

BEHAVIOR OF RUDDY DUCK BROODS IN UTAH

DAVID E. JOYNER

ABSTRACT.—This study reports on the brood-related behavior of Ruddy Ducks at Farmington Bay Waterfowl Management Area, Farmington, Utah. Drake accompaniment of hens and broods apparently resulted from a residual mate attraction rather than from a paternal relationship with the brood. Hen Ruddy Ducks accomplished inter- and intraspecific brood defense by means of agonistic displays and actual aggression. Communication between hen and brood was accomplished through visual and, occasionally, auditory signals. Calls were used to regroup ducklings, whereas visual displays were used to stimulate specific brood response. Brood behavior varied according to the age of the ducklings and the site occupied.—*School of Life Sciences, University of Nebraska-Lincoln, Lincoln 68508. Present address: Department of Zoology, University of Guelph, Guelph, Ontario N1G 2W1. Accepted 17 November 1975.*

THE behavior of wild duck broods has been little studied. Beard (1964) made important observations on several species at the Seney National Wildlife Refuge, Michigan, and reports of less intensive studies of brood activities are widely scattered in the literature (Low 1945, Weller 1957, Erskine 1971, Johnson 1974). However, no comprehensive studies of the brood behavior of Ruddy Ducks (*Oxyura jamaicensis*) have been published. This species is of special interest because males have been reported escorting females and broods (Bent 1925, Oring 1964), an unusual pattern in Northern Hemisphere ducks. This study examined inter- and intraspecific relationships involving adult Ruddy Ducks and their broods.

METHODS

The work was conducted at Farmington Bay Waterfowl Management Area, Farmington, Utah during 1972–74. Daily observations (excluding weekends) were made of Ruddy Duck drakes, hens, and broods during May, June, July, and August of each year. Broods were counted three times weekly during June and early July, and once each week for the rest of each summer. Broods were visually categorized into biweekly age classifications from newly hatched ducklings into those estimated to be 8 weeks of age, using plumage descriptions derived from captive ducklings. The presence or absence of a drake and/or hen was noted for each brood. Adult (51 males, 76 females) and juvenile (28 males, 33 females) Ruddy Ducks were taken in funnel traps or caught with a small hand net and then marked for individual identification with yellow (1972) or red (1973–74) nasal saddles (Doty and Greenwood 1974) and banded with USFWS leg bands.

BROOD BEHAVIOR

Mean brood size.—Brood merging impaired the estimation of average brood sizes for 4- to 8-week-old Ruddy Ducks. Younger ducklings (newly hatched to approximately 3 weeks of age) maintained brood coherency and were less apt to merge with other Ruddy Duck broods of comparable age. Hens accompanying downy broods (<3 weeks old) also prevented brood merging by selectively attacking ducklings that differed in size and age from their own. As a result, I was able to estimate an average of 8 ducklings per brood for 126 one-week-old broods. This average approximates the 7.1 ducklings per clutch hatched from 47 successful Ruddy Duck nests (Joyner ms). Duckling losses during the second and third weeks of life reduced average brood sizes by approximately two ducklings. These losses were attributed to predation by Black-crowned Night Herons (*Nycticorax nycticorax*), California Gulls (*Larus californicus*), and Ring-billed Gulls (*L. delawarensis*), to inclement weather

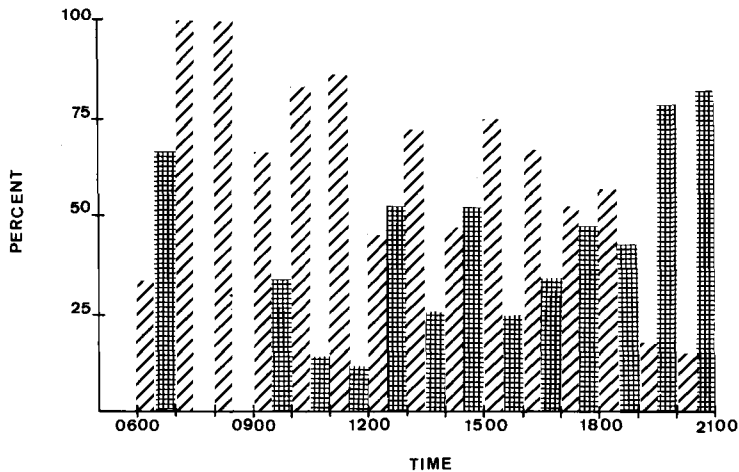


Fig. 1. Partitioning of the hourly activities of a 3-week-old Ruddy Duck brood on the Turpin Unit borrow pit. Squares represent feeding time, diagonal lines represent other activities i.e. sleeping, preening, swimming, and movement.

and to unknown causes. Additional losses resulted from seasonal outbreaks of avian botulism (*Clostridium botulinum* type C) during late July and early August each year.

Although downy Ruddy ducklings were susceptible to chilling during severe storms, ducklings 3 weeks old or older appeared to be little affected by colder temperatures. Downy ducklings responded to cold ambient temperatures by leaving the water and climbing on top of, next to, or underneath the hen. Hens made no visible attempt to brood the ducklings other than to stand and allow the ducklings to lie next to them. These quasi-brooding activities rarely lasted more than 5–10 min. Older ducklings also left the water during severe storms and climbed onto mud mounds or emergent vegetation. Less severe storms had little effect on brood behavior other than to force the younger ducklings into shallower water. Hen Ruddy Ducks were never seen brooding their ducklings at the nest site during daylight (0600–2100), nor did I see them lead their broods to the nest site immediately after sunset, but Mathews and Evans (1974) indicated that in the Eurasian stiff-tail, the White-headed Duck (*Oxyura leucocephala*), hens with broods did use nest structures for at least 12 days after hatching.

Feeding behavior.—Brood feeding activity varied with the time of day (Fig. 1). Ducklings fed extensively during the early morning (0600–0700), but infrequently during midmorning. The lack of midmorning feeding activity possibly resulted from their having fed during the night (Swanson and Sargeant 1972). Feeding activity remained sporadic throughout the day, but generally accounted for 25–50% of each hour's activity. Feeding duration and intensity increased in the evening (1800–2100) and continued until the birds could no longer be seen. The feeding bouts of recently hatched ducklings (< 3 weeks old) were more frequent but for shorter durations than those of older ducklings.

As Ruddy ducklings increased in age from newly hatched to 8 weeks of age, their diving abilities also increased (Table 1). Siegfried (1973) found that 5-day-old Ruddy ducklings averaged 12.9 sec per foraging dive ($N = 39$), whereas 25-day-old ducklings averaged 14.8 sec ($N = 18$). I found diving durations to vary significantly ($P < 0.05$)

TABLE 1
 VARIATIONS IN FORAGING DIVING TIMES (SEC) FOR FOUR AGE CATEGORIES OF UNFLEDGED RUDDY DUCKS¹

Age (weeks)	Mean	SE	Range	N (dives)	Water depth (m)
0-1	6.4	0.15	3-8	64	0.5-1.0
1-2	8.2 ²	0.15	4-11	88	0.5-1.0
2-4	10.6 ²	0.20	5-16	86	0.5-1.0
4-7	11.7 ²	0.33	9-17	55	0.5-1.0

¹ All observations were conducted on the same borrow pit.

² Two means are significantly different ($P < 0.05$), Steel and Torrie (1960: 81), t -test with $S_1^2 \neq S_2^2$, $N_1 \neq N_2$.

for Ruddy ducklings ranging in age from 1-7 weeks. Mathews and Evans (1974) also noted age-related variations in mean diving times for two captive White-headed ducklings. Diving durations ranged from 5.9 (1 day old) to 11.5 sec (7 days old) during the first week of life, and from 10.9 (week 1) to 18.1 sec (week 7) for ducklings 1 to 7 weeks of age.

Increasing age also increased Ruddy duckling independence. Downy Ruddy ducklings rarely strayed more than 1-3 m (472 observations) from the hen, a distance considerably less than that observed for Mallard (*Anas platyrhynchos*), Cinnamon Teal (*A. cyanoptera*), and Redhead (*Aythya americana*) broods of comparable age, but similar to that reported for downy White-headed ducklings (Mathews and Evans 1974). Ruddy ducklings 2-4 weeks of age were frequently found feeding 3-5 m (512 observations) from the hen, and some older ducklings moved 10 m or more from her. Downy broods in canals or borrow pits appeared less independent than broods on the larger lakes, which was probably nothing more than a response to relatively confined conditions, versus a lack of environmental confinement.

Older ducklings (>4 weeks old) responded less frequently to the hen's activities. Hen body postures signifying potential danger did not stimulate an immediate grouping response in 4- to 5-week-old ducklings as it had in younger birds. Older ducklings were probably less susceptible to predation by gulls and herons, and their behavior reflected that decreased vulnerability. California and Ring-billed Gulls were watched, but otherwise ignored by older ducklings. Black-crowned Night Herons always stimulated a response, regardless of the age, location, or activities of the brood.

HEN BEHAVIOR—RELATIONSHIP WITH THE BROOD

Banded hen Ruddy Ducks with broods expressed strong affinities for certain preferred localities; some hens moved no more than 50-75 m along a canal or borrow pit during a 3-5 week period. Other hens, especially when disturbed by human intrusion, moved their broods 0.5 km or more. Brood movement was minimal when nests were located within favorable brood-rearing localities (Libby 1972), whereas broods in less favorable habitats were led to more suitable rearing sites within 24-48 h after hatching.

Hen-brood attentiveness was demonstrated by a reduction in the duration of hen diving times when compared to the diving times of foraging drakes and broodless hens (Table 2). Similar results were also expressed by Mathews and Evans (1974) for female White-headed Ducks. The average duration of foraging dives by hen Ruddy Ducks with broods was significantly less ($P < 0.05$) than for broodless hens, although mean duration between dives was found not to differ significantly. Siegfried

TABLE 2
 VARIATIONS IN FORAGING DIVING TIMES (SEC) FOR THREE SPECIES OF DUCKS

Species	N (indiv.)	Age	Mean	SE	Range	N (dives)	Water depth (m)
Ruddy Duck (F) (with brood)	8	Adult	5.9	0.29	2-16	87	0.5-1.0
Ruddy Duck (F) (without brood)	5	Adult	11.5	0.31	7-18	69	0.5-1.0
Ruddy Duck (M)	8	Adult	12.5	0.30	7-20	77	0.5-1.0
Redhead		1 week	4.0	0.47	3-5	13	0.5-1.0
Redhead		3 weeks	4.6	0.34	2-7	15	0.5-1.0
Mallard		3 weeks	3.0	0.36	2-4	6	0.5-1.0

(1973) recorded the diving times of female Ruddy Ducks (water depth 1 m) and found a mean of 20.6 sec (SE = 0.24) for 46 foraging dives, a value considerably greater than that recorded at Farmington Bay, especially for hens with broods (5.9 sec).

Interspecific brood defense.—Hen interspecific brood defense was closely associated with the age of the brood and the habitat being utilized. Hens with newly hatched ducklings were highly aggressive. As the ducklings grew older, the hen's aggressive behavior waned, and she generally abandoned her brood when ducklings were 4-5 weeks of age. Mathews and Evans (1974) indicated that 5-week-old White-headed ducklings were essentially independent of their hen. Hen Ruddy Ducks found on the larger lakes at Farmington Bay appeared to be less aggressive (number and intensity of interspecific encounters observed per h) than hens on enclosed canals or borrow pits. Although canals confined Ruddy Ducks and other species in close proximity, the same species could be readily found intermingling on the larger lakes with little or no interspecific aggression. Undoubtedly, much of the variation observed in hen Ruddy Duck agonistic behavior probably reflected variations in the corresponding behavior of nesting and territorial American Coots, *Fulica americana*, (Gullion 1952, 1953; Fredrickson 1970) and other waterfowl.

Agonistic duck-coot encounters were seen frequently at Farmington Bay each year during June. For 30 different hen Ruddy Ducks with broods watched over a total of 26 h during 1973, 163 interspecific encounters (range 0-18/h, mean = 6.2/h) were recorded involving hen Ruddy Ducks, 85% of them with coots, 6% with Redheads, 3% with muskrats (*Ondatra zibethicus*), and 2% with Mallards. The remaining 4% consisted of rare encounters with Gadwalls (*Anas strepera*), Pintails (*A. acuta*), Cinnamon Teal, Snowy Egrets (*Egretta thula*), and Pied-billed Grebes (*Podilymbus podiceps*). The number and intensity of interspecific encounters also reflected the abundance as well as the aggressiveness of the species involved.

In most instances hen Ruddy Ducks initiated the interaction, either by gaping at or by physically attacking the intruder. Adult coots consistently dominated Ruddy Duck-coot interactions, whereas younger coots were invariably chased away.

Intraspecific brood defense.—A total of 102 intraspecific conflicts (range 0-12/h, mean = 4.2/h) were recorded involving 23 hen Ruddy Ducks with broods over a total time span of 24 h. Hen-to-drake interactions comprised 62% of all intraspecific encounters, whereas female-to-female conflicts were less frequent, and accounted for 33% of the total. Stray ducklings were usually ignored unless they approached the hen's brood. The intensity and duration of the hen's intraspecific agonistic response were partially governed by her location (greater intensity and duration on canal versus lake) and by the age of her own brood (younger broods were defended more aggressively).

Conspecific communication.—Ruddy Duck hen-to-brood communication was primarily visual. Variations in hen body and plumage positions were the principal visual signals used during a disturbance. Hens assumed an alert posture (which consisted of raising the head vertically and flattening the head and body plumage) when approached by potential predators (e.g. gulls, herons, dogs). This posture elicited a grouping response in the ducklings. Continued predator approach resulted in the movement of the hen and brood away from vegetation and into deeper water. If harassed by the predator, hens occasionally performed a weak imitation of the bubble display (Johnsgard 1965), which usually evoked a similar response in the ducklings, regardless of age.

Hen Ruddy Duck vocal communication was found to be similar in function to that reported for the White-headed Duck (Mathews and Evans 1974). Calls were used primarily when hens were visually separated from their broods. Ducklings showed little visible response to the hen's calling until the hen came into sight, whereas hens responded to visual stimuli as well as to the distress and contentment calls of ducklings.

DRAKE BEHAVIOR—RELATIONSHIP WITH HEN AND BROOD

Drake accompaniment of Ruddy Duck hens with broods is well documented (e.g. Bent 1925, Oring 1964), although the significance of this relationship remains vague and speculative. As a result, even the permanency (one reproductive season, 3–4 months) of the pair bond remains open to question.

During the three consecutive nesting seasons (1972–74) at Farmington Bay, drake abandonment of the hen and brood first became evident during late June and, almost without exception, was complete in early to mid-July. Drakes were rarely seen on display canals or small ponds after 15 July, the majority having moved onto the larger lakes for the postnuptial molt.

Drake-hen relationship.—Most adult Ruddy Ducks captured as pairs or singles during May and June of each year were rarely seen again after release. Hens nesting in close proximity to canals or borrow pits were occasionally seen feeding on those canals, but unproductive hens and all drakes either left the release site or remained in stands of emergent vegetation. One pair, for example, captured on a borrow pit on 9 June 1972 was sighted 11 days later (20 June) on a marsh 400–500 m from the release site.

Ruddy Duck mobility (primarily drakes and broodless hens) via water was at least partially governed by the topography of the territory being used. Pairs on lakes showed greater mobility than pairs utilizing canals and borrow pits. Some identifiable drakes (plumage traits such as black spotting on the white cheekpatch helped identify individual drakes, as only about 5% of the resident males were banded) remained within a 30–50 m stretch of borrow pit for 3 or more weeks at a time. Minimal drake mobility may have facilitated pair reunion after the successful completion (or abandonment) of the clutch, but the paternal relationship indicated by Bent (1925) and Oring (1964) was not evident. Drake Ruddy Ducks were attracted to the hens, not to the broods. Accordingly the drake's presence reflected what I submit to be an extension of the original pair bond; the presence or absence of the brood had little or no discernible effect on the behavior of the drake. This assumption is based on several criteria: (1) hens with broods tolerated the accompaniment of one male only, all other drakes were immediately driven away from the brood, (2) minimal

drake mobility facilitated the immediate reunion of presumed pairs when hens were intentionally forced away from their nests, and (3) the lack of any perceivable selective advantage in forming a new quasi- (and probably nonfunctional) pair bond with a second drake when (or if) the original mate remains available. In support, B. Gray (pers. comm.) reported that one pair of banded Ruddy Ducks remained together for 7 weeks at the Tule Lake National Wildlife Refuge, California. Therefore the perpetuation of the original pair-bond probably depends on the sexual condition and availability of the original mate accompanying the hen and brood, on the degree of individual variation in hen agonistic behavior, and on the hatching date of the brood, White-headed Ducks, in contrast, apparently do not form distinct pair bonds (Mathews and Evans 1974).

Brooding hen Ruddy Ducks became increasingly intolerant of accompanying drakes during late June. Hens initially ignored accompanying drakes although allowing them to intermingle with the broods. As tolerance diminished, hen agonistic behavior shifted from gaping to physical aggression. In some instances, drake abandonment seemingly resulted from the hen's aggressive behavior, whereas in others, drake abandonment may have been due to physiological changes preceding the molt.

Drake-brood relationship.—Drake intraspecific defense of the brood remained questionable. The drake's presence could, perhaps, be construed as having a beneficial effect, as accompanying males did defend hens from harassment by other Ruddy drakes. By preventing excessive drake harassment of the hen, the accompanying male decreased the number of hen-to-drake interactions, thus enabling the hen to remain with the brood and possibly increasing their chances of survival.

Drakes accompanying hens with broods also failed to defend the ducklings interspecifically, as Oring (1964) suggested. Regardless of the circumstances, drakes failed to pursue avian species that purposely or inadvertently harassed the ducklings. The drake's usual response was to move away from the disturbance. Comparable to the behavior in White-headed Ducks (Mathews and Evans 1974) and Cape Teal, *A. capensis* (Siegfried 1974), interspecific defense of the brood remained the sole responsibility of the hen. Of 163 hen interspecific encounters noted, not once did accompanying drakes intervene other than to attack nearby drake Ruddy Ducks.

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LITERATURE CITED

- BEARD, E. B. 1964. Duck brood behavior at the Seney National Wildlife Refuge. *J. Wildl. Mgmt.* 28: 492-521.
- BENT, A. C. 1925. Life histories of North American wildfowl. *U. S. Natl. Mus. Bull.* 130.
- DOTY, H. A., AND R. J. GREENWOOD. 1974. Improved nasal-saddle marker for Mallards. *J. Wildl. Mgmt.* 38: 938-939.
- ERSKINE, A. J. 1971. Buffleheads. *Canadian Wildl. Serv. Monogr. Ser. No.* 4.
- FREDRICKSON, L. H. 1970. Breeding biology of American Coots in Iowa. *Wilson Bull.* 82: 445-457.
- GULLION, G. W. 1952. The displays and calls of the American Coot. *Wilson Bull.* 64: 83-97.
- . 1953. Territorial behavior of the American Coot. *Condor* 55: 169-186.
- JOHNSGARD, P. A. 1965. *Handbook of waterfowl behavior.* Ithaca, Cornell Univ. Press.
- JOHNSON, T. W. 1974. A study of Mottled Duck broods in the Merritt Island National Wildlife Refuge. *Wilson Bull.* 86: 68-70.

- LIBBY, H. J. 1972. Ruddy Duck brood distribution in relation to marsh habitat. Unpublished M.S. thesis, Madison, Univ. Wisconsin.
- LOW, J. P. 1945. Production of the Redhead (*Nyroca americana*) in Iowa. *Wilson Bull.* 52: 153-164.
- MATHEWS, G. V. T., AND M. E. EVANS. 1974. On the behavior of the White-headed Duck with especial reference to breeding. *Wildfowl* 25: 56-66.
- ORING, L. W. 1964. Behavior and ecology of certain ducks during the post breeding period. *J. Wildl. Mgmt.* 28: 223-233.
- SIEGFRIED, W. R. 1973. Summer foods and feeding of the Ruddy Duck in Manitoba. *Canadian J. Zool.* 51: 1293-1297.
- 1974. Brood care, pair bonds and plumage in southern African Anatini. *Wildfowl* 25: 33-40.
- STEEL, R. G. D., AND J. H. TORRIE. 1960. Principles and procedures of statistics. New York, McGraw-Hill.
- SWANSON, G. A., AND A. B. SARGEANT. 1972. Observations of nighttime feeding behavior of ducks. *J. Wildl. Mgmt.* 36: 959-961.
- WELLER, M. W. 1957. Growth, weights and plumages of the Redhead *Aythya americana*. *Wilson Bull.* 69: 5-38.