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Dromaius novaehollandiae 47

Order STRUTHIONIFORMES

Flightless cursorial birds; all, except Apterygidae, huge. Also known as Ratitae and referred to loosely as 'ratites' from the Latin *ratiss* (raft) after their raftlike sternum, without a keel. Five living families Struthionidae, Rheidae, Casuariidae, Dromaiidae and Apterygidae, placed in four sub-orders; Casuariidae and Dromaiidae being combined in one, Casuarii. Has also been combined with Tinamiformes to form a single order Palaeognathiformes (Cracraft 1974) or split into three separate orders without Apterygidae (Storer 1971). On basis of DNA-DNA hybridization, four families recognized: Struthionidae, Rheidae, Casuariidae, Apterygidae in two sub-orders Struthioni and Casuarii (Sibley *et al.* 1988). Dromaiidae, Casuariidae and Apterygidae confined to A'sian region. Struthionidae introduced to Aust. Usually now considered to have common origin, probably from flying ancestors and likely to have originated in Gondwanaland (Cracraft 1974; Rich 1975).

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Family **APTERYGIDAE** kiwis

Nocturnal, flightless, cursorial birds, smallest ratites, only 25–55 cm tall. Endemic to NZ. Three species in one genus. Generally regarded as most closely related to moas (extinct), both being descendants of Gondwana fauna and most ancient element of NZ avifauna. Much reduced thoracic musculature and bone-structure; small head and long neck, usually held forward, but well-developed pelvis and legs give a pear-shape to body. Bills long (up to 200 mm), with nostril openings and rictal bristles at base. Wings greatly reduced and mostly naked with claw at tip. No tail. Feathers of one type with single rachis and unlinked barbs giving shaggy appearance to plumage. No seasonal change to plumage. Eyes small. Legs and feet, well developed. Three forward-pointing toes with strong claws. Hind toe small and above foot. Chicks hatch fully feathered and active. Juveniles reach adult size at about 18 months. Habitat is sub-tropical to temperate, evergreen forest and scrub from sea-coast to alpine terrain at 1000 m. Feed principally on invertebrates. Eat some plant material including fleshy fruits. Use bill to probe for food and can detect it by smell (Wenzel 1968). May also be able to hear movement of larger invertebrates. Feet not used for scratching. Nocturnal, except Brown Kiwi on Stewart I. Sedentary and territorial throughout year. Territories maintained by calls and aggressive encounters. Roost singly or in pairs in burrows dug by birds themselves or in natural cavities at or near ground-level. Monogamous with long-lasting pair-bonds probably reinforced by sharing of roosts and by allopreening. Voice has considerable carrying power and probably serves to keep members of pairs in contact as well as to advertise territory. Little pre-copulation behaviour has been observed, but chasing, jumping, hissing and close-contact grunting occur. Long laying-season of 4–8 months. Replacement laying occurs. Nest in burrows or natural cavities. Clutch 1–3. Eggs very large and 18–25% of female's body weight. Generally, only males incubate, but females may take part at times. No brood-patch. Approximate incubation period 63–92 days. Chicks precocious and nidifugous; first leave nest when few days old and feed unaccompanied; probably never fed by parents. Males brood chicks in nest during day for first 2–3 weeks. Young may disperse in first year. Can breed in their second year in captivity. May live in captivity for over 20 years.

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Apteryx haastii Potts, 1872; *Trans. NZ Inst.* 5: 186–196 — Westland. Type from Okarito R. *vide* Oliver 1955 *NZ Birds* 2nd Ed: 55.

Named in honour of Sir J.F.J. von Haast (1824–87), Director Canterbury Museum 1866–87.

OTHER ENGLISH NAMES Great Grey Kiwi.

MONOTYPIC

FIELD IDENTIFICATION Height 45–50 cm; bill 85–130 mm. Medium-sized, flightless, nocturnal bird with pear-shaped body tapering to small head. Tail absent, wings vestigial and hidden under body plumage. Bill long, slender, with nostrils in small recess near tip. Plumage soft and hair-like, predominantly mottled grey and streaked with chestnut on back. Sexes similar, but females heavier with longer bills. Similar in size to Brown Kiwi *A. australis* on Stewart I.; similar in appearance to Little Spotted Kiwi *A. owenii*.

DESCRIPTION **ADULT MALE.** Head and neck, dark charcoal-grey with small dark patch below eye. Above, predominantly light yellowish grey, tinged with chestnut and irregularly banded with brownish black. Some specimens entirely mottled grey, others distinctly ginger. Throat and underparts, light grey, tending to fawn between legs. Bill, long, light horn suffused with pink; sometimes slate-grey hue on upper mandible. Iris, black. Feet and legs dark brown, occasionally creamy white. Claw colour varies and is apparently related to age: black in young birds, horn with black central stripe in middle age and white in older birds. **ADULT FEMALE.** As male, but about 15% heavier and bill 20–40 mm longer. **JUVENILE.** Distinctly smaller than adult for first 20 months. Light bands on upperparts mainly yellowish grey rather than chestnut.

SIMILAR SPECIES Similar only to other kiwis. **Brown Kiwis** lack chestnut fringes to feathers and longitudinal bands or streaks in plumage (Great Spotted Kiwis have dark, transverse bands on upperparts); also, call of Brown Kiwi is a shrill ascending then descending whistle without warbling quality of Great Spotted Kiwi. Greatest confusion likely with **Little Spotted Kiwi**: adult Little Spotted are much smaller, with slightly darker plumage, bands on upperparts less rufous and bill finer. However, juvenile Great Spotted Kiwis probably indistinguishable from Little Spotted in field (J.N. Jolly); colour of legs may differ: pale pink-white in Little Spotted ($n=c.$ 15 birds), black in Great Spotted ($n=1$) (R.M.

Colbourne). Distant calls of Great Spotted Kiwis can be confused with those of Wekas *Gallirallus australis*.

Nocturnal; mainly found in alpine and subalpine forest and tussock grasslands. Generally solitary or in pairs. Heard much more often than seen; males have shrill warbling ascending whistle; females, deeper and slower whistle. Flightless; high-stepping gait as in other kiwis. Often swim across streams and rivers, even in flood.

HABITAT Occur mainly in mountain ranges running parallel to coasts of nw. Nelson and Westland, SI. Some sparse populations farther inland and in lowland and coastal forests. In variety of habitats: tussock grassland; damp, mossy beech forests; dry, alluvial podocarp and hardwood forest; and scrub-covered coastal pasture. Density highest in wet beech (*Nothofagus*) forest with thick ground cover of moss and lichens. Occasionally seen on edge of rough farmland, but not yet in exotic forests, although several of these established within range. Found from sea-level to 1200 m (Jolly & Roderick 1983), but mainly subalpine to alpine, 700 to 1100 m.

Nests found under tussocks, in holes, in hollow logs and under overhanging rocks and one in cavity of limestone outcrop; in Heaphy Ra., nest on n. side of wooded spurs (Oliver) though one nest found s. side (R.M. Colbourne).

Population has declined in lower Punakaiki R., where country accessible and close to cleared land; birds may have been killed by baits and traps intended for possums or by feral dogs (Jolly & Roderick 1983).

DISTRIBUTION AND POPULATION Endemic to NZ; confined to SI. Mainly W of Southern Alps, especially in nw. Nelson and Westland. Now two (NZ Atlas) or three (J.N. Jolly) isolated populations.

Two populations shown in NZ Atlas: one in Paparoa Ras; second S of Whanganui Inlet to SW of Takaka, then S to Buller R. and back along coast. S. limit of range not known

precisely but at least to Karangarua R. (J.N. Jolly). Isolated population occurs E of main divide between Lewis and Arthur Passes; sub-fossil in Pyramid Valley shows they have been on e. side of main divide for at least 1000 years (Reid & Williams 1975). Unverified reports along Matiri and Victoria Ras suggest populations may still be joined (NZ Atlas); reports of kiwis in nearby areas may be Great Spotted Kiwis.

Before European settlement, occurred on Canterbury Plains; recorded by von Haast in Canterbury last century (Buller 1868). Formerly more widespread in W from Tasman Bay to Foveaux Str. (Oliver). Supposedly collected in Dusky Sound, Fiordland last century (Oliver 1955) but specimens probably Little Spotted Kiwis (J.N. Jolly). No evidence of recent expansion E as suggested (Falla *et al.* 1981). Introduced to Little Barrier I. in 1915 but now doubtfully extant (Oliver; NZCL).

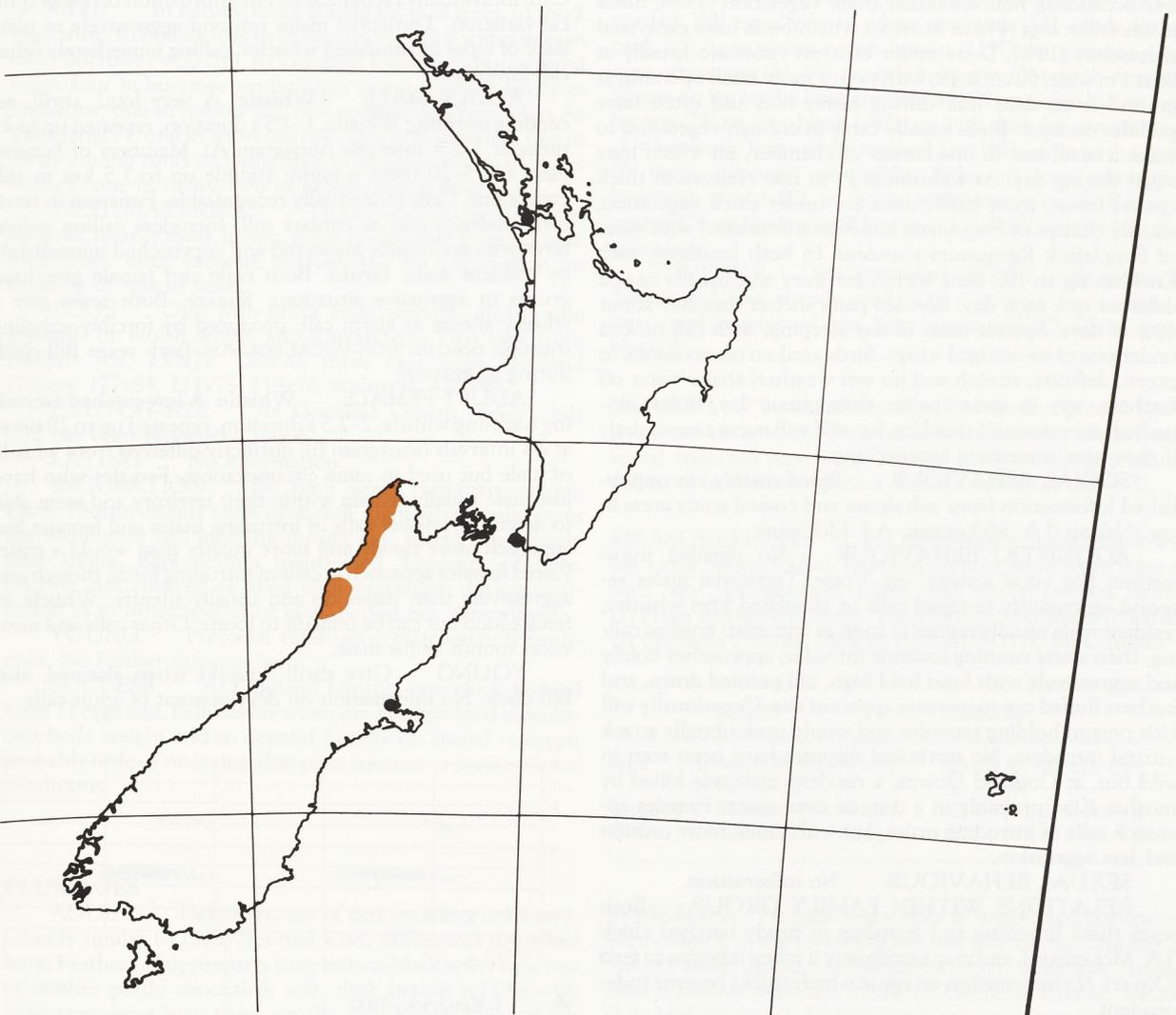
Presumed to breed throughout present range. In subalpine tussock and beech forest on Goulard Downs in nw. Nelson density c. 6 pairs/km²; in lowland coastal forest near Kahurangi Pt, nw. Nelson, c. 5 pairs/km² (J.A. McLennan); in central and s. Westland, density much lower, 1 pair/km² in lowland forests of Paparoa Ras, minimum 3-4 pairs/km² in

subalpine and beech-podocarp forest (Jolly & Roderick 1983; J.N. Jolly).

Status, possibly threatened or vulnerable (J.N. Jolly) though total population not known. Not threatened by land clearance, but declining in lowland forests (J.N. Jolly; R. Taylor) probably by use of gin-traps and poison for Common Brush-tailed Possums *Trichosurus vulpecula*. In some lowland forests, up to half of the birds have fractured or amputated toes, evidence of previous captures in gin-traps (J.A. McLennan). May also be subject to predation by dogs, mustelids, pigs and cats.

MOVEMENTS Sedentary within territories; no other information.

FOOD Mostly invertebrates; beetle larvae and earthworms during winter; large crickets and spiders added during summer and freshwater crayfish when these abandon flooded streams. Food obtained by probing ground, tussock tillers or rotting logs. Food usually grasped in bill tip before swallowing, may also use bill to pierce spires of snails (Jackson 1958). Food >1 m above ground level obtained by walking



along trees leaning out from hillsides (J.A. McLennan). Entirely nocturnal in winter but may remain active up to an hour after dawn in midsummer.

Only detailed observation of diet beyond generalized observations, snails *Paryphanta gagei* (Jackson 1958).

SOCIAL ORGANIZATION Based on unpublished information from subalpine and coastal study areas in nw. Nelson (J.A. McLennan; A.J. McCann). Occurs mostly in pairs, occasionally singly.

BONDS Mainly sustained monogamous; pair-bonds maintained through non-breeding season and in successive breeding seasons. Will re-mate if partner dies. Some females in lowland forests may be polyandrous, with home ranges including two or three territorial males. No information on parent-young bonds.

BREEDING DISPERSION Solitary; nests within fixed, defended territories. Territories 12–26 ha in sub alpine vegetation at Goulard Downs; 8–25 ha in rich coastal forest at Kahurangi Pt. Territories maintained throughout year.

ROOSTING Daylight hours spent sleeping and preening in dens. At Goulard Downs, dens are of four types: natural holes under buttress of roots of living trees (41% of 147 occasions), hollows under thick vegetation (39%), holes inside fallen logs (4%) or burrows which birds have excavated themselves (16%). Dens under buttress roots are usually at least 1 m wide, 50 cm high, with two or more small openings at ground level; dens leak during heavy rain and often have puddles on floor. Birds usually carry in enough vegetation to make a small mat in one corner of chamber, on which they squat during day. At Kahurangi Pt in nw. Nelson, in thick coastal forest, most (60%) dens are under thick vegetation, usually clumps of *Freyinetia baueriana* interlaced with vines of Supplejack *Ripogonum scandens*. In both locations, each Kiwi has up to 100 dens within territory and usually uses a different one each day. Bonded pairs shelter together about 40% of days. Spends most of day sleeping, with bill tucked under one of its vestigial wings. Birds awaken on occasions to preen, defecate, stretch and (in wet weather) shake water off feathers; stay in same shelter throughout day, unless disturbed; are extremely timid by day, and will move away quietly if they hear something approaching.

SOCIAL BEHAVIOUR Based mainly on unpublished information from subalpine and coastal study areas in nw. Nelson (J.A. McLennan; A.J. McCann).

AGONISTIC BEHAVIOUR No detailed information. For vocal activity, see Voice. Territorial males respond aggressively to taped calls or simulated kiwi whistles; resident male usually replies as soon as 'intruder' finishes calling, then starts running towards intruder; approaches boldly and aggressively with head held high, bill pointed down, and feathers fluffed out to increase apparent size. Occasionally will kick person holding recorder and would undoubtedly attack natural intruders. No territorial disputes have been seen in wild but, at Goulard Downs, a resident male was killed by another Kiwi probably in a dispute over space. Females approach calls of intruding males, but with much more caution and less aggression.

SEXUAL BEHAVIOUR No information.

RELATIONS WITHIN FAMILY GROUP Both sexes share brooding and guarding of newly hatched chick (J.A. McLennan), and may accompany it when it begins to feed (Oliver). No information on age at which chicks become independent.

VOICE Information from nw. Nelson, (unpublished studies, J.A. McLennan, A.J. McCann). Most vocal of the three kiwis (J.A. McLennan). Call at night throughout the year; rate of calling greatest in 2–3 h after sunset. Whistles are loud; birds heard much more often than seen. Calls of males usually a shrill warbling ascending Whistle, repeated up to 25 times; females have a lower-pitched and slower Whistle, repeated up to 20 times. Calls similar to those of other kiwis; warbling Whistle, generally distinguishable from Whistles of Brown Kiwi; calls of female unmistakable; calls of males can sometimes be confused with calls of male Brown Kiwis, especially if distant. Distant calls of both sexes easily confused with calls of Wekas. No mimicry reported. Non-vocal sounds: adults and young Bill-clack, produced by snapping mandibles shut. **RATE OF CALLING.** Little or no seasonal variation in rate of calling; however, sometimes varies by a factor of 6 between nights. Calling is generally suppressed during periods of full moon and long dry periods. Rate also varies within nights; generally rises steadily to a peak 2–3 hrs after sunset, then remains steady at about half peak-rate from then till dawn. At Goulard Downs, 55% of calls were by males, 45% by females (n=243). **DUETTING.** Often female will call during final few repeats of male's call. Distinct sexual differences in Whistle Call; individually recognizable. No information on geographical variation. Territorial males respond aggressively to playback of tapes or simulated whistles, calling immediately other call finishes.

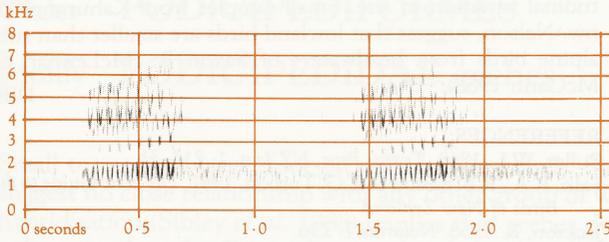
ADULT MALE Whistle. A very loud, shrill, ascending warbling Whistle, 1–1.5 s duration, repeated up to 25 times at 1–2 s intervals (sonagram A). Members of bonded pairs call 5–20 times a night; audible up to 1.5 km in still conditions. Calls individually recognizable. Function in territorial defence and as contact call. Intruders calling within territories are usually answered and approached immediately by resident male. **Grunt.** Both male and female give loud grunts in aggressive situations. **Sneeze.** Both sexes give a wheezy sneeze as alarm call; produced by forcibly exhaling through nostrils. **NON-VOCAL SOUNDS.** Both sexes Bill-clack during aggression.

ADULT FEMALE Whistle. A low-pitched ascending warbling whistle, 2–2.5 s duration, repeated up to 20 times at 2-s intervals (sonagram B); distinctly different from whistle of male but used in same circumstances. Females who have lost mate usually remain within their territory and seem able to defend it; answer calls of intruding males and females but approach more slowly and more quietly than would a male. Paired females approach at calls of intruding birds, though less aggressively than males do and usually silently. Whistle of female loud but can be difficult to locate. Other calls and non-vocal sounds as for male.

YOUNG Give shrill Squeaks when alarmed; also Bill-clack. No information on development of adult calls.



A. J. Kendrick; P100



B J. Kendrick; P100

BREEDING Little known. Information from unpublished studies by J.A. McLennan and A.J. McCann. Breed in solitary pairs in subalpine forest.

SEASON July to Nov., with replacement laying Nov. to Jan. At Saxon R., nw. Nelson, month of laying: July, one clutch; Aug., four; Sept., one; two first clutches started 27 and 28 Aug. 1988; at Kahurangi Pt, nw. Nelson, month of laying: July, two; Sept., one. At Saxon R. one replacement clutch Dec. after failed laying Aug. Chicks and eggs with well-developed embryos recorded late Dec. and early Jan. in Heaphy Ra., nw. Nelson (Oliver).

SITE In natural holes among roots of trees, in thick vegetation, in hollow logs or in fissures in rocks; sometimes in short burrows (<50 cm). At Gouland Downs: four in natural holes, four in burrows (under logs), one in shallow cavity in limestone, one in hollow log, one under thick vegetation At Kahurangi Pt, one in short burrow, one in hollow log, one in cavity among roots of living tree In Heaphy Ra., one under tussock, one in cavity, two in hollow logs (Oliver).

NEST, MATERIALS Thick (5–10 cm) layer of plant material, usually moss, lichen, grass, in chamber at end of hole or burrow. Birds excavate burrows but no information on building or role of sexes.

EGGS Oval with blunt ends; smooth, glossy; pale greenish or bluish white. **MEASUREMENTS.** Two eggs from Heaphy Ra., 130x79, 120x70; three eggs from Gouland Downs, 127x84, 121x75, 119x76. **WEIGHTS.** 470, 400.

CLUTCH-SIZE At Gouland Downs, 5x C/1 but C/2 has been reported (Oliver).

LAYING No information.

INCUBATION By both sexes, uniquely among kiwis. Female usually takes over each night when male leaves but sometimes also incubate during day. Starts immediately after laying. Eggs seldom unattended. Entrance of hole, burrow, not covered or filled with vegetation during incubation as in other species of kiwi. Period not determined.

YOUNG Precocial, nidifugous. Hatched fully feathered. No further information.

SUCCESS At Gouland Downs, one chick fledged from 11 eggs laid. Females lay when not enough food to maintain body weight and so depend heavily on stored reserves; probably little or no laying after poor autumn or severe winter conditions.

PLUMAGES

ADULT Definitive, age of first breeding unknown. Closely similar to Little Spotted Kiwi, differences described here. Feathers of upperparts have brown-black spiky tips; rest of feather partly concealed; soft, dark brown (c119a) with paler transverse bars; these usually light brown (39) but can

range from light brown (c223D) to brown (37). This reddish cast restricted to distal bars, which are perhaps lost with wear in some birds. Transverse bars also subject to fading, losing some of their reddish tinge with age.

JUVENILE Unknown how long retained but only observed on small chicks. Closely similar to juvenile Little Spotted Kiwi. In one bird (DOC photograph) some chevron shaped tips to feathers of upperparts were light brown (c223D).

IMMATURE Smaller than adults; adult size attained in c. 20 months (J.A. McLennan). Two skins (NMNZ) differ from adults in that dark brown (22) on back formed by dark tips to feathers, contrasting with blackish-brown crown. Lighter bars light brown (c39) and about half width or less of dark bars (about two-thirds of width in immature Little Spotted Kiwi).

ABERRANT PLUMAGES Partial albinos observed (Oliver).

BARE PARTS Based on captive birds (Mt Bruce), skins (NMNZ) and photos (NZDOC).

ADULT, IMMATURE Iris, black-brown. Narrow eye-ring usually pale cream (c54); light blue-grey (88) also recorded. Bill usually horn-white to cream (54), often with a pink (c7) tinge giving a pink-brown (219D) appearance. Culmen often grey (84, 85) or with light grey (85) patch near tip. Scutes on leg can be light grey-brown (27) or paler, but usually brown (28) to grey-black (c82), or with dark-brown patches; skin between, horn-white to pearl grey (81), often with a pink (7) tinge strongest on ankle. Sides of toes sometimes brownish-grey (c80) in birds with extensive dark-brown scutes. Claws, dark grey (83) to grey-black (82); cream (54) also recorded.

JUVENILE Iris, grey-black (82). Bill, light pink (c7). Tarsus and feet, mostly pink (c7); scutes on front edge of tarsus and on joints of toes, light brown (c222C). Claws, grey-black (82).

MOULTS Little information; like Little Spotted Kiwi, prone to shock moult. Three adults and two immatures (both sexes) collected June–Aug. showed body-moult; two adults collected in the same period showed no moult (NMNZ).

MEASUREMENTS For difficulties in measuring kiwis, see Little Spotted Kiwi. Exposed culmen from front edge of cere, and conventional tarsus and toe presented below. (1) From throughout range, adults, fresh specimens (NMNZ). (2) Gouland Downs, Nelson, live adults (J.A. McLennan).

	MALES	FEMALES	
BILL	(1) 96.0 (5.79; 87.3–99.9; 7) (2) 98 (n=12)	125.8 (8.59; 105–131; 13) 119 (n=9)	**
TARSUS	(1) 84.9 (8.85; 72.6–97.1; 7)	88.4 (10.47; 73.4–112; 13)	
TOE	(1) 82.0 (6.32; 70–91.4; 7)	89.2 (4.93; 82.4–101.4; 13)	**

WEIGHTS Adults lose weight in winter and late spring, recovering it in the following autumn and spring. Changes of weight more marked in subalpine birds, especially females (McLennan & McCann 1988). (1) Gouland Downs, Nelson (J.A. McLennan). (2) NMNZ; birds collected from throughout

range, including emaciated and very fat birds. Note Reid (1971) found weights of kiwis from museums can be deceptively low.

Males	(1) 2610 (n=12);	(2) 1692 (416.1; 1215-2320; 7)
Females	(1) 3270 (n=7);	(2) 2418 (389.3; 1530-2718; 12)

STRUCTURE As Little Spotted Kiwi; possibly leg bones relatively wider (T. Worthy).

RECOGNITION See Little Spotted Kiwi.

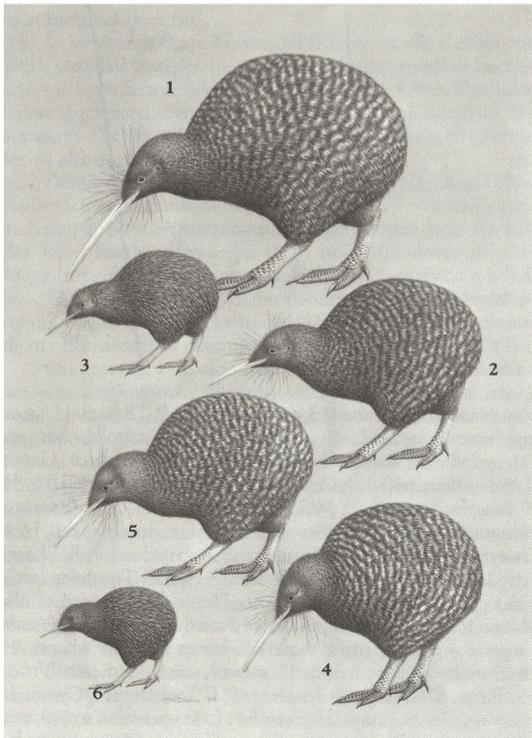
GEOGRAPHICAL VARIATION Perhaps some alti-

tudinal variation in size. Small samples from Kahurangi Pt, nw. Nelson, suggest that lowland birds are smaller than sub-alpine birds from headwaters of Saxon R. (McLennan & McCann 1988).

DIR

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Volume 1 (Part A), Plate 4

Great Spotted Kiwi *Apteryx haastii*

- 1. Adult
- 2. Immature
- 3. Juvenile

Little Spotted Kiwi *Apteryx owenii*

- 4. Adult, light morph
- 5. Adult, dark morph
- 6. Juvenile

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