BREEDING BIOLOGY AND PARASITISM IN THE RUDDY DUCK

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There is little published information on the breeding biology of the Ruddy Duck (*Oxyura jamaicensis*). Ruddy Duck eggs have been found in the nests of other waterfowl, and this form of parasitism has been intraspecific as well as interspecific (Weller 1959, Joyner 1973). This paper is concerned with aspects of the breeding biology of the Ruddy Duck, and the species' parasitism.

METHODS

I studied Ruddy Ducks in the pothole region near Minnedosa, Manitoba, during May–August 1971. Descriptions of this area and its use by waterfowl appear in Evans et al. (1952), Bird (1961) and Dzubin (1969).

I recorded all Ruddy Ducks on ponds within a 580 ha study area. All emergent cover in 203 ponds was searched for duck nests. Nest-searches and censuses of Ruddy Ducks were performed at bi-weekly intervals. The "beat-out" technique (Evans and Black 1956) was used in censusing adults and broods. Ruddy Ducks were collected periodically from ponds outside the confines of the 580 ha census area. Each duck was weighed to the nearest gram and standard physical characteristics measured as in Baldwin et al. (1931).

RESULTS

Breeding chronology.—Migratory Ruddy Ducks began arriving in Manitoba during the last week of April and the majority of the population was present in mid-May 1971, which is normal (Hochbaum 1944, Dzubin 1969).

Ruddy Ducks collected in May and early June generally were fat. Subcutaneous fat deposits carefully dissected from the bodies of 2 pre-laying females collected in May amounted to 150 and 200 g or 18 and 27% respectively of the females' body weights. Later in the season, brood-accompanying females had exhausted their subcutaneous and visceral fat reserves and were much lighter (Table 1). Early in the season females generally were heavier than males, although males and females are very similar in body size (cf. Tables 1 and 2). The difference in body weight can be attributed to the females' relatively greater fat reserves. The gonads of both sexes were well developed in May (Table 1). For 2 of the laying females collected in June, I determined, through examination of their ovaries and nests, that they were in the process of completing clutches of 7 eggs each.

In the Minnedosa area a sharp peak in egg-laying occurred in the last half of June (Table 3). Thus, most females began nesting about 4 weeks after their arrival on the breeding grounds.

TABLE 1

MEAN BODY AND GONAD WEIGHTS (G) OF RUDDY DUCKS IN RELATION TO CHRONOLOGY OF BREEDING

Dates specimens collected	Body weight[1]			Gonad weight[2]			Status
	x̄	range	*n*	x̄	range	*n*	
Females							
May 25–31	688	620–789	4	55.0	50–65	4	Pre-laying
June 15–25	732	690–765	5	31.0	8–55	5	Laying
July 28–31	490	460–525	6	0.9	0.4–1.4	6	With broods 1–2 weeks old
Males							
May 25–31	656	619–705	6	2.4	1.3–5.3	6	
June 15–25	653	627–680	5	3.3	1.7–4.8	5	
July 28–31	625	594–660	4	0.5	0.1–1.7	4	

[1] Does not include weight of gonads, oviducal eggs, and contents of esophagus and gizzard.
[2] Includes both testes of each male.

In a sample of 40 egg-sets, ducklings hatched successfully from 28, a nesting success of 70%. Of the 12 clutches which failed to hatch ducklings, 3 were depredated, 3 flooded, 3 deserted, and 2 lost to unknown causes. I suspect that re-nesting attempts comprised a small proportion of all nests found during the course of the season. Relatively few clutches were started after July, and I found no new clutches in August. Some of the late clutches may have been produced by females, possibly first-year individuals, which had

TABLE 2

MEAN MENSURAL DIMENSIONS (MM) ± S.D. OF ADULT RUDDY DUCKS. ALL DATA DERIVED FROM SHOT OR TRAPPED BIRDS MEASURED IN THE FIELD

Dimension	Males			Females		
	n	x̄ SD	range	*n*	x̄ SD	range
Culmen length	37	41.5 ± 1.3	(38– 44)	27	41.5 ± 1.2	(38– 43)
Culmen width	36	25.7 ± 0.8	(24– 27)	26	25.9 ± 0.7	(24– 27)
Tarsus	38	32.9 ± 0.8	(31– 34)	28	32.2 ± 0.8	(30– 34)
Middle toe	37	54.9 ± 1.9	(50– 58)	27	54.6 ± 1.8	(51– 58)
Wing	32	147.7 ± 2.5	(143–153)	23	143.9 ± 2.1	(140–148)
Primary 10	30	86.3 ± 1.7	(82– 89)	27	83.3 ± 1.9	(80– 87)
Tail	34	73.8 ± 3.0	(67– 81)	27	71.4 ± 3.2	(65– 78)

TABLE 3

BREEDING SEASON OF THE RUDDY DUCK IN MANITOBA, BASED ON NUMBER OF CLUTCHES AND BROODS OBSERVED IN 1971. ALL RECORDS ADJUSTED TO DATES WHEN EGGS WERE LAID

May		June		July		August	
1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–31
0	3	41	77	36	12	0	0

molted their remiges after arrival on the breeding grounds (Siegfried 1973a). Hochbaum (1944) states that at Delta a small number of ducklings are not yet able to fly when ice closes the bays in late October or early November. Clearly, the Ruddy Duck is not double-brooded in Manitoba.

Nesting habitat.—I found 40 Ruddy Duck nests in 36 of the 203 ponds during the course of the breeding season. This represents a high density of breeding Ruddy Ducks (cf. Dzubin 1969). A comparison of the mean number of females (50) counted with the maximum number of nests found (40) indicated that most females initiated clutches. The mean sex ratio (70:50) was biased in favor of males, which is normal (Dzubin 1969).

Nests usually were spaced far apart. Only 4 ponds supported as many as 2 nests at the same time, and 2 occupied nests less than 10 m apart were found only once. In this case the 2 females were observed copulating with the same male. I was not able to determine the precise nature (polygyny or promiscuity) of the sexual association among these birds. However, within the Ruddy Duck population breeding in Manitoba, monogamous pair bonds of varying stability were usual; some individuals of both sexes essentially lacked bonds (Siegfried 1976). Quantitative data on these phenomena are lacking.

TABLE 4

NUMBER OF RUDDY DUCK NESTS LOCATED IN PONDS CLASSIFIED ACCORDING TO DOMINANT EMERGENT VEGETATION

Period in which clutch completed	> 50% *Scolochloa festucacea* and *Carex atherodes*	> 50% *Typha latifolia* and *Scirpus acutus*
1–15 June	29	9
16–30 June	35	28
1–15 July	11	15
16–31 July	2	6

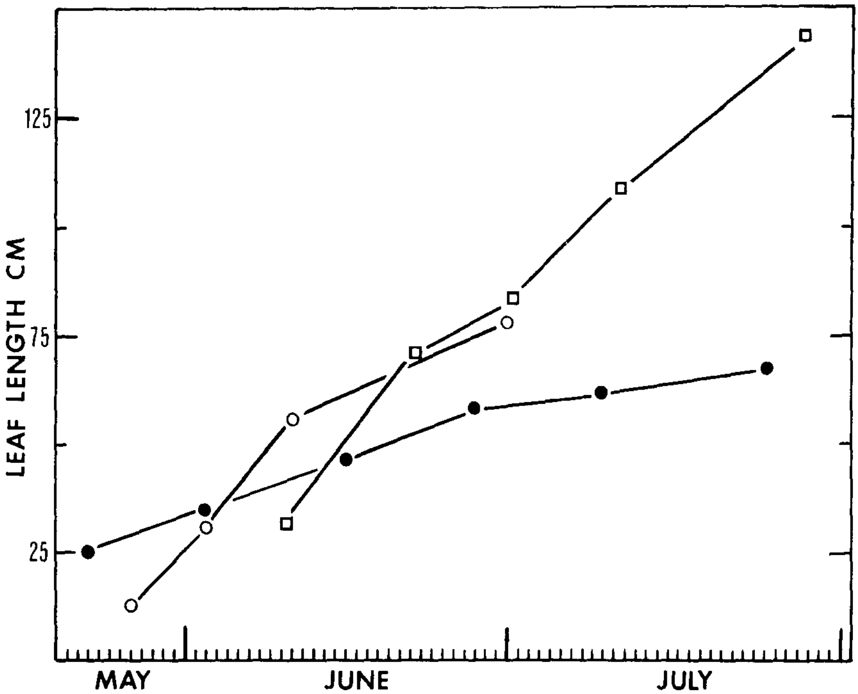

FIG. 1. Growth in length of longest leaf in *Scolochloa festucacea* (solid circles), *Scirpus acutus* (open circles) and *Typha latifolia* (squares). Each data point represents a mean value derived from measurements of five plants.

Most June nests were found in ponds supporting primarily *Scolochloa* and *Carex* as emergent vegetation, whereas July nests were found more often in ponds containing predominantly *Typha* and *Scirpus* (Table 4, $\chi^2 = 6.5$, $p \leqslant .05$). *Scolochloa* started growing earlier in the season than *Typha* and *Scirpus*, and remained ahead until after the first week in June (Fig. 1). Most

TABLE 5

NUMBER OF RUDDY DUCK NESTS LOCATED IN STANDS OF *SCOLOCHLOA*, *CAREX*, *TYPHA* AND *SCIRPUS*

Month in which clutch completed	*Scolochloa festucacea*	*Carex atherodes*	*Typha latifolia*	*Scirpus acutus*
June	33	6	4	4
July	7	2	8	5

TABLE 6

MEAN DEPTH (CM) OF WATER UNDER RUDDY DUCK NESTS BUILT IN *SCOLOCHLOA*, *SCIRPUS* AND *TYPHA*

Scolochloa festucacea (A)				*Scirpus acutus* (B)				*Typha latifolia* (C)			
x̄	± S.D.	range	*n*	x̄	± S.D.	range	*n*	x̄	± S.D.	range	*n*
42	11	30–75	24	57	18	35–90	11	61	21	30–90	10

$A > B$ ($t = 2.47$, $P < 0.02 > 0.01$.
$A > C$ ($t = 2.70$, $P < 0.02 > 0.01$.

early nests were constructed in *Scolochloa* and late nests were located relatively more often in *Typha* and *Scirpus* (Table 5, $\chi^2 = 12.8$, $p \leqslant .01$). Nests in *Typha* and *Scirpus* were built over slightly deeper water than those in *Scolochloa* and *Carex* (Table 6).

Clutch size and nest parasitism.—Slightly more than half of all clutches contained 7 or 8 eggs (Table 7). Although the clutches averaged slightly larger in June than in July, the difference was not significant statistically (7.65 ± 1.96 S.D. versus 7.26 ± 1.65 S.D., *df* 48 $t = 0.72$). Only one clutch (13 eggs) exceeding 10 eggs was completed in July, the remaining 7 containing 10 or more eggs were completed in June. The frequency distribution of clutches in Table 7 is skewed to the right. Plotted on arithmetic probability paper, the frequency distribution showed a deviation from normal at a clutch of 10 eggs which may be the maximum clutch possible for one female.

I was able to observe 3 individual females (2 marked with nasal-saddles) throughout the egg-laying phase of their reproductive cycle. Two produced 7 eggs each and the 3rd a 9-egg clutch. Each female deposited one egg daily. I suspect that clutches of more than 10 eggs are the result of more than one female laying in the same nest. Direct evidence for this supposition is, however, meager and results on 2 clutches (11 and 13 eggs) for which I established clearly that extra eggs had been deposited subsequent to onset of

TABLE 7

CLUTCH SIZE OF THE RUDDY DUCK

No. eggs in clutch									
4	5	6	7	8	9	10	11	12	13
1	3	10	16	17	5	3	2	1	2

incubation. Of 8 clutches containing 10 or more eggs, only one (10 eggs) successfully hatched all eggs.

I examined 53 nests and 61 broods of 9 other duck species. I found no Ruddy Duck eggs or ducklings in 15 nests and 21 broods of the Redhead (*Aythya americana*). Only 2 of 42 Canvasback (*Aythya valisineria*) clutches had been parasitized by Ruddy Ducks. One Canvasback nest contained 5 of its own eggs and 1 egg of the parasite. A Canvasback brood included 2 Redhead, 4 Ruddy Duck, and 3 Canvasback ducklings. These 2 clutches were completed in late May and early June respectively. I found no Ruddy Duck eggs in 234 American Coot (*Fulica americana*) nests. These data indicate a low incidence of interspecific parasitism by the Ruddy Duck.

The incidence of intraspecific parasitism is much more difficult to assess. However, assuming that clutches of 11 eggs and more represented the product of intraspecific parasitism, then a minimum of 8% of all clutches had been parasitized. During the period 25 May–8 June I found 6 Ruddy Duck eggs which had been dropped on the ground, each at different places and at least 50 m from the nearest nest. Isolated, dropped eggs were not subsequently encountered.

DISCUSSION

This paper reports data gathered during the course of a single breeding season. Hence, caution is needed when interpreting results and in comparing findings with those made by other workers.

The Ruddy Duck breeds later in the year than most duck species and onset of nesting is delayed for about 4 weeks after the bird's arrival on the Manitoba breeding grounds. Low (1941) found that first nests were built in May, about 7 weeks after arrival of Ruddy Ducks in Iowa. The timing of nesting may be correlated with the availability of nesting cover, though other factors influencing onset of breeding will be involved as well. Ruddy Ducks usually use fresh, green plant material in constructing nests, unlike the Canvasbacks and to a lesser extent the Redheads which often construct nests in old, dead vegetation. These species normally nest about 3 weeks ahead of the Ruddy Duck (Hochbaum 1944, Weller 1959). The peak of Ruddy Duck nesting occurred during 1–15 June in 3 years (1938–1940) in Iowa, and nests built after 1 June were predominantly of green plant materials (Low 1941).

Fresh, green emergent plant growth, tall and dense enough to provide cover suitable for the Ruddy Duck's nesting requirements, is generally unavailable before June. It is unlikely that shortage of food limits onset of nesting, since most birds examined soon after arrival in Minnedosa had well developed gonads, and extensive deposits of body fat and had fed on protein-rich food (Siegfried 1973b). Thus, females presumably were not short of the energy and protein necessary for forming eggs. Indeed, pre-laying females were observed to spend most of their time loafing and not feeding (Siegfried 1973c).

The length of the delay in onset of nesting and the sharp peak in initiation of clutches in June should be viewed in relation to the species' temporally limited opportunity for breeding successfully in regions as far north as Manitoba. Drought and freeze-up imminent in fall means that Ruddy Ducks initiating clutches after July have little chance of producing flying young. There is thus a premium on nesting as early as possible after arrival in Manitoba. Consequently, nests are constructed as soon as the first green emergent cover becomes available. An arrival time earlier than the start of May would, however, appear to be disadvantageous, since it appears that the almost exclusively aquatic Ruddy Duck does not tolerate cold water (Siegfried 1973c). Like all other *Oxyura* species, the Ruddy Duck is essentially warm temparate in its area of geographical distribution, and members of the genus are warm season breeders generally nesting in stands of newly grown, emergent vegetation, mainly rushes and sedges (Siegfried 1976).

Weller (1959), in commenting on the Ruddy Duck's tendency to drop eggs on the ground and in nests of other birds, says that this occurs most often early in the breeding season and that it presumably results from variation in synchrony of nesting and laying behavior. The data available now suggest tentatively a relationship between incidence of dropped eggs and parasitism and the chronology of nesting concomitant with the quantity and quality of available nesting cover. I have suggested that some females are physiologically ready to lay soon after their arrival on the nesting grounds, and that a lack of coordination between a female's readiness to breed (in particular the nest-construction "drive") and the availability of suitable nesting cover provides the motivation for "abnormal" nest-building behavior (Siegfried 1973c). It seems likely that one explanation for the Ruddy Duck's parasitic laying, resorts fundamentally in a degree of asynchrony between physiological and behavioral responses to environmental cues. Dropped eggs and parasitic laying may be regarded as responses caused by lack of attunement of egg-laying and nesting. A female physiologically ready to lay, but lacking the environmental stimuli for constructing her own nest, conceivably might be stimulated by the sight of an already complete nest, containing eggs, to lay parasitically in that nest.

Weller (1959) considered the influence of both environmental and genetic factors in reviewing several causes for parasitism in waterfowl. He concluded that cover quality did not affect the number of eggs laid parasitically, and thought it likely that the parasitic tendencies of the Redhead and Ruddy Duck are inherent and not subject to measurable modification by the physical environment. In the case of the Ruddy Duck in Manitoba, I suggest that the incidence of parasitism is expressed as a consequence of variation in the response of phenotypes to environmental factors.

The apparently low incidence of interspecific parasitism by the Ruddy Duck in Minnedosa, contrasts with Joyner's (1973) finding that 11% of 305 duck nests of 5 species at Farmington, in Utah, were parasitized by the Ruddy Duck. Clearly geographical and perhaps also annual differences attend the species' parasitism, and the factors promoting the behavior in one region may be different in other areas.

SUMMARY

The breeding phenology of the Ruddy Duck (*Oxyura jamaicensis*) in Manitoba, Canada, is described. Most females began nesting about 4 weeks after their arrival on the breeding grounds. The delay in onset of nesting may be correlated with the availability of suitable cover. The incidence of interspecific nest parasitism by the Ruddy Duck was low. A relationship is indicated between degree of parasitism and the chronology of nesting concomitant with the quantity and quality of available nesting cover. Parasitic laying apparently results from a lack of attunement of a female's physiological and behavioral responses to environmental cues.

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