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SHORT NOTE

Southern extensions for Holocene records of Australian pelican (*Pelecanus conspicillatus*) and New Zealand musk duck (*Biziura delautouri*) in New Zealand

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The distributions of birds in New Zealand immediately before human colonisation are derived from bones recovered from Holocene and archaeological sites. Bones from several extinct species and extirpated populations were identified during examination of a natural deposit of bones of Holocene age found on intertidal sand flats at Harwood (45° 46'S, 170° 40'E), Otago Harbour, south-eastern South Island, New Zealand. Most were species, such as moa (*Dinornithiformes*), South Island adzebill (*Aptornis defossor*) and black swan (*Cygnus atratus*), known from other coastal assemblages from south-eastern South Island. Here we record bones from 2 species that were unexpected

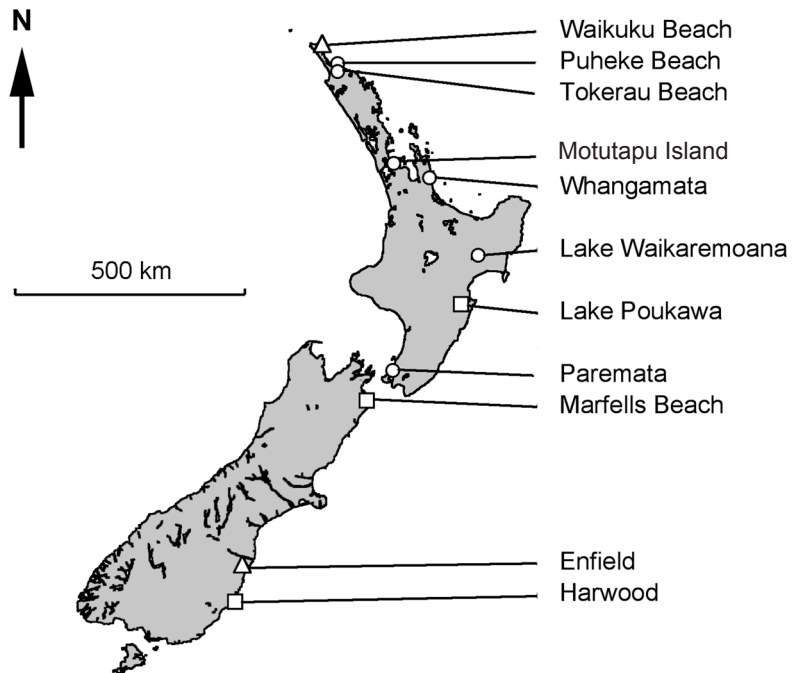
in that area—2 bones from an Australian pelican (*Pelecanus conspicillatus* Temminck, 1824) and 1 bone from a New Zealand musk duck (*Biziura delautouri* Forbes, 1892). The 3 bones are now registered with the Museum of New Zealand Te Papa Tongarewa, Wellington (hereafter referred to as "Te Papa"), with catalogue numbers designated with the prefix NMNZ.

Pelican bones have been reported previously from 8 sites in New Zealand (Fig. 1), with at least 10 individuals represented (Gill & Tennyson 2002). The material was previously referred to an extinct, endemic species larger than the Australian species (Rich & van Tets 1981). Subsequent comparisons showed that they are indistinguishable from bones of Australian pelicans, so they are now referred to as *P. conspicillatus* (Worthy 1998; Gill & Tennyson

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Fig. 1. Locations of Holocene records of Australian pelican (Gill & Tennyson 2002) and New Zealand musk duck (Worthy 2002) in New Zealand, and the new southern-most location for both species at Harwood. Circles = pelican only (6 locations); triangles = musk duck only (2 locations); squares = both species (3 locations).



2002; Worthy & Holdaway 2002). The paucity of pelican bones in the fossil record suggests that the species has always been, as it is now, a rare vagrant in New Zealand, and not an extirpated breeding species (Worthy 1998; Gill & Tennyson 2002; Worthy & Holdaway 2002; Miskelly *et al.* 2013).

The 2 Australian pelican bones from Harwood were a right coracoid (NMNZ S.45667) identified by THW using a mounted skeleton (OM Av6683) in the Otago Museum collection and a left tibiotarsus (NMNZ S.45668) identified by AJDT using the Te Papa reference collection (Fig. 2). Anatomical descriptions follow Livezey & Zusi (2006). The right coracoid is missing the entire sternal end, the *processus acrocoracoideus* and the *processus procoracoideus*, and only one standard measurement was possible. The width of the shaft at the *foramen nervi supracoracoidei* measured in ventral view was 16.7 mm, which was within the range of 13.8–16.8 mm from 3 modern specimens in the Te Papa reference collection. The left tibiotarsus is lacking the proximal end but is otherwise intact. Two standard measurements were possible; the distal end was 21 mm wide (within the range of 20–25 mm from 15 modern specimens measured by Rich & van Tets 1981), and the maximum mid-shaft width was 13.6 mm, which matched that of a modern tibiotarsus measured and depicted by Gill & Tennyson (2002).

Holocene-aged musk duck bones have been reported previously from 4 locations in New Zealand (Fig. 1), representing at least 8 individuals

(Worthy 2002). Bones of the New Zealand musk duck are larger than those of the Australian musk duck (*B. lobata*) and there are enough morphological differences to support the New Zealand and Australian forms being accepted as separate species (Olson 1977; Worthy 2002). The New Zealand musk duck went extinct soon after the human colonisation of New Zealand with the primary cause of extinction thought to be human hunting (Worthy & Holdaway 2002; Tennyson & Martinson 2007). Australian musk ducks exhibit sexual dimorphism, with males being distinctly larger than females, and this size dimorphism is reflected by relatively large size ranges for particular bones from New Zealand (Worthy 2002).

The single New Zealand musk duck bone from Harwood is a right humerus (NMNZ S.45669) identified by AJDT using the Te Papa reference collection (Fig. 3). The humerus lacks the proximal end but is otherwise intact. Two standard measurements were possible: width of the distal end was 14.8 mm; maximum mid-shaft width was 7.0 mm. Worthy (2002) presented comparisons of shapes and measurements of bones from the extinct New Zealand musk duck and from the smaller, extant Australian musk duck. Measurements for the humerus from Harwood were within the range of 4 male specimens of *B. lobata* but larger than those of 3 *B. lobata* female specimens and towards the larger end of the size range for 5 unsexed New Zealand fossils (based on Worthy 2002 and the Te Papa reference collection).



Fig. 2. Australian pelican (*Pelecanus conspicillatus*) left tibiotarsus NMNZ S.45668 (A) and right coracoid NMNZ S.45667 (B) from the Holocene deposit at Harwood. Scale bar 50 mm. Photographs: C. Lalas.

Fig. 3. New Zealand musk duck (*Biziura delautouri*) right humerus NMNZ S.45669 from the Holocene bone deposit at Harwood. Scale bar 50 mm. Photograph: C. Lalas.

The 3 bones from Harwood reported here add a ninth location and eleventh individual to New Zealand Holocene records of Australian pelicans and a fifth location and ninth individual to Holocene records of New Zealand musk ducks. The Harwood site represents a southward extension of Holocene records for both species: 450 km south of Marfell's Beach for Australian pelican and 80 km south of Enfield for New Zealand musk duck. Harwood is also the third site to have yielded both species (Fig. 1). The bone deposit at Harwood is amorphous and bones appear on the surface of intertidal sand: the bones described here were among 393 identifiable bird bones collected by CL in 4.5 years from their discovery in June 2003 until December 2007. JH and CL are preparing a description of this bone assemblage. Bones are still being exposed at the site, and further material of the 2 taxa recorded here may be recovered.

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