

SHORT NOTE

The bill and foraging behaviour of the Huia (*Heteralocha acutirostris*): were they unique?

The Huia (*Heteralocha acutirostris*), a member of the wattlebird family (Callaeidae), was last seen on the North Island of New Zealand in 1907. It is described by various ornithologists as distinctive or unique in its sexual differences in bill size and shape (see Fig. 1). Females had a long, slender and strongly decurved bill averaging 96 mm in length while males had a medium length, stout and slightly decurved bill averaging 60 mm (Burton 1974). In fact, the differences in bill morphology are so great that the male and female were first described as separate species (Buller 1888). This difference in bill morphology reportedly allowed pairs to forage in a cooperative nature on larvae in the bark of trees (see below), a type of mutual behaviour unknown in other species of birds. The purpose of this note is to point out that sexual differences in bill size and shape are not unique to the Huia and that cooperative foraging by males and females described in popular accounts of the Huia's habits and behaviour probably did not occur.

Both scholarly works and popular accounts of the Huia's behaviour and natural history tend to stress that the bill of the male and female was unique relative to other birds. For example, Phillipps (1963: 25) in *The Book of the Huia* begins the chapter on 'Food and Habits' as follows:

"The most remarkable fact about the huia from a scientific view point is that it is the only bird in the world (as far as we know) in which male and female have beaks of different types."

More recently, Gill & Martinson (1991: 90) in their book *New Zealand's Extinct Birds* describes the Huia as:

"...the only bird known in which the bill of the male and female are radically different in shape, that of the female being much longer (up to 104 mm) and therefore more curved than the male's (up to 60 mm). Pairs seemed to cooperate in their search for food. "

Chambers' (1989: 448) locality guide to birds of New Zealand emphasizes the Huia's unique bill and feeding behaviour:

"The huia was distinctive by way of its dimorphism, not as to plumage colouration as in most birds, but as to sexual differences in bill shape. The two different shaped bills allowed the mated huia pairs to carry out co-operative feeding rituals with the male bird using its bill to open up the holes of larvae such as that of the Long-horn Beetle while the female used its bill to extract the grub. This unique behaviour is unknown in other world bird families."

All of the cases cited above, and others, apparently rely on information taken from Sir Walter Buller's classic *A History of the Birds of New Zealand*. Buller's (1888:10) description of the Huia's foraging habits stem from a single study of a pair of birds he held in captivity:

"...what interested me most of all was the manner in which the birds assisted each other in their search for food, because it appeared to explain the use, in the economy of nature, of the differently formed bills in the two sexes."

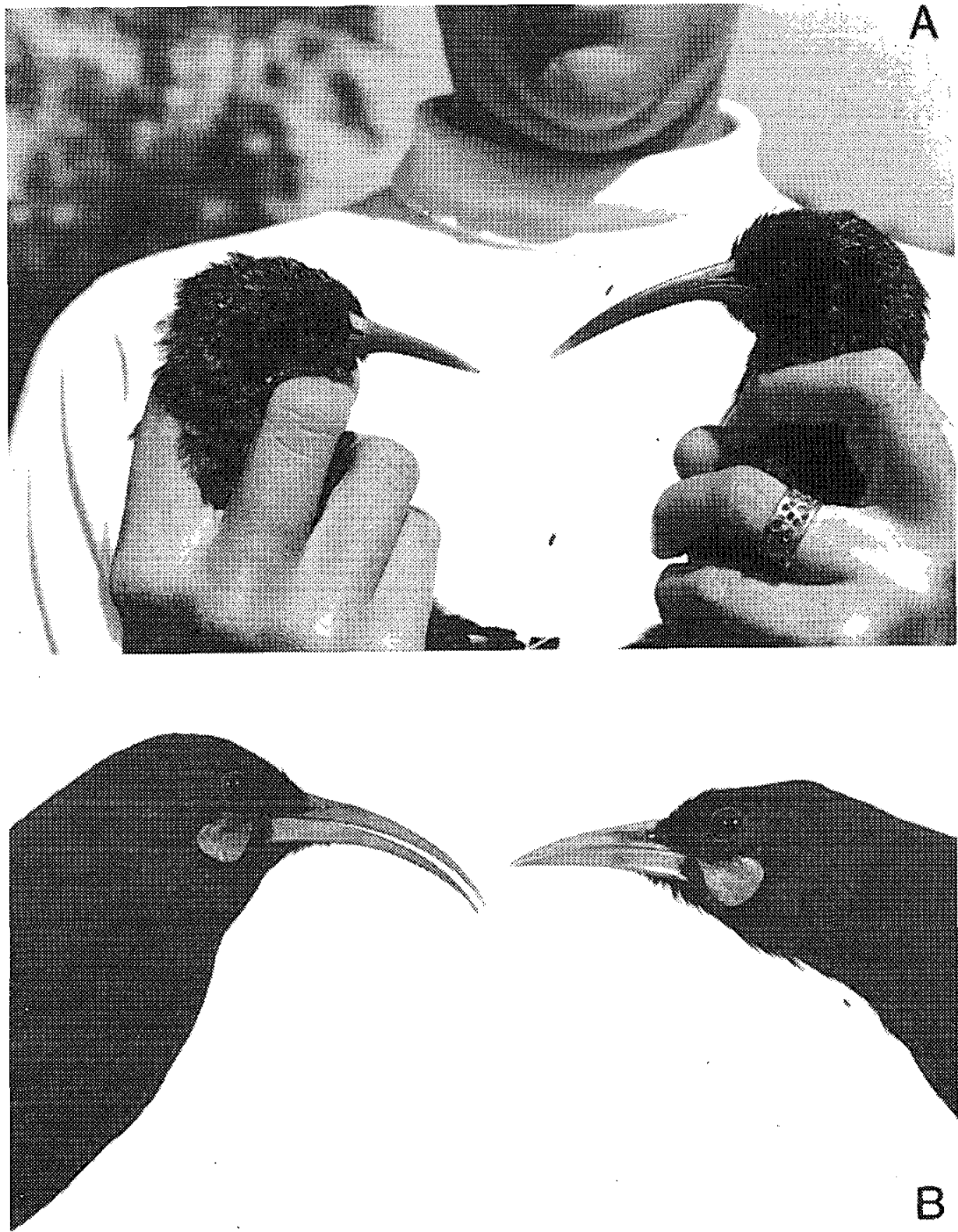


FIGURE 1 - (A) Picture of a male (right) and female (left) Green Woodhoopoe. [with permission of D. Ligon]
(B) Picture of a male (right) and a female (left) Huia. [courtesy of the Otago Museum]

Yet nowhere in this account, either in the original note on which it was based (Buller 1871) or any other place we have seen it cited, does Buller actually go on to describe any such cooperative behaviour between the pair. Instead, what Buller describes is that the male and female fed independently on different parts of a decaying log which he had introduced into their cage:

“The male always attacked the more decaying portions of the wood, chiselling out his prey after the manner of some woodpeckers, while the female probed with her long pliant bill the other cells, where hardness of the surrounding parts resisted the chisel of her mate. Sometimes I observed the male remove the decaying portion without being able to reach the grub, when the female would at once come to his aid, and accomplish with her long slender bill what he had failed to do. I noticed, however, that the female always appropriated to her own use the morsels thus obtained.”

Although Buller's use of the phrases “assisted each other in their search for food” and “the female would come to his aid” suggest a cooperative feeding nature, he himself did not see it that way. As Galbreath (1989) recounts, when a famous writer of popular science took poetic licence with Buller's observations to suggest that the female Huia shared her morsels with her mate just as a wife might help her husband, Buller (1895: 107) took exception to this:

“It seems a pity to destroy the pretty sentiment of the case as put by Sir John Lubbock [in his *The Beauties of Nature*] but science is inexorable, and truth must be upheld.”

Buller then went on to restate what he had written in his earlier account in which it is clear that the pair did not share their food as Lubbock had suggested. As Burton (1974) has subsequently argued, the female may have occasionally derived some benefit from the male's chiselling, but the reason for the Huia being found most regularly in pairs was probably not for mutual assistance in foraging, as is often interpreted from Buller's work, but for reasons dealing with social or sexual interactions. We concur with Burton (1974) and Williams (1976) that there is no firm evidence that indicates that male and female Huia assisted each other in extracting grubs from wood, although Buller's original comment (and one by J. M. Wright, quoted in Oliver (1955: 518)) are suggestive.

Williams (1976) suggested that the simplest explanation for the Huia's sexually dimorphic bill is that it is a secondary sexual characteristic used in courtship. This explanation seems unlikely to us, however, because it was the female who possessed the exaggerated trait and not the male as would be expected in avian species which breed as monogamous pairs (see Moorhouse 1996). That the two sexes fed in different manners, and possibly on different food items, due to the substantial difference in their bill size and shape is undoubtedly true. Burton's (1974) detailed anatomical study reveals that the skeletal structure and musculature of the head and neck region of the Huia have diverged extensively between the two sexes with each adapted for different means of using its bill: chiselling and gapping (or prying) for the male, probing for the female.

Sexually dimorphic bills and foraging patterns are not unique to Huia as is often claimed by New Zealand ornithologists, however. For example, bills of the African Green Woodhoopoes (*Phoeniculus purpureus*: Phoeniculidae) are sexually dimorphic in size and shape, although in this case it is the male with the longer

decurved bill (see Fig. 1): mean bill length for male's is 50 mm, while mean length for female's is 40 mm (Ligon & Ligon 1979). Furthermore, the dimorphism in bill size and shape appears to be linked to where and how Green Woodhoopoes forage. Males forage lower down on the trunks of trees and take considerably larger insects on average than females who feed primarily out on the limbs (Ligon & Ligon 1990; D. Ligon, pers comm). Sexual differences in bill size (but not shape) and foraging behaviour also occur in another group of wood excavators, the woodpeckers (Picidae) although differences are less marked with more overlap in food items and behaviour (Selander 1966).

Other marked differences in bill sexual dimorphism, which are associated with niche separation in intersexual competition for food, are seen in some species of nectar feeding birds such as Hawaiian honeycreepers (Drepanidinae), sunbirds (Nectariniidae) and hummingbirds (Trochilidae) (Selander 1966). In these cases, sexual dimorphism in bill size (with males larger than females) is relatively greater than dimorphism in other body measurements suggesting that bill dimorphism is not simply a result of sexual selection on increased body size (Selander 1966; Moorhouse 1996). Similar size dimorphism (but not shape) is also seen in some waders such as dowitchers, curlews and godwits (Scolopacidae), although in these cases the female has the larger bill. The Trembler (*Cinlocerthia ruficauda*: Mimidae) from the Lesser Antilles is most similar to the Huia in that females have longer bills than males but are smaller with respect to other body measurements such as tarsus and wing length (Selander 1966). However, little is known about their feeding ecology with respect to bill sexual dimorphism (Zusi 1969).

For woodpeckers, Selander (1966) proposed that bill dimorphism results in expanded feeding niches relative to more monomorphic congeneric species and is associated with a reduction in intensity of interspecific competition resulting from the absence on island or insular populations of other species with similar foraging behaviour and ecology. Whether this explanation holds for the Huia is uncertain although there were presumably few other species of birds in New Zealand which would have foraged in a similar manner. Kaka (*Nestor meridionalis*) tear apart bark with their bill when in search of larvae (P. Wilson, pers. comm.) but wouldn't be able to chisel or gape like the Huia. The close relative of Huia, the Saddleback (*Philesturnus carunculatus*), is known to excavate insect food from decaying timber and does show development of skeletal and musculature features associated with bill gaping, but these are much less specialised and show no pronounced sexual dimorphism (Burton 1974). The third member of the Callaeidae, the Kokako (*Callaeas cinerea*), is primarily a fruit and leaf eater and shows no skeletal specialisation for bill gaping and no dimorphism in bill size (Burton 1974). We might deduce from this that Huia and Saddlebacks shared a more recent common ancestor with the Huia diverging and evolving a sexually dimorphic bill possibly resulting in an expanded food niche (see also Moorhouse 1996).

In summary, Huia were remarkable birds in the extent of differences in the size and shape of the male and female bills. However, they are only unique in the sheer magnitude of this difference – the largest known (Selander 1966) – and not in bill sexual dimorphism itself or in the resulting differences in male and female foraging technique. In addition, early accounts of the Huia's foraging behaviour do not indicate that mated pairs assisted each other in finding and excavating wood insects,

as has sometimes been interpreted, but instead suggest that the male and female foraged independently. Rather than continuing to emphasise any unique characteristics of the Huia, we would like to point out that several groups of birds (including the Huia) which specialise on feeding on insects in timber show a similar pattern of sexual dimorphism in bill size.

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