SHORT NOTES

The only flightless passerine; the Stephens Island wren (*Traversia lyalli* : Acanthisittidae)

ABSTRACT

New anatomical evidence shows that New Zealand's extinct Stephens Island wren (*Traversia lyalli*) had a much reduced wing skeleton, short, rounded, soft-quilled wings and an almost acarinate sternum. It was therefore the only known completely flightless passerine.

New Zealand's so-called Stephens Island wren (*Traversia lyalli* Rothschild, 1894) holds a unique place in the history of extinct birds, having been discovered but also soon afterward exterminated, it is alleged, by the lighthouse keeper's cat. Only 16-18 specimens were collected, all within a short period in late 1894, but perhaps not all by the cat. Of these just 12 can now be located in museum collections, all of them study skins or mounts, though at least two of them, and another now untraced, were initially preserved as whole birds in spirit.

The Stephens Island lighthouse keeper, D. Lyall, was apparently the only one to have seen the bird alive and then just twice. His unique, though limited, observations have led to much speculation and debate on the habits and, in particular, the flying ability of *Traversia*. Rothschild (1894), from his examination of the type, commented only that the weak character of the wing and the very soft and loose nature of the plumage "pointed to flightlessness" but later, having learned through H.H. Travers of Lyall's observations, stated that the species "ran like a mouse" and "did *not* fly at all". This last statement was rephrased in less definite terms by Oliver (1955) as, "it was never seen to fly", while other authors, speculating without recourse to detailed anatomical examination, pronounced the species variously as "not flightless" (Buller 1896), showing "no clear evidence of flightlessness" (Fitzgerald 1985) or "flightless" (Stanley 1979, Feduccia 1985).

Flightlessness is widespread among various orders of birds, but although the Central American Wren-thrush (*Zeledonia coronata*) and several neotropical rhinocryptids have been described, tantalisingly, as "flightless or nearly so" (Feduccia 1985), as yet there has been no unequivocal proof of complete loss of flight in any of the Passeriformes. To prove whether or not *Traversia* was capable of flight, Lyall's meagre observations need to be supplemented by morphological and functional analysis of the wing and pectoral girdle. Such an analysis has hitherto been impossible because none of the existing specimens (which all lack trunk skeletons) has a sternum, a coracoid or a complete humerus.

In 1976 subfossil remains of *Traversia* were, for the first time, identified from mainland New Zealand (Millener 1984), and they are now known from four North Island and three South Island sites of Late Pleistocene/Holocene age. In August 1988 several more almost complete skeletons, including for the first time intact sterna, were found at one of these South Island sites, the Honeycomb Hill cave system in northwest Nelson.

Examination of these subfossil specimens of *Traversia* has established that the elements of the wing and shoulder girdle are relatively shorter and less robust than those of other acanthisittids (Millener 1988). Reduction of the wing skeleton is shown by comparison of ratios of combined wing bone lengths (humerus + ulna + carpometacarpus) to femur length in the various acanthisittids. For the fully volant Rifleman (*Acanthisitta chloris*) this ratio is 3.26:1, for the weak-flying Rock Wren (*Xenicus gilviventris*) and Bush Wren (*X. longipes*) 2.68:1 and 2.56:1 respectively, and for *Traversia* 2.05:1. The coracoid (Fig. 1b) and humerus (Fig. 1d) are distinctively slender in *Traversia*. In measures of 'relative stoutness' obtained by expressing 'breadth of proximal extremity' and 'minimum shaft breadth' as percentages of shaft length, these elements of *Traversia* are at least 20% more slender than those of any other acanthisittid (cf. *X. gilviventris*, Fig. 1a, c).

The short, rounded wings and soft-plumaged "ralline" appearance of *Traversia* were interpreted by Rothschild (1894) and Buller (1896) as trends toward but not definite evidence of flightlessness. My examination of the relaxed wings of two mounted specimens of *Traversia* showed that, relative to body weight, they are somewhat shorter than those of the other acanthisittids, the wing area is 45-70% less, and the wing loading is correspondingly higher. However, it is in the structure of the flight feathers themselves that *Traversia* is particularly distinctive. In typical flying birds the primary feather vanes, in the outermost primaries particularly, are strongly asymmetrical, the outer vane being reduced almost to nothing (Feduccia 1979). However, in *Traversia*, but not in the other acanthisittids, *all* the primaries show much greater symmetry, having outer vanes at least half the width of the inner. In addition, because the barbules of adjacent barbs scarcely overlap, the webs of its primaries lack the smooth sheen and continuous, airtight surface typical of volant forms. *Traversia's* wing feathers are thus, in many ways, remarkably similar to those of flightless rails such as the weka (*Gallirallus australis*).

While reduction in wing size and degeneration of flight feathers suggest flightlessness, it is the conformation of the hitherto unknown sternum which provides the final proof. In Fig. 2, a *Traversia* sternum (b,d) is shown beside that of *X. gilviventris* (a,c), chosen because it is, among the acanthisittids, the closest to *Traversia* in body size. In ventral view one can see that, in *Traversia*

(1) The sternal body is somewhat broader, yet markedly shorter than that of *X. gilviventris*, thus providing a lesser area for attachment of pectoral muscles;

(2) The manubrial spine (spina externa), large and bifid in *X. gilviventris*, is entirely absent, indicating a lesser development of the sternocoracoclavicular membrane;

(3) The regions of sternocoracoidal articulation are narrower (and the coracoidal sulci less excavated), indicating a less rigid attachment of the markedly more slender coracoids to the sternum.

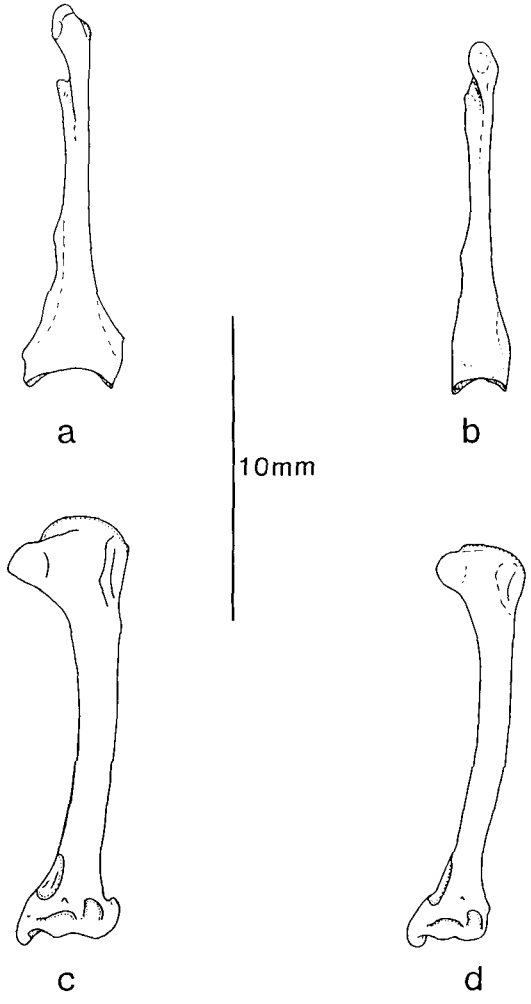

FIGURE 1 — Left coracoids (a,b) and humeri (c,d) of *Xenicus gilviventris* (a,c — BMNH.1940,12.8.144) and *Traversia lyalli* (b — NMNZ.S22797, d — NMNZ.S22800)

In lateral view (Fig. 2c,d) the differences between the two taxa, particularly in the size of their sternal carinae (shaded) are dramatic. In *X. gilviventris* the carina extends for over 85% of the length of the sternal body, but in *Traverisa* for only 30%. In *X. gilviventris* the maximum depth of the carina ($x = 3.52$ mm, $n = 5$) is 43% of the minimum breadth of the sternal body (measured behind the posterior costal notch), whereas in *Traversia* (carina depth: $x = 0.70$ mm, $n = 3$) the equivalent figure is a mere 8%. This extraordinary degree of carinal reduction in *Traversia* is emphasised by

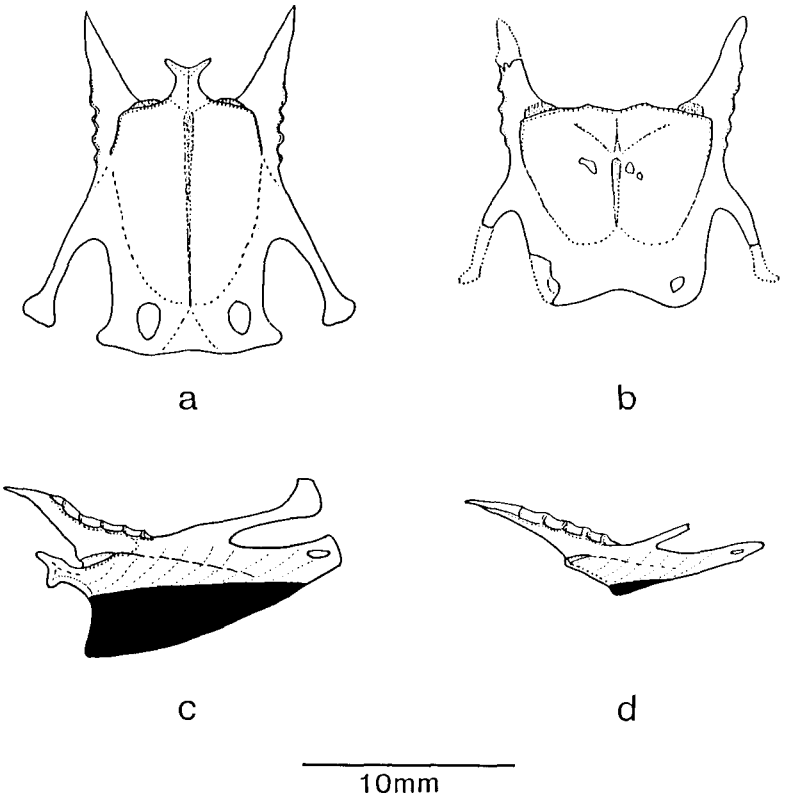

FIGURE 2 — Ventral (a,b) and left lateral (c,d) views of sterna of *Xenicus gilviventris* (BMNH.1940.12.8.144) and *Traversia lyalli* (NMNZ.S25593)

comparison with *Atrichornis rufescens*, the almost flightless Rufous Scrub-bird of Australia, for which the figure is 23% (data from Rich *et al.* 1985). The sternal carina provides a key attachment area for pectoral muscles and its size largely determines a bird's flight muscle mass. Perhaps the most telling comparison to be made between *Traversia* and *X. gilviventris* is that the surface area of the sternal carina in *Traversia* is less than 6% of that of *X. gilviventris*. As noted previously, the surface area of the sternal body available for attachment of flight muscles is also very much reduced in *Traversia*, and so its flight muscle mass was probably no more than 2-3% that of *X. gilviventris*. As the Rock Wren is itself a weak flyer, "usually covering only five or six metres in one stretch" (Shaw 1985), the functional consequences of *Traversia* having such reduced flight muscles are obvious.

Such compelling anatomical evidence, supplementing the meagre historical observations of a bird which was "never seen to fly", leads one to the inescapable conclusion that *Traversia lyalli* was the only known completely flightless member of the Passeriformes.

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A 1973 record of Chestnut-breasted Shelducks

While going back through my notes of field observations recently, I came across one dated 20 January 1973 about what were at the time two puzzling shelducks, seen on the bed of the Hokitika River downstream of the Kaniere township bridge. My notebook has notes and a sketch of one bird, plus a comment that both birds had similar plumage.

Having knowledge now of the Chestnut-breasted Shelduck *(Tadorna tadornoides)*, I submitted the record to the Rare Birds Committee, which has accepted the record as the first sighting for New Zealand. The sketch and description show that one bird was a male, and the other may have been also.

This note should be read in relation to the article by Heather (1987; The Chestnut-breasted Shelduck in New Zealand 1983-1986, *Notornis* 34: 71-77), as it brings to light a record that was not available to him.

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