Weight changes and wing moult in the Red-billed Teal

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The Red-billed Teal *Anas erythrorhyncha* is one of the commoner ducks in southern Africa. At Lochinvar National Park, on the Kafue Flats in southern Zambia, it is principally a dry season visitor (May–October), and many birds complete their post-nuptial wing moult at this time. Few birds are present in January, February and March, particularly when the rains are heavy, and although this period coincides with the breeding season (Benson *et al.* 1971) very few, if any, breed (Douthwaite 1974).

In 1972 and 1973 many birds were trapped and ringed in order to determine the origin of the moult migrants. Small catches were also made at other times of the year and a number of birds were shot in order to study their diet.

Methods

Most full-winged birds were caught in house traps baited with the seeds of Japanese barnyard millet *Echinochloa frumentacea*, or foxtail millet *Setaria italica*. The method also caught flightless birds in 1972. However, at times it was unsuccessful and during the post-nuptial moult in 1973, flightless birds had to be rounded-up into enclosures. About 80 full-winged birds were shot.

Weights were taken to the nearest 5 g. The wing was flattened along the rule to measure its length. Live birds were sexed by cloacal eversion; dead ones by dissection. The amount of fat on the gizzard, gut mesenteries and skin of the neck of dissected birds was noted as 'very thin' (i.e. no fat or a trace), 'thin' (i.e. a little fat present), 'fat' or 'very fat'.

Results

Full-winged birds

The full grown male Red-billed Teal is both longer-winged and heavier than the female, but the differences are not diagnostic (Table 1).

Seasonal variations in the mean weights of both sexes were similar (Table 2). Birds were heaviest from June through September, and lightest in February. The fat reserves of dissected birds reflected these seasonal changes.

Table 1. Wing lengths and weights of full-grown, full-winged Red-billed Teal.

Sex	Wing length				Weight			
	No.	Mean length mm	Standard deviation	95% confidence limits	No.	Mean weight g	Standard deviation	Extremes recorded
Male	40	226	6·0	214–238	232	590	70	445–795
Female	32	219	4·3	211–228	219	535	54	400–735

Table 2. Mean monthly weights of full grown, full-winged Red-billed Teal.

	Male			Female		
		Weight			Weight	
	No.	g	s.d.	No.	g	s.d.
January	22	563	53	16	504	44
February	15	507	43	22	452	41
March	3	568	111	8	519	35
April	3	588	28	4	536	39
May	9	570	64	8	535	68
June	15	599	59	10	571	68
July	33	611	73	29	564	79
August	36	607	67	38	560	49
September	17	621	58	21	571	56
October	31	572	40	24	530	53
November	38	599	58	25	525	42
December	20	593	57	24	547	52

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Thus most birds examined between December and April were 'thin', whereas they were mostly 'fat' or 'very fat' between May and November (Table 3). This difference was significant ($p < 0.001$).

Table 3. Estimates of the fat reserves of Red-billed Teal.

	Number of birds	
Fat class	Dec–Apr	May–Nov
Very thin	5	1
Thin	17	4
Fat	8	13
Very fat	4	13
Total	34	31

Variation in mean monthly weight of samples containing five or more weights per sex was examined using the t-test. Differences significant at the five per cent level are shown in Figure 1. In 1972–1973 the mean weights of both sexes declined each month from November to February. The decline occurred as most of the population left, and comparatively few, non-breeding birds remained in January, February and March. Food was evidently scarce in January and February as whole maize grains were used successfully as bait in house traps—a unique event. Trapping success fell in mid-February when the fruits of the grass *Panicum subalbidum* matured and became the main source of food. By March, in females at least, a rise in mean weight had occurred. A food shortage may also have occurred between September and October 1973 when the weights of both sexes declined. The main feeding grounds, where birds had filtered for the seeds of aquatic herbs, dried up; the population dropped and the remaining birds grazed upon the leaves of an aquatic herb growing in a permanent lagoon.

Differences in the mean monthly weights between years may have been associated with food supply, but possibly also with differing migratory tendencies. In 1972 none of the 346 birds ringed during the post-nuptial moult was recovered outside the Kafue Flats before the breeding season, perhaps because many of them remained on the floodplain, where water levels were high, until the rains began. Water levels in 1973 were very low and most teal had left the floodplain by August. Nine of the 1,120 birds ringed that year during the moult, and four ringed in 1972, were recovered away from the Kafue Flats in Namibia, Botswana, Rhodesia and South Africa, before the breeding season.

Birds in wing moult

In the post-nuptial moult some birds became flightless well before their remiges were shed, while others flew until their flight feathers fell out. Flightless birds were observed between 6th April and 7th October but the largest groups were seen in June, July and August. The timing of moult in pen-reared birds at Jonkershoek in South Africa was similar. Fifty-six of the 62 moults recorded were between May and October. The six exceptions which moulted later, in November, December and January, were all juveniles (Siegfried 1965).

The wing lengths of moulting birds are shown in Figure 2. The length-frequency histograms for 1973, when only flightless birds were trapped, show that females are able to fly again with wings of 160–179 mm; males with wings of 175–189 mm. This contrasts with the Yellowbill Duck *Anas undulata,* which does not fly until regrowth is complete (Rowan 1963). In both 1972 and 1973 proportionately fewer birds were caught with wings of 80–154 mm than with wings of 155–189 mm, suggesting that the remiges grow more quickly over the former range. The histogram for 1972, which does not show the difference so clearly, is biased against longer-winged birds as no retraps are included. The small number trapped in house traps with growth almost complete indicates that such birds either became less hungry and more trap shy or that they left the area. Indeed a male with a wing of 173 mm trapped on 13th June 1973, was shot on 29th June 100 km east of Lochinvar. In 1973 catches were made during the mid-morning, mainly on the feeding grounds but also at a roost. The proportionately greater numbers of longer-winged birds caught at the roost, compared with catches on the feeding grounds, suggest that they tend to feed less during the mid-morning than the shorter-winged birds.

Regressions of weight on wing length have been calculated using data from 100 flightless birds of each sex caught in 1973. The regression for males is $W = 650 - 0.5L$; for females, $W = 640 - 0.9L$, where W is weight in grammes and L is wing length in millimetres. Although the correlations between weight and wing length are low ($r = -0.32$ for males; -0.47 for females) the regressions are significant ($p < 0.001$) and are significantly different from each other with females losing weight more rapidly than

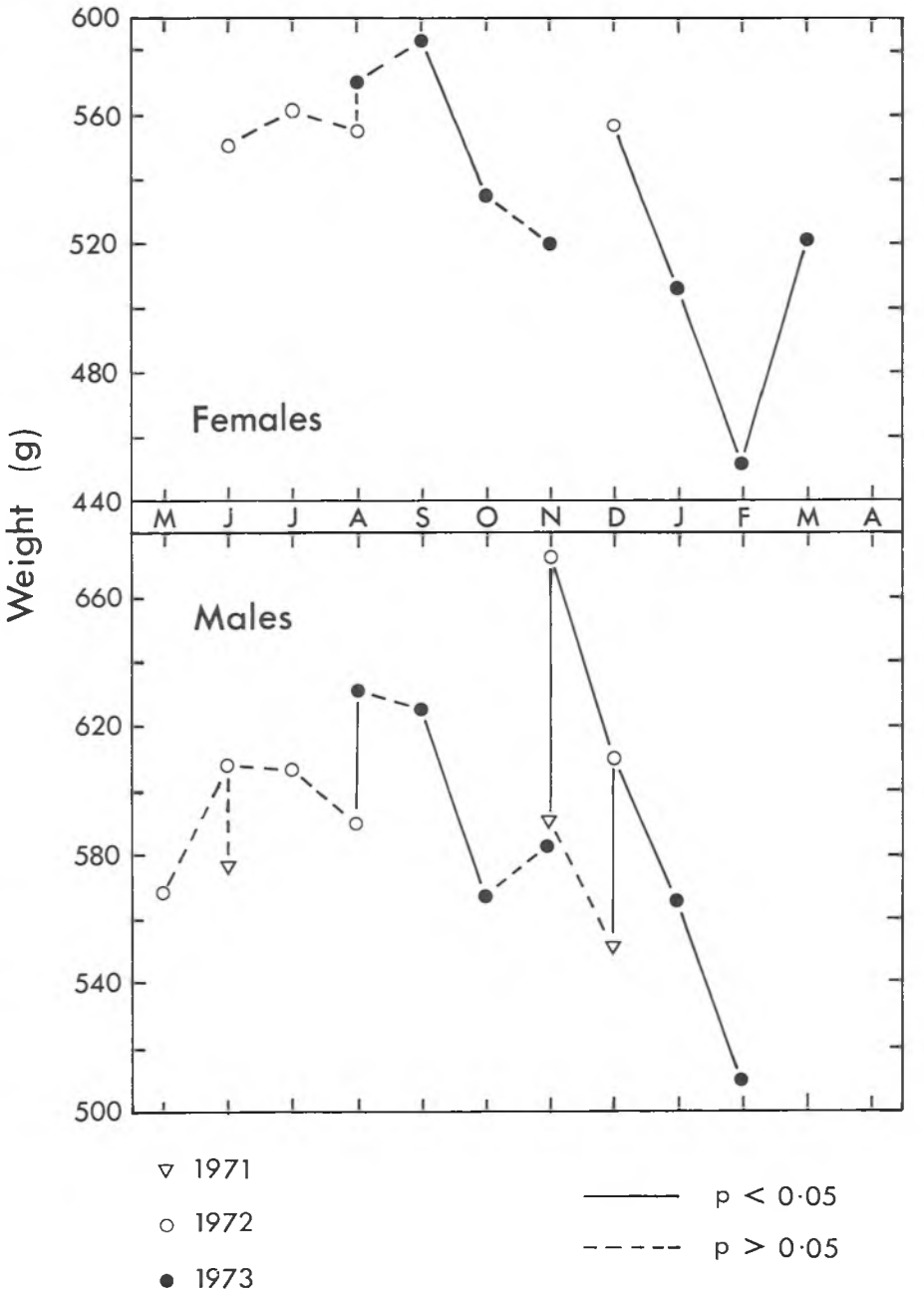

Figure 1. Variation in mean monthly weight of samples of five or more weights.

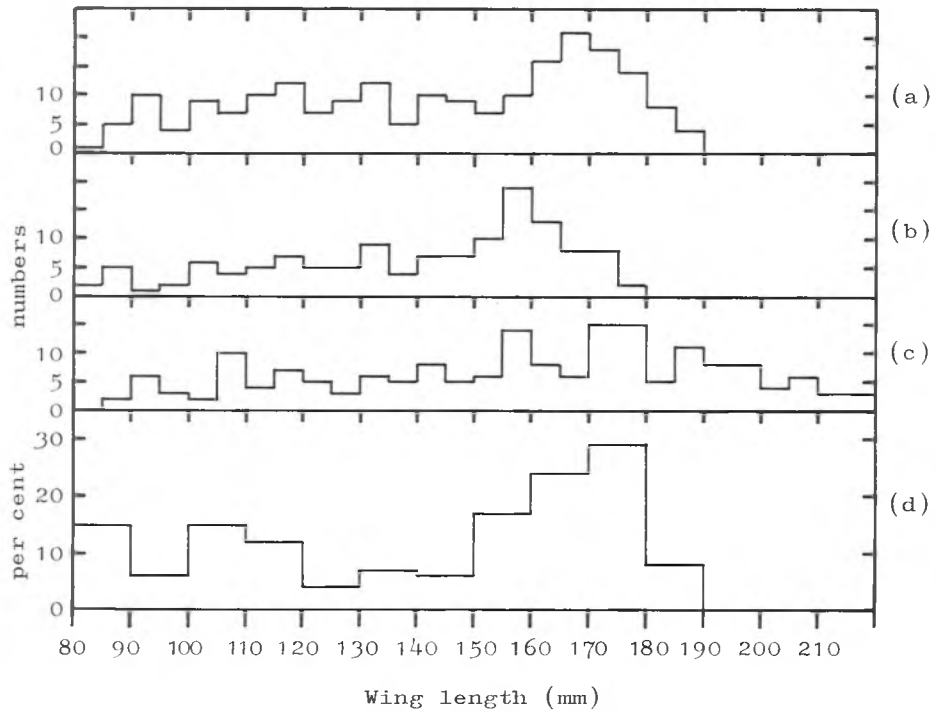

Figure 2. Wing length of Red-billed Teal caught in wing moult in 1972 and 1973. (a) Males caught in 1973. (b) Females caught in 1973. (c) Both sexes caught in 1972. (d) Catch at the day roost as a percentage of the total catch on feeding grounds and roost.

males ($p < 0{\cdot}05$). In 1972 weight continued to fall after the end of the flightless period (Table 4). Rowan (1963) estimated that during wing moult the Yellowbill Duck loses on average 22·4% of its pre-moult weight.

Table 4. Weights and wing lengths of Red-billed Teal in wing moult in 1972.

Wing length mm	No.	Mean weight g
80–89	2	575
90–99	9	619
100–109	12	587
110–119	11	566
120–129	8	561
130–139	11	607
140–149	13	584
150–159	20	561
160–169	14	559
170–179	30	536
180–189	16	523
190–199	16	501
200–209	10	514
210–220	6	512

Shewell (1959) gave a figure of 20%. Assuming the regressions calculated for Red-billed Teal held over the entire period of regrowth the females lost 21% of their pre-moult weight, but males only 11%.

It is often assumed that the post-nuptial moult is a period of physiological stress, but the reserves of body fat accumulated before the moult make birds less vulnerable to food shortages, enable them to feed less in situations where they would be exposed to predators, and perhaps enable the feathers to grow more quickly. However, excess weight would prolong the flightless period, increasing the risks of predation. Under good conditions weight loss during the post-nuptial moult may therefore be adaptive and not due to stress. The desirability of reducing weight to shorten the flightless period is probably balanced by the need to retain adequate reserves to ensure uninterrupted growth of the new feathers. At the end of the flightless period, when the average female is estimated to weigh 490 g, and the average male 560 g, some reserves should therefore still remain; the evidence from full-winged birds suggests that this is so (Table 5).

Table 5. Comparison of mean weight and estimated fat reserves.

Fat reserves	Males		Females	
	No.	Mean weight g	No.	Mean weight g
Very thin	3	480	5	445
Thin	14	550	14	525
Fat	11	575	12	560
Very fat	13	640	4	555

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Summary

The male Red-billed Teal *Anas erythrorhyncha* is longer-winged and heavier than the female but the data overlap. At Lochinvar National Park in Zambia, mean weight, reserves of abdominal fat and population size were minimal in February, during the breeding season (though none bred locally), and greatest between June and September, during the post-nuptial moult. In the moult of 1973 females probably lost 21% of their pre-moult weight, but males only 11%. It is suggested that weight loss is normally adaptive and not due to stress and allows birds to fly before the growth of the remiges is completed.

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