FOODS OF THE SHINING CUCKOO (*CHRYSOCOCCYX LUCIDUS,* AVES: CUCULIDAE) IN NEW ZEALAND

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SUMMARY: Weights, measurements and stomach-contents of a sample of shining cuckoos *(Chrysococcyx lucidus)* are summarised. Mean weights and measurements did not differ between the sexes. The diet comprised only insects, mainly caterpillars and beetles. A third of the caterpillars were larvae of the magpie moth *(Nyctemera annulata)* whose spines embed in the lining of the gizzard, and most beetles were ladybirds (Coccinellidae). Thus many prey were insects generally avoided by other birds. Ingested items were mostly less than 16 mm long, and a third were only 1-5 mm long.

INTRODUCTION

The shining cuckoo (the nominate race of *Chrysococcyx lucidus,* Cuculidae: Cuculinae) is one of only two terrestrial birds that migrate beyond New Zealand. Shining cuckoos are common and widespread throughout New Zealand (Bull, *et al.,* 1978) from about October to February, and they are said to winter in the Solomon Islands (Mayr, 1932).

The diet of cuckoos is interesting because many species eat warningly-coloured, hairy, partly toxic caterpillars (Lack, 1968: 82) and other insects that most birds avoid. For example, Grimmett (1922), Smith (1923) and Graham (1940) recorded shining cuckoos in New Zealand capturing and ingesting the hairy larvae of magpie moths *(Nyctemera annulata,* Lepidoptera).

As for other foods, Fulton (1910) reported that shining cuckoos take "flies, gnats, fruit-slugs, moths, and butterflies", and he alleged that they also eat fruits. A "crop" examined for Fulton by Dr Benham contained "a great number of moths, daddy-long-legs, and caterpillars". More recently, Blackburn (1963) found that a captive, slightly injured shining cuckoo accepted pear-slugs (larvae of *Caliroa cerasi,* Hymenoptera), small cicadas and various caterpillars. The cuckoo rejected earthworms, wood-lice (Isopoda), wood-boring grubs, spiders and house-flies.

MATERIALS AND METHODS

I examined 24 shining cuckoos obtained mainly from the Canterbury Museum (Christchurch) and preserved by freezing. Most had been killed by cats or by flying into panes of glass. After thawing each specimen I weighed and measured it and sexed it by dissection. Professor W. C. Clark examined the gut for parasites (Clark, in preparation), and I retained the proventriculus, gizzard and contents in 70 % ethanol.

The measurements of cuckoos were as follows. "Wing" was the minimum chord of the flattened but unstraightened wing from the carpal flexure to the tip of the longest primary. "Tail" was taken ventrally from the point of insertion to the tip of the median feathers. "Bill-length" was dorsally from the tip to the junction of the bill and skull. "Bill-width" was horizontally immediately anterior to the nostrils, and "bill-depth" was vertically at the mid-point of the nostrils. "Tarsus" (actually tarsometatarsus) was taken laterally from the ankle-joint to the articulation of the folded toes. I took weight to the nearest 0.5 g, wing to the nearest millimetre and other measurements to the nearest 0.1 mm. I measured the right wing and leg, and took other measurements on the right side as appropriate.

Diet was analysed from 20 stomachs (of 11 males, 8 females and one bird of unknown sex) that contained food. Excepting two cuckoos from Whangarei, all were from the South Island: Kaikoura, Greymouth, Hokitika, Kumara, Christchurch, Lyttelton, Franz Josef, Mount Cook and south Canterbury. They were collected between the months October and February in the years 1968-78. Recognisable remains from the stomachs were identified at least to order, counted, and (where possible) measured in the longest axis.

RESULTS AND DISCUSSION

Measurements

Table 1 summarises the weights and measurements

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TABLE 1. *Weights (g) after freezing and measurements (mm) of shining cuckoos.*

	$\bar{x}$	n	s	Range
Weight	23.1	16	2.77	18.0-27.5
Wing	102.5	19	2.07	97-105
Tail	71.10	16	1.96	67.7-74.0
Bill-length	19.49	20	0.54	18.0-20.6
Bill-width	5.60	19	0.26	5.1-6.0
Bill-depth	5.21	18	0.21	4.8-5.5
Tarsus	21.80	19	0.58	20.7-22.9

Notes: $\bar{x}$ mean.
n number in sample.
s standard deviation.

TABLE 2. *Classification by order of 460 items from the stomachs of 20 shining cuckoos.*

	Stomachs		Total items		Items / Stomach	
	No.	%	No.	%	Mean*	Max.
Lepidoptera	11	55	225	48.9	11.3	60
caterpillars	10	50	211	45.9	10.6	60
moths	2	10	14	3.0	0.7	9
Coleoptera	11	55	125	27.2	6.3	55
Diptera	8	40	41	8.9	2.1	18
Hymenoptera	2	10	9	2.0	0.5	7
Hemiptera	1	5	2	0.4	0.1	2
Odonata	2	10	10	2.2	0.5	9
Plecoptera	3	15	40	8.7	2.0	38
Ephemeroptera	1	5	1	0.2	0.1	1
Dermaptera	1	5	1	0.2	0.1	1
unidentified	3	15	6	1.3	0.3	4
INSECTA	20	100	460	100.0	23.0	62

Note: * Average over all stomachs.

of cuckoos in the sample. Data for males and females are pooled because in all cases the means did not differ significantly (t-test; $p > 0.05$) between the sexes. Birds desiccate during freezing and thawing (Clark, 1979), so the weights are minima and in life the cuckoos may have been heavier. In the absence of fresh weights the data are indicative; at 23 g shining cuckoos are among the smallest members of the family, if not order. According to Mayr (1932) the width of the bill taken "just before" the nostrils is 5.0-6.0 mm, averaging 5.5 mm, in the nominate race of *Ch. lucidus*. My figures for bill-width, taken immediately anterior to the nostrils, agree closely.

Diet

Tile stomachs contained no plant-material or extraneous matter (grit etc.). Although many insectivorous birds take arachnids and crustaceans, all items recovered from the cuckoos were insects (9 orders). I identified 460 items and computations based on their ordinal classification are given in Table 2.

Over half the stomachs contained lepidopterans (mainly caterpillars, otherwise moths) and beetles (Coleoptera). Dipterans also occurred frequently. Nearly half the items were lepidopterans (mainly caterpillars) with up to 60 per stomach. Caterpillars are probably the shining cuckoo's primary source of food in New Zealand, as is the case for *Chrysococcyx cup reus* in tropical Africa (De Naurois, 1979). Thus, shining cuckoos probably compete for food with many native insectivorous passerines. Beetles comprised nearly a third of the items from shining cuckoos, with up to 55 per stomach. Dipterans and plecopterans were numerically next most important overall, though the latter occurred in few stomachs. On average there were 23 insects per stomach, including 11 caterpillars, 6 beetles, 2 dipterans and 2 plecopterans. Most insects taken by shining cuckoos were less than 16 mm long (Fig. 1). This is as expected considering the size of the cuckoo's bill, but it is perhaps surprising that a third of items were only 1-5 mm long.

All the hymenopterans were ants, and many dipteram were craneflies (Tipulidae). Most odonatans were probably the damselfly *Austrolestes colensonis* (R. J. Rowe, pers. comm.). Most stoneflies (Plecoptera) were *Austroperla cyrene* (M. J. Winterbourn, pers. comm.). Of the 125 beetles recovered, 88% were ladybirds (Coccinellidae) despite the fact that when alarmed these discharge a fluid toxic to vertebrates (Britton, 1970). Of the 110 ladybirds (occurring in 6 stomachs with up to 55 per stomach), 58% were *Coccinella undecimpunctata,* 30% *Adalia bipunctata,* 10% probably *Leis conformis* and 2% *Coccinella leonina*. AIl these species have been introduced, though native ladybirds occur in New Zealand.

Of the 211 caterpillars recovered, most were smooth-skinned but 36% (occurring in 4 stomachs with up to 31 per stomach) were larval magpie moths *(Nyctemera annulata),* which are densely spined. Smith (1923), who watched shining cuckoos eating these caterpillars, found fresh skins, some compressed into pellets, beneath where the cuckoos had perched. Smith concluded that cuckoos collect several larvae and "munch them until the viscera and intestinal matter is compressed from them, when

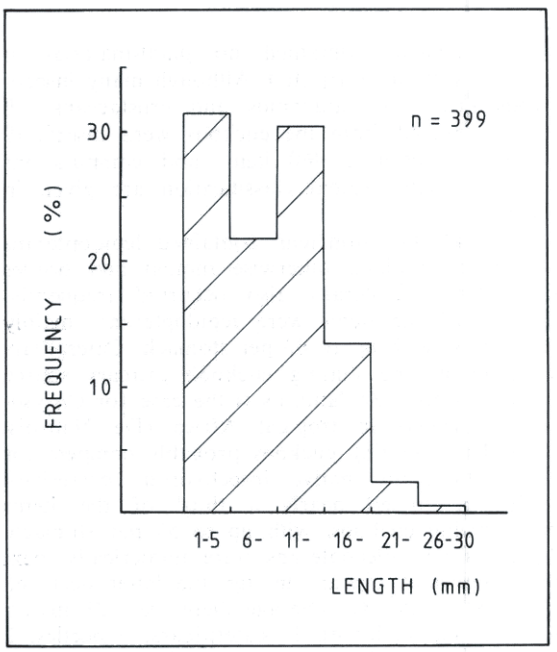

FIGURE 1. *Distribution of items from the stomachs of shining cuckoos according to length of the longest axis.*

they eject the skins. They certainly do not swallow all the larvae". (Smith presumably meant that not every larva is swallowed, rather than that no larva is swallowed whole. In this study, stomachs contained larval *N. annulata* intact.)

In many birds the gizzard has a more or less well-developed keratinoid inner lining, but the shining cuckoo's gizzard (as with that of other cuckoos) has a soft, thick, non-keratinoid inner layer. Where larval magpie moths had been ingested, clusters of their spines in regular rows had pierced the gizzard-lining in much the same way that the bristles of a brush are inserted. Similarly, when European cuckoos *(Cuculus canorus)* eat the hairy caterpillars of processionary moths (Lepidoptera: Thaumetopoeidae), pointed hairs cover the wall of the gizzard. Patches of mucous membrane plus hairs peel off and are regurgitated (Meise and Schifter, 1972). A similar mechanism for disposing of barbed hairs is likely in shining cuckoos.

This study has confirmed that insects generally considered unpalatable to most birds contribute significantly to the shining cuckoo's diet. Whether cuckoos have evolved this feeding-habit merely to exploit an otherwise untapped resource, or whether as migrants they have been forced to reduce competition with resident insectivores by taking less attractive prey, remains unclear. I doubt that the diet is related to brood-parasitism, since young shining cuckoos apparently do not receive such foods from their foster-parents (pers. obs.). Therefore, eating toxic caterpillars and beetles is a habit acquired in the adult or sub-adult.

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