

NORTH ISLAND BROWN KIWI:
Apteryx australis mantelli
MEASUREMENTS AND WEIGHTS OF A
YOUNG CHICK

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INTRODUCTION

At Kupe, Taranaki, on 26 October 1971 a dog exposed a nest and killed the incubating male bird. The contents of the nest, an emerging, half-hatched chick which the dog's owner removed from its shell, and a fertile egg, were placed in a heated cupboard. Within 18 hours the chick had died from internal haemorrhaging — and the embryo did not develop further. The adult, chick and egg were sent to the Wildlife Service and prepared as study specimens.

The egg measured 129.0 x 81.8 mm, contained a half-grown feathered embryo and weighed 430.7 g (shell 23.1 g; contents 407.6 g). When fresh, an egg with these dimensions would probably weight about 485 - 490 g (Reid 1971a).

THE DAY-OLD CHICK

The chick had a pink bill with an exposed length of 40.2 mm, and its vibrissae were only slightly longer than the other facial feathers. While the distal third of the claws were horn-colour, the proximal two-thirds were black; and the feet and toes were pinkish-grey. The yolk-sac was fully enclosed and, at death, the chick weighed 318.6 g — or about 65% of the calculated fresh weight of its sibling egg. The feathers, except for being proportionately smaller, were indistinguishable from those of the adult. Measurements and weights of the incubating adult and chick are given in Table 1.

Excluding the yolk-sac, the chick weighed 205.5 g or 12.1% of the weight of the incubating male. The skin (including wings) formed 30.3%, the carcass (head, neck, trunk, thighs, legs and feet) 50.1% and the viscera 19.7% of the chick's weight.

Compared with the adult, the hind limbs of the chick were disproportionately long (Table 1B) but they were poorly fleshed (Table 1A) and formed a smaller part of the bird's weight. Relative to their respective trunk lengths, the hind limbs of the chick were 15% longer than the hind limbs of the adult; but, relative to their respective trunk (including head and neck) weights the hind limbs of the chick were about 40% lighter than those of the adult.

Yolk sac:

The 318.6 g total weight of the chick included a 1.2 g yolk-sac containing 111.9 g of yolk. The yolk-sac from this chick is compared in Table 2 with those present in chicks of other species and shows

that the yolk reserve in the kiwi, per unit of body weight, is two-and-a-half times as great as that of the domestic chick, three times as great as that of the Adelie Penguin and five times as great as that of the Antarctic Skua.

The ages are not known of the other kiwi chicks included in this table. One (with a 54 g yolk-sac) was killed while foraging outside its burrow and is thought to be at least six days old. The other, whose vertebral column, pelvis and long bones were about 18% longer than those of the one-day chick, is estimated to be about three weeks old.

Adelie Penguin chicks, which hatch with an average food reserve of 1.8 g yolk per 10 g of body weight, may sometimes survive if not fed until the fifth day following hatching (Reid & Bailey 1966). A kiwi chick hatching with a food reserve of 5.5 g of yolk per 10 g of body weight should be able to withstand a more prolonged fasting period and undergo considerable weight loss without ill effect. Young kiwis totally denied food and water would probably die from water privation long before they depleted their yolk (and fat) reserves.

Data in Table 3 show that yolk from both the one-day-old and the (estimated) three weeks old chicks had a similar water content which was considerably below that of yolk from a fresh egg (Reid 1971 *b*). This suggests that proportionately more water than solids are withdrawn from the yolk, either during development, or within the first few hours following hatching. The 111.9 g of yolk in the day-old chick had the same dry weight, and may therefore have about the same nutritive value, as 126.3 g of yolk from a fresh egg.

The yolk-sac opened into the intestine at a point midway between the gizzard and the paired caeca. In the three-week old chick the tube of the 1.2 cm long connecting stalk was still continuous with the intestine.

Fat reserve:

The chick (excluding yolk-sac) weighed 205.5 g. It had a lean weight of 162.0 g and carried 43.5 g of fat. Approximately 70% of the fat was subcutaneous and only six percent visceral. Of the latter; 1.15 g was on the gizzard and 1.45 g was distributed throughout the other internal organs. The distribution of fat in the day-old and three-weeks-old chick is shown in Table 4.

DISCUSSION

In the day-old chick the legs were lightly fleshed and the proximal third of the three metatarsals (which fuse together and with the tarsals to form the tarsometatarsus) were still separate — and Robson's (1958) observations on kiwis hatched in captivity showed they were unable to stand until their fourth day, and did not leave the nest to feed until their sixth day. Turbott & Wightman (1959) observed a nest in the wild and believed that the chick did

not venture out until about 10 days after hatching, but T. R. Hartree (pers. comm.) stated that a chick hatched by the Hawke's Bay Wildlife Trust on 14 December 1971 first left its burrow on the fifth night following hatching.

There is a considerable reduction from the hatching weight during this fasting period. Robson and Hartree each took a few weights at irregular intervals and their data, along with that for the day old chick are summarised in Table 5. Both used kitchen scales and the weights obtained should be regarded as only approximate. Furthermore, the minimum weights they recorded are probably heavier than the minimums reached by the chicks, as it is improbable that any weighings coincided with the minimum weight. The weight of the one-day-old chick (excluding yolk-sac) was about 42% of the weight of the sibling egg, and this agrees closely with the data of Robson and of Hartree. Weights taken by the latter show the nine-day-old chick weighed 39% of the weight of the fresh egg.

It is doubtful whether the chick of any other species hatches with such an abundant food reserve. The lean weight of the one-day-old chick represented only 50.8% of its total weight; and for every 10 g of lean body weight this chick carried 9.6 g (6.9 g yolk; 2.7 g fat) of food reserves. Utilisation of the yolk-sac alone would account for a decrease in the hatching weight by about 35%, but a considerably greater loss in weight (perhaps approaching half the hatching weight) could probably be tolerated as the fat reserves represented about 27% of the chick's lean weight.

It seems fairly certain that the fasting and associated weight loss noted in chicks reared in captivity is also characteristic of wild-reared birds. Seven young kiwis found outside their burrows (and therefore thought to be at least five or six days old) all weighed less than the one-day-old chick. Their weights were — 185.8, 236, 251, 263.5, 281, 283.5 and 300 g. The 281 g chick contained a 54 g yolk-sac and the 263.5 g chick had a 14.1 g yolk-sac. Two chicks, one weighing 251 g, the other 300 g, were both carrying plenty of fat (F. C. Kinsky, pers. comm.). Robson stated that his chicks did not regain their hatching weight until they were four weeks old; but Hartree reported that his chick, which weighed 140 g at the age of ten days, weighed 240 g (about two-thirds the weight of the fresh egg and therefore, approximately the hatching weight) when it was only 16 days old.

In 55 days the weight of the chick hatched by the Hawke's Bay Wildlife Trust increased from its minimum of 140 to 565 g — a gain of 425 g or 7.7 g a day. A young chick at Mt Bruce, suffering several injuries including a blind weeping eye that required daily treatment over several weeks, also gained at a mean rate of 7.7 g a day over a period of 57 days. This chick weighed 185.8 g when it arrived on 20 April 1971 and 625.3 g on 17 June 1971, a gain of 439.5 g.

Table 1 COMPARISON, INCUBATING MALE AND DAY OLD CHICK

A. WEIGHTS	Adult		Chick		Chick as % of Adult
	grams	%	grams	%	
Feathers	115.2	6.8	12.9	6.3	11.2
Skin (incl. fat and wings)	321.1	18.9	49.4	24.0	15.4
Feathers and skin	436.3	25.7	62.3	30.3	14.3
Head, Neck, Trunk	363.7	21.4	47.0	22.9	12.9
Legs, Thighs	518.0	30.5	42.3	20.6	8.2
Feet	74.5	4.4	13.5	6.6	18.1
Legs, Thighs, Feet	592.5	34.9	55.8	27.2	9.4
Viscera and fluids	306.7	18.0	40.4	19.7	15.2
TOTAL	1699.2	100.0	205.5	100.0	12.1

B. BONE MEASUREMENTS	Adult (mm)	Chick (mm)	Chick as % of Adult
Bill, exposed length	96.8	40.2	41.5
Vertebrae, cervical & thoracic	244.0	96.0	39.3
Rib, fifth	58.0	23.5	40.5
Ilium	108.0	43.0	39.8
Femur	91.8	41.2	44.9
Tibiotarsus	128.7	58.4	45.4
Metatarsus	66.8	34.4	51.5
Digit and claw, third	57.4	32.0	55.7

C. VISCERA, WEIGHTS and MEASUREMENTS	Adult	Chick	Chick as % of Adult
Gizzard, fat free and clean (g)	18.7	2.975	15.9
Heart, fat free and clean (g)	15.7	0.780	5.0
Liver, " " " " (g)	46.7	3.850	8.2
Oesophagus (cm)	23.5	8.8	37.4
Proventriculus (cm)	4.0	1.4	35.0
Intestines (cm)	136.0	35.5	26.1
Caecum I (cm)	18.0	6.6	36.7
Caecum II (cm)	19.0	7.1	37.4
Rectum (cm)	11.5	5.5	47.8

Table 2 YOLK-SAC AND CHICK WEIGHT

Species	Total Weight (g)	Yolk Sac (g)	True Weight (g)	Yolk sac as % of True Wt.
Hen	36.0	6.5	29.5	22.0
Skua	68.6	6.8	61.8	11.0
Penguin	86.3	13.1	73.2	18.0
Kiwi, 1 day	318.6	113.1	205.5	55.0
Kiwi, 6 days	281.0	54.0	227.0	24.0
Kiwi, 3 weeks	263.5	14.1	249.4	6.0
1 Romanoff 1960; 2 Reid 1966; 3 Reid and Bailey 1966.				

Table 3 WEIGHT OF YOLK IN KIWI EGG AND CHICKS

Source	Wet Weight	Dry Weight	Percent Solids	Fresh Equivalent
Fresh Egg	251.4	142.5	56.7	251.4
Chick, 1 day	111.9	71.6	64.0	126.3
Chick, 3 weeks	14.1	9.1	64.5	16.0

Table 4 WEIGHT AND DISTRIBUTION OF FAT IN KIWI CHICKS

Part of Body	Day Old Chick			Three Week Chick		
	Lean	Fat	Total	Lean	Fat	Total
Skin and Wings	31.7	30.6	62.3	-	-	67.7
Head and Bill	11.0	0	11.0	12.5	0	12.5
Trunk and Neck	28.3	7.7	36.0	36.9	7.4	44.3
Legs and Thighs	39.7	2.6	42.3	57.1	2.0	59.1
Feet	13.5	0	13.5	15.1	0	15.1
Viscera etc.	37.8	2.6	40.4	48.1	2.6	50.7
TOTALS	162.0	43.5	205.5	-	-	249.4

Table 5 WEIGHTS OF KIWI EGGS AND CHICKS

	Egg Weight (g)	Chick Weight		Days After Hatching	Hatching Wt. as % Egg Wt.	Lowest Wt. as % of	
		At Hatching	Lowest Weight			Egg Weight	Hatching Weight
I	290	180	115	-	62	40	64
I	370	240	170	14	65	46	71
II	355	-	140	9	-	39	-
III	485*	319	205	-	65	42a	64a
III	485*	319	162	--	-	33b	51b
I Robson, II Hartree, III Reid: * Estimated Weight of Sibling Egg a = Weight of Chick excluding 113 g. yolk-sac b = Weight of Chick excluding 113 g. yolk-sac and 43.5 g. of fat.							

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