. 475, not figured.

Holotype: MA70054, **Figure 2f**, collected from the Pliocene (Nukumaruian), near Redclyffe [Taradale] Bridge Hawke Bay, New Zealand.

Current name: *Ataxocerithium robustum* Finlay, 1924 – MolluscaBase (2020).

***Mendax attenuatospira* Powell, 1937**

Powell, A.W.B., 1937, p. 205, pl. 54, fig. 5 (holotype).

Holotype: NHM 19621039

Paratype: MA72278, eight specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Trituba (Paramendax) attenuatospira* (Powell, 1937) – Spencer *et al.* (2018).

***Paramendax apicina* Powell, 1937**

Powell, A.W.B., 1937, p. 206, pl. 54, fig. 4 (holotype).

Holotype: NHM 19621040

Paratype: MA72279, two specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Trituba (Paramendax) apicina* (Powell, 1937) – Spencer *et al.* (2018).

***Socienna aureola* Powell, 1933**

Powell, A.W.B., 1933b, p. 38.

Holotype: CM M5321

Paratype: MA72374, one specimen, collected from the type locality, by J. Fairchild on 1 June 1893, from 311 m (170 fathoms), Bounty Islands, New Zealand.

Current name: *Eumetula (Altispecula) aureola* (Powell, 1933) – Spencer *et al.* (2018).

***Socienna maoria* Finlay, 1930**

Finlay, H.J., 1930b, p. 230, pl. 45, fig. 45 (holotype).

Holotype: MA70713, collected from 11 m (6 fathoms), Doubtless Bay, Northland, New Zealand.

Current name: *Metaxia maoria* (Finlay, 1930) – Spencer *et al.* (2018).

Family CERITHIOPSIDAE***Altispecula elegantula* Powell, 1930**

Powell, A.W.B., 1930a, pp. 539, 540, pl. 61, fig. 11 (holotype), fig. 12 (paratype).

Holotype: MA72007, dredged by J. Bollons from 60 fathoms, Poor Knights Islands, Northland, New Zealand.

Paratype: MA71395, specimens, from the type locality.

Current name: *Retilaskeya (Marshallaskeya) elegantula* (Powell, 1930) – Spencer *et al.* (2018).

***Cerithiopsis diadema* Monterosato, 1874**

Monterosato, T.A. 1874, pp. 273, 274.

Holotype: MCZR-M-21014

Paratypes: MA73237, three specimens, collected from the type locality, Madeira, Portugal.

Remarks: Appolloni *et al.* (2018: 39) described the type locality as “Palermo (Sicily), Madeira and [imprecise] locality near Modena”.

Current name: *Cerithiopsis diadema* Monterosato, 1874 – MolluscaBase (2020).

***Joculator caelata* Powell, 1930**

Powell, A.W.B., 1930a, p. 540, pl. 62, fig. 19 (holotype).

Holotype: MA70371, dredged by W. La Roche in 1922, from 11 m (6 fathoms), off the entrance to Mangonui Heads [Mangonui Harbour], Doubtless Bay, Northland, New Zealand.

Paratypes: MA71396, two specimens, from the type locality.

Current name: *Synthopsis caelata* (Powell, 1930) – Spencer *et al.* (2018).

***Mendax trizonaloides* B.A. Marshall, 1978**

Marshall, B.A., 1978, pp. 65, 66, figs 7A–C (holotype).

Holotype: MONZ M.049299

Paratype: MA72980, one specimen, collected by E.G. Williams, from a fish stomach, off Mayor Island, Bay of Plenty, New Zealand.

Current name: *Mendax trizonaloides* B.A. Marshall, 1978 – Spencer *et al.* (2018).

***Seila (Notoseila) elegantissima* B.A. Marshall, 1978**

Marshall, B.A., 1978, pp. 100, 101, figs 18D–G (holotype).

Holotype: MONZ M.051719

Paratype: MA72981, one specimen, collected by E.G. Williams, from 73 m (40 fathoms), off Mayor Island, Bay of Plenty, New Zealand.

Current name: *Seila (Notoseila) elegantissima* B.A. Marshall, 1978 – Spencer *et al.* (2018).

***Sundaya campbellica* Powell, 1955**

Powell, A.W.B., 1955, pp. 92, 93, pl. 2, fig. 18 (holotype).

Holotype: MA71226, collected by J.H. Sorensen in 1943, during the ‘Cape Expedition’, Perseverance Harbour, Campbell Island / Motu Ihupuku, New Zealand.

Paratypes: MA71613, 15 specimens, from the type locality.

Current name: *Specula campbellica* (Powell, 1955) – Spencer *et al.* (2018).

***Zaclys murdochi* B.A. Marshall, 1978**

Marshall, B.A., 1978, p. 81, figs 12G–I (holotype).

Holotype: MONZ M.051714

Paratypes: MA72979, 62 specimens, collected from Tahunanui Beach, Nelson, New Zealand.

Current name: *Zaclys murdochi* B.A. Marshall, 1978 – Spencer *et al.* (2018).

***Zaclys paradoxa* Powell, 1937**

Powell, A.W.B., 1937, p. 205, pl. 54, fig. 1 (holotype).

Holotype: NHM 19621038

Paratypes: MA72277, three specimens, collected by A.W.B. Powell on 17 August 1932 from the type locality, station 934, R.R.S. Discovery II cruise, in 92 m

off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Horologica dirempta* (Odhner, 1924) – Spencer *et al.* (2018).

Family TRIPHORIDAE

***Mendax duplicarinata* Powell, 1940**

Powell, A.W.B., 1940, p. 232, pl. 29, fig. 4 (holotype).

Holotype: MA72092, collected by J. Bollons from 91 m (50 fathoms), between Piwhane / Spirits Bay and Manawatāwhi / Three Kings Islands, New Zealand.

Paratypes: MA71597, two specimens, from the type locality.

Current name: *Metaxia duplicarinata* (Powell, 1940) – Spencer *et al.* (2018).

***Notosinister aupouria* Powell, 1937**

Powell, A.W.B., 1937, pp. 206, 207, pl. 54, fig. 2 (holotype).

Holotype: NHM 19621041

Paratypes: MA72280, four specimens, collected by A.W.B. Powell in 1932 from the type locality, station 933, R.R.S. Discovery II cruise, in 260 m off Manawatāwhi / Three Kings Islands, New Zealand.

Current name: *Nototriphora aupouria* (Powell, 1937) – Spencer *et al.* (2018).

†*Notosinister tepikiensis* Powell, 1934

Powell, A.W.B., 1934, pp. 265, 266, pl. 57, fig. 4 (holotype).

Holotype: MA70545, collected by A.W.B. Powell in August 1933 from the late Pleistocene (Haweran) Te Piki Member, Waipaoa Formation, from a roadcutting approximately 6 km east of Whangaparaoa (Cape Runaway), Bay of Plenty, New Zealand.

Paratype: MA70811, one specimen, from the type locality.

Current name: *Costatophora granifera* (Brazier, 1894) – B.A. Marshall (1994); Beu (2004); MolluscaBase (2020).

***Seilarex exaltatus* Powell, 1930**

Powell, A.W.B., 1930a, pp. 538, 539, pl. 60, fig. 3 (holotype).

Holotype: MA72140, dredged by A.W.B. Powell in January 1924, from 9–11 m (5–6 fathoms), Tryphena Bay, Aotea/Great Barrier Island, New Zealand.

Current name: *Metaxia exaltata* (Powell, 1930) – Spencer *et al.* (2018).

***Viriola samoana* Cernohorsky, 1977**

Cernohorsky, W.O. 1977, pp. 130, 131, figs 21–26 (holotype).

Holotype: MA71353, dredged by crew of the HMNZS *Lachlan*, from Apolima Strait, west of Upolo Island, Western Samoa.

Remarks: No date is given for the collection of this specimen, but given HMNZS *Lachlan*’s service record it is likely to have been collected during survey work in June/July 1973.

Current name: *Viriola abbotti* (Baker & Spicer, 1935) – MolluscaBase (2020).

Family EPITONIIDAE

***Acirsa annectens* Powell, 1951**

Powell, A.W.B., 1951b, p. 115, pl. 7, fig. 23 (holotype).

Holotype: MNH 1961398

Paratypes: MA71932, two specimens, collected from the type locality, on 18 October 1931, Discovery Station WS 766, in 545 m, north of Falkland Islands, British Overseas Territory.

Current name: *Gregorioiscala annectens* (Powell, 1951) – MolluscaBase (2020).

†***Cirsotrema caelicola* Finlay, 1926**

Finlay, H.J., 1926a, p. 231, pl. 57, figs 17, 18 (holotype).

Holotype: MA70174, collected by Mr Moore of Dunedin Training College, from the early Miocene (Altonian) at All Day Bay, Kakanui, Otago, New Zealand.

Current name: *Cirsotrema caelicola* Finlay, 1926 – MolluscaBase (2020).

†***Cirsotrema (Tioria) marshalli* Laws, 1935**

Laws, C.R., 1935b, p. 27, pl. 4, fig. 9 (holotype).

Holotype: MA70175, collected from the middle Eocene (Bortonian) Hampden Formation, near Kakaho Creek, Hampden Beach, Otago, New Zealand.

Current name: *Cirsotrema (Tioria) marshalli* Laws, 1935 – MolluscaBase (2020).

***Epitonium bucknilli* Powell, 1924**

Powell, A.W.B., 1924, p. 138, pl. 5.

Holotype: MA72057, collected from Mount Maunganui, Bay of Plenty, New Zealand.

Current name: *Epitonium (Hyaloscala) bucknilli* Powell, 1924 – Spencer *et al.* (2018).

***Funiscalca maxwelli* Finlay, 1930**

Finlay, H.J., 1930b, pp. 233, 234, pl. 44, fig. 33 (holotype), fig. 32 (paratype).

Holotype: MA70330, dredged by M. Young, from 91 m (50 fathoms), 16 km (10 miles) E.N.E. of Otago Heads [Taiaroa Head], Otago, New Zealand.

Paratype: MA73605, one specimen, from the type locality.

Current name: *Opalia (Nodiscalca) maxwelli* (Finlay, 1930) – Spencer *et al.* (2018).

†***Hyaloscala muricata* Laws, 1933**

Laws, C.R., 1933, p. 322, pl. 31, fig. 19 (holotype), pl. 33, fig. 36 (holotype).

Holotype: MA70364, collected by C.R. Laws from the early Miocene (Altonian) Southburn Sand at Sutherlands, Tengawai River, South Canterbury, New Zealand.

Paratype: MA73606, one specimen from the type locality.

Current name: *Epitonium (Hyaloscala) muricatum* (Laws, 1933) – Maxwell in: Spencer *et al.* (2009: 244); MolluscaBase (2020).

***Murdochella alacer* Finlay, 1926**

Finlay, H.J., 1926b, p. 402, pl. 19, fig. 41 (holotype).

Holotype: MA70494, collected from 73 m (40 fathoms), off Cuvier Island, New Zealand.

Current name: *Murdochella alacer* Finlay, 1926 – Spencer *et al.* (2018).

***Murdochella superlata* Finlay, 1930**

Finlay, H.J., 1930b, p. 234, pl. 44, fig. 31 (holotype).

Holotype: MA70495, collected from 137 m (75 fathoms), North Cape, New Zealand.

Current name: *Papuliscala superlata* (Finlay, 1930) – Spencer *et al.* (2018).

***Murdochella tertia* Finlay, 1930**

Finlay, H.J., 1930b, p. 234, not figured.

Holotype: MA70496, **Figure 2g**, collected from 137 m (75 fathoms), North Cape, Northland, New Zealand.

Current name: *Murdochella alacer* Finlay, 1926 – Spencer *et al.* (2018).

***Nodiscalca zelandica* Finlay, 1930**

Finlay, H.J., 1930b, p. 232, pl. 44, fig. 35 (holotype).

Holotype: MA72581, collected from 137 m (75 fathoms), North Cape, Northland, New Zealand.

Current name: *Opalia (Nodiscalca) zelandica* (Finlay, 1930) – Spencer *et al.* (2018).

***Pliciscalca (Nodiscalca) ahiparana* Powell, 1930**

Powell, A.W.B., 1930a, pp. 541, 542, pl. 61, fig. 10 (holotype).

Holotype: MA72118, dredged by J. Bollons, from 128 m (70 fathoms), off Ahipara, Northland, New Zealand.

Current name: *Opalia (Nodiscalca) ahiparana* (Powell, 1930) – Spencer *et al.* (2018).

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