FAECES OF TAKAHE (Notornis mantelli): A GENERAL DISCUSSION RELATING THE QUANTITY OF FAECES TO THE TYPE OF FOOD AND TO THE ESTIMATED ENERGY REQUIREMENTS OF THE BIRD

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ABSTRACT

It is estimated that a Takahe requires about 300 K cal metabolizable energy daily for maintenance and that a bird feeding exclusively on grass will excrete about eight metres of faeces a day.

INTRODUCTION

A report covering the findings and opinions of the first official party, which visited Takahe Valley in January 1949, stated — " . . . while only 12-14 different Takahe were seen, total evidence suggested . . . at least 20 nesting pairs . . . and . . . a conservative estimate places the population . . . in some 500 acres (200 hectare) at 100 birds." Subsequent studies have shown the area referred to hold between 30-36 birds, including 9-12 pairs. The optimism of this first appraisal was based on the number of nests found and on the abundant 'sign' — cut tussock tillers and droppings — which covered the valley floor. It is now known that individual pairs may build up to seven nests (several are built prior to laying and additional brood nests may be made after the chicks hatch), and work at Mt Bruce Native Bird Reserve gives some data on the total length of faeces voided daily by captive birds feeding mainly on pasture grasses and poultry pellets. These data allow an approximate estimate of the length of faeces that would be excreted by birds feeding on a feral, mainly 'grass,' diet.

Takahe droppings are cylindrical and firm. They are haylike in texture and measure 6.3-14.8 (mean 10.2) cm in length. The diameter is usually between 8.5-13.8 (mean 10.63 mm but thin droppings (5.2-6.0 mm diameter) are occasionally voided and, in the field, these are sometimes incorrectly attributed to half-grown chicks. Sitting birds frequently pass large 'clocker' droppings 15-17 mm diameter. Macroscopic inspection of droppings from both wild and captive birds leads to the conclusion that only a small part of the vegetation eaten is digested as most of the constituent material seems little altered in colour or texture after its passage through the alimentary canal.

The diet of wild Takahe is rough and fibrous and birds spend much of their day grazing and browsing. Their staple food is tussock (*Chionochloa* spp) — they eat the more succulent tiller bases throughout the year and strip the seed heads in season. They also feed on seeds and leaves of other grasses (*Poa, Festuca* and *Hierochloe* spp.), the leaf bases of mountain daises (*Celmisia* spp.) and the stalks and rhizomes of the fern *Hypolepis* (Williams 1960). Takahe actively forage for and snap at insects but while these may provide a nutritionally important component of the diet, they represent only an infinitesimal portion of the total food ingested.

BODY WEIGHT, FOOD INTAKE AND FAECAL OUTPUT: MT BRUCE

Two pairs of Takahe were taken from the McKenzie Burn in Fiordland and placed in neighbouring 130 m^2 enclosures at Mt Bruce on 1 February 1970. Both pairs were in a high state of stress when released and, being a territorial species, the condition of each was further aggravated by the close proximity of the other pair. All four birds ignored the feed trays. Much of their time was spent pacing the hessian covered partition fence and although tension remained high, the number of faeces present (averaging 4.76 and 7.1 m per pair daily) suggested at the time that the birds were at least feeding adequately on pasture grasses. The birds were weighed four days later. All showed a decrease in body weight (from 12.7 to 18.6 percent) indicating that the intake of grass which produced the abundant faecal material was, under the conditions prevailing, insufficient to maintain the birds' weights. Although none of the birds took grit during this period, grit from Fiordland was still present in faeces voided four days after capture — suggesting the gizzard has the capacity to selectively retain some of its contents. During this period the 19.05 m of faeces voided by one pair contained 41 pieces of grit (from 1.0 to 3.2, mean 1.8 mm diameter), and the 28.46 m voided by the other pair contained 232 pieces of grit (from 1.1 to 5.3, mean 2.9 mm diameter; volume 5.7 cm^3).

To reduce tension the birds were isolated from each other on 16 February and the most debilitated pair (male 2155 g; female 1770 g) was placed in a small (3 x 3 m) enclosed coop. This was shifted daily to provide limited grazing of fresh grass and the birds were also given a broth containing glucose and a milk powder-based invalid food. (Birds under stress settle down more quickly in small coops with solid walls for they quickly appraise the extent of their new environment and with familiarity comes security; and while birds in a stressed state may refuse to eat adequately they do not deny themselves fluids — presumably because hunger is not unduly uncomfortable, but water privation is physiologically intolerable). This liquid ration, in which the organic nutrient comprised 7% protein, 4% fat and 89% carbohydrates (dry weight), had an energy value of approximately 175 K cal/litre. These birds were at rest (the coop was warm and

they remained inactive) and the food required to maintain condition was minimal. By the end of four days both had gained slightly in weight (the male by 45 g, the female by 85 g) on a daily average consumption of 1.4 litres (240-250 K cal) of liquid per bird plus an unknown, but very reduced, intake of grass. In addition to passing a daily average of 1.42 m of normal grass droppings, each bird also voided between 8-12 almost clear, watery faeces every hour.

While both birds continued to show little inclination to graze or eat solid foods, they maintained a strong interest in the water troughs — on some days drinking in excess of four (maximum 4.13) litres broth/pair. The broths were progressively thickened (i.e. the birds were fed two or three different formulations daily and the thickest brew that was readily accepted on one day became the thinnest offered the following day). These reached a maximum in nutritive value on 10 March when one containing 21% protein, 8% fat and 71% carbohydrate (digestible organic nutrients, dry weight), and (based on the metabolizable energy values of the constituent foodstuffs for poultry) having an energy value of 1130 K cal/litre was accepted. One week later they had progressed to eat dry pellets almost exclusively. As the birds rehabilitated and increased in weight during this 25 day period, the area of their pen was progressively enlarged from 9 m^2 to 70 m^2.

By 24 March the male weighed 2680 g and the female 2255 g (mean weights of wild birds in Takahe Valley: 68 males, 2680 g; 67 females, 2265 g) and on that date the liquid supplements were discontinued. During the next six days these birds fed exclusively on grass and dry poultry pellets (average ration, 150 g/pair daily) and all their faeces were collected — once daily during the first three days and then twice daily (at 0630-0830 hours and 1630-1800 hours, Table 1) to distinguish between daylight and night droppings. Droppings voided during the late afternoon and night, which were collected during the early morning before being subjected to excessive drying by the sun were, per unit length, generally 27% heavier than daytime faeces collected and weighed in the late afternoon. The night faeces produced from eating pellets had an average weight of 1.05 g/cm, while those resulting from grazing at night weighed 0.98 g/cm. There was no apparent difference in the dry weight of daytime or night-time faeces. Within the limits of accuracy available with an old household oven, the pellet faeces had a dry weight of 0.316 g/cm and the grass faeces had a dry weight of 0.27 g/cm.

When pellets, which were given just before the start of the afternoon collecting of faeces, were available both birds ate these enthusiastically and ignored grass. Observations during the evening and early morning indicated that the birds were sleeping, or at rest, for about 9.5 hours daily — they were inactive from about 1945 hours (or 30 minutes after nautical twilight) to about 0515 hours (or 15 minutes before nautical twilight). During these 9.5 hours each bird

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TABLE 1 : WEIGHT OF PELLETS EATEN AND LENGTH OF FAECES EXCRETED IN SIX DAYS

Date March	Period of Day	Number of Hours	Pellets Eaten (g)	Length of Faeces (cm)			Faeces cm/Bird per Hour	Pellet Faeces cm/g Pellets
				Pellet	Grass	Total		
25-26	0900-0830	23.5	156	212	840	1052	22.4	1.36
26-27	0830-0830	24.0	157	216	701	917	19.1	1.38
27-28	0830-0830	24.0	154	206	752	958	20.0	1.34
28-29	0830-1730	9.0	0	0	691	691	38.4	-
"	1730-0630	13.0	127	173	159	332	12.8	-
"	0830-0630	22.0	127	173	850	1023	23.3	1.36
29-30	0630-1630	10.0	0	15	718	733	36.6	-
"	1630-0700	14.5	126	155	180	335	11.6	-
"	0630-0700	24.5	126	170	898	1068	21.8	1.35
30-31	0700-1800	11.0	0	0	752	752	34.2	-
"	1800-0930	15.5	147	203	262	465	15.0	-
"	0700-0930	26.5	147	203	1014	1217	23.0	1.38
		144.5	867	1180	5055	6235	21.6	1.36

voided between 8-11 faeces, with an average total length of 68.5 cm, in a heap or ' latrine.' These latrine droppings were composed almost entirely of pellet constituents indicating that the birds cleared their alimentary tracks of grass in the 2.5-3.0 hours between when the pellets were provided and when they settled for the night. It is not known by what hour the last of the pellets were eaten but the last faeces derived from pellets were voided betwen 0630-0730 hours — thereafter grass droppings appeared.

Over a period of 145.5 hours this pair grazed fairly extensively, ate 867 g of pellets and maintained body weight. In an average day each bird ate 72 g of pellets and voided 5.18 of faeces. The faeces derived from pellets measured 0.98 m and those derived from an unknown intake of grass measured 4.20 m. During the 14.5 hours the birds were awake each passed about 44-45 faeces with an average cumulative length of 31 cm/hour. During some periods of active feeding the birds voided 40 cm (or more) faeces/hour.

Grit was plentiful in the droppings — it numbered from 243 to 436 (mean 304) pieces per pair daily. The average size of the particles was 18 mm^3 and the largest measured 6.6 x 6.4 x 6.0 mm. Grit was in frequent in droppings voided during the daytime and most was concentrated in the last two or three night time ' latrine ' faeces. It appears that the birds may expel most of the grit in their gizzard along with the last of the food. The last pellet faece voided by the male in the early morning of 29 March measured 13.5 cm and contained 7.1 g (3.85cm^3) of grit and silt — this included 156 pieces larger than 1mm^3.

DISCUSSION

From the length of faeces voided daily by captive Takahe feeding on a known ration of poultry pellets plus an unknown intake of grass it is possible to make a broad estimate of the length of faeces excreted daily by a bird living on grass alone. This estimate relies on two assumptions;

(I) The calorie requirements for Takahe are about the same as for hens of similar size; and

(II) The relative digestibility (and nutritive value) of grass and pellets are about the same for poultry and Takahe.

The maintenance requirements for poultry having the same body weight as an average-sized Takahe (about 2.475 kg) are 290-300 K cal metabolizable energy (ME) per day (McDonald *et al.* 1966). The pellets fed to Takahe have a ME value for poultry of 2.595 K cal/g. Organic matter constitutes nearly 84% (dry weight) of the pellets and poultry digest about 74% of this (Bolton 1963; Titus 1961). While the dry weight of poultry faeces would represent about 38% of the dry weight of pellets eaten if all minerals and additives were voided along with the non-digestible organic matter; the dry weight of Takahe faeces averaged 48-49% of the dry weight of pellets eaten. It appears, therefore, that the utilization of pellets by Takahe is only 80-85% as efficient as the utilization of pellets by poultry and their ME rating of about 2.6 K cal/g for poultry may be as low as 2.0-2.2 K cal/g for Takahe. If this is so, the 72 g of pellets eaten daily by each bird would provide about 150 K cals and the ME value of the grass eaten (which produced 4.20 m of faeces) would be about the same if the energy requirements of Takahe are approximately the same as similar-sized, non-laying poultry.

For poultry, the nutritive value of dried grass is only half that of pellets. The former contains about 52% indigestible organic matter and has a ME rating of approximately 1.3 K cal/g (Bolton 1963) — compared with 26% indigestible organic matter and a ME rating of nearly 2.6 K cal/g for pellets. The faeces of a bird obtaining its calories from pellets should, therefore, have about one-quarter of the bulk of faeces excreted by a bird feeding on grass. During an average day, the length of the pellet faeces (0.98 m) voided by Takahe at Mt Bruce was 23% of the length of their grass faeces and the dry weight of the pellet faeces (31 g) was about 27% of the dry weight of the grass faeces.

The proportion of pellet to grass faeces excreted daily suggests that both foods provided a similar number of calories and this, in turn, suggests the energy requirements of Takahe are about 300 K cal ME per day.

The Capercaillie *(Tetrao urogallus)*, which may weigh up to 6.5 kg, is frequently mentioned in texts because of the excessive length of faecal material it excretes. This large member of the grouse family

feeds mainly on an exceptionally low grade diet of conifer needles and buds, and voids about three metres of faeces each day (Welty 1962). The smaller Takahe, which in captivity excretes in excess of five metres of faeces daily on a diet of poultry pellets and pasture grass, is estimated to excrete in excess of eight metres daily on a less nutritious diet of only grass or tussock.

The alimentary canal of the Takahe, from the start of the oesophagus to the cloaca, measures 1.41 m or only 27% of the length of faeces voided daily by birds in captivity.

ACKNOWLEDGEMENTS

I thank Colin Roderick, the Officer in Charge at Mt Bruce, for all the help willingly given during this and related studies on Takahe in captivity; and Dr G. R. Williams for commenting on this paper.

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