NESTING OF THE RUDDY DUCK IN IOWA[1]

BY JESSOP B. LOW

Plate 17

INTRODUCTION

THE Ruddy Duck (*Erismatura jamaicensis rubida*), though often elusive and secretive to the hunter and of late years relatively scarce in hunting bags, affords a great deal of pleasure to the Nature lover who seeks the bird in its native haunts. Aside from its esthetic value, a knowledge of the Ruddy Duck's habits during the critical period of reproduction is essential to the conservationist who would wisely perpetuate and increase this game bird. The nesting habits and habitat requirements of the Ruddy Duck were investigated as part of the waterfowl-research program of the Iowa Cooperative Wildlife Research Unit. The results of the research conducted in northwestern Iowa during the 1938, 1939 and 1940 seasons are here presented. Acknowledgments are made to Dr. George O. Hendrickson, Zoology Department, Iowa State College, and to Mr. Thomas G. Scott, U. S. Fish and Wildlife Service, for suggestions and supervision of this work.

An area with an abundance of natural lakes and marshes extending from two to three miles on either side of the Clay and Palo Alto County line was chosen for intensive observations. Within a radius of five miles of the city of Ruthven lie six lakes and numerous marshes constituting the largest single remnant of duck-breeding habitat in Iowa. The lakes, in common with other lakes scattered throughout northern Iowa, are the result of the relatively late Wisconsin glaciation which extended from the north-central part of the State as far south as Des Moines. Glacial débris in the form of morainic hills surrounds the lakes in the southern part but gives way to a high rolling plain in the northern part of the area. Approximately 53 square miles were included although only the 6000 acres of lakes, marshes and sloughs were of particular interest. Lost Island Lake, the largest lake of the group, has a surface area of 1260 acres, while marshy spots as small as a quarter acre are numerous.

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TYPICAL NESTING ENVIRONMENT OF RUDDY DUCK

RUDDY DUCK'S NEST AMONG BURR-REED AND BULRUSH

Water depth varied from a maximum of about twenty feet in Lost Island Lake to several inches in the small marshes, averaging near three to four feet for all areas. According to cover maps used in connection with a study of the Redhead (*Nyroca americana*) over the same period and on the same area (Low, 1940), it was found that only about 1000 acres (16.67 per cent) of the total 6000 acres of water held vegetation dense enough to be favorable nesting habitat for Ruddy Ducks. The amount of vegetation available to nesting ducks appears to bear a close relationship to the prevailing water level during the nesting season and to the extent of vegetation removal by muskrats (*Ondatra zibethica*).

Within the emergent vegetation of the water areas the Ruddy Duck found suitable nesting sites as did the Redhead and occasionally a Canvas-back (*Nyroca valisineria*). Other large birds nesting in the same habitats as the Ruddy Duck were the American Coot (*Fulica americana americana*), Florida Gallinule (*Gallinula chloropus cachinnans*), American Bittern (*Botaurus lentiginosus*), Pied-billed Grebe (*Podilymbus podiceps podiceps*), Eared Grebe (*Colymbus nigricollis californicus*) and marsh-nesting Black-crowned Night Heron (*Nycticorax nycticorax hoactli*).

Few records of the nesting of the Ruddy Duck are found in Iowa ornithological literature prior to 1932. Although there is little doubt that the Ruddy Duck was breeding in Iowa when the earliest settlers arrived, no historical note seems to have been made of it until 1903 when it was reported breeding at Eagle Lake, Hancock County (Anderson, 1907). Its status as a migrant was recorded at an earlier date (Keyes and Williams, 1887). Leopold (1932–33) reported the bird breeding in Palo Alto and Allamakee Counties since 1920; and Bennett (1938) reported on twenty-two Ruddy Duck nests found incidental to his intensive study of the Blue-winged Teal (*Querquedula discors*) during the drought and semi-drought years, 1932 to 1937.

Data were secured by wading or by pushing a small boat through the emergent vegetation of the shallow lakes and marshes. As very few Ruddy Ducks' nests have down-feathers in them and since the female very seldom, if ever, flushes from the nest or nest site—both important clues to the location of Redhead nests—the search involved careful inspection of all the localities that offered nesting possibilities for the Ruddy Duck. A methodical weekly search was made over the nesting habitat of the species to bring under observation new nests and to secure data on those previously found. As a matter of convenience in study, maps of the nesting territory were drawn and the location of each nest was carefully plotted.

NESTING POPULATIONS AND DENSITIES

The first Ruddy Ducks appeared in the Ruthven area on northward migration on March 23 in 1939; however, the birds were first noted on April 14, 1938, and on April 2 in 1940. Warm spring weather, earlier than usual, prevailed over Iowa and surrounding States during the 1939 season when the birds were observed ten days to two weeks ahead of the arrival dates of 1938 and 1940. The principal flights occurred between April 29 and May 6 in the three seasons. It was estimated that 1000 Ruddy Ducks migrated through the area of study each spring, and of these approximately 100 breeding and non-breeding birds remained to spend the season. In the pre-nesting period an unbalanced sex ratio existed in the Ruddy Duck, as well as in the other diving ducks. Of a total 850 birds counted, 497 were males and 353 were females, a ratio of 1.41 males to 1 female. A much higher male-female ratio was found on the nesting grounds of Saskatchewan, Canada, where the average ratio for two seasons was 2.51 males to one female (Furniss, 1935, 1938).

The first nests were built by the females approximately May 8 (46 days after entering the area) in 1938 and 1939, and May 18 in 1940; the peak of nesting occurred June 1 to 15 in all three years. Latest hatching occurred August 13.

Density of nesting varied greatly in the different habitats. On the 1000 acres of potential nesting cover in the region an average of 23 nests, representing an estimated 50 per cent of the total nests, was located each year, or one nest to each 21 acres. However, on exceptionally favored areas the density approached one nest to 10 acres. The maximum nesting density on a 32-acre slough was one nest to 2.4 acres. Redhead nests were approximately twice as numerous as Ruddy Duck nests. Greatest nesting densities were on small, 10- to 15-acre marshes of Dewey's Pasture and in portions of the 1200-acre Barringer's Slough.

PRODUCTIVITY

Fifty-two, or 73 per cent, of the nestings under observation terminated successfully with extremes of 82 per cent in 1939 and 61 per cent in 1940. An average of 69.2 per cent of the eggs hatched. Records from Bear River Marshes, Utah, showed a 38-per cent nesting success and a 52-per cent egg hatch for the Ruddy Duck (Williams and Marshall, 1938). Fate of the nests and eggs during the period of study is summarized in Table 1. Greatest period of hatching was July 1 to 16 during which the eggs in 54 per cent of the nests hatched (Table 2). Nineteen, or 26.7 per cent, of the nests were

unsuccessful. Desertion of nests and eggs, the foremost cause of nest failure, accounted for 17 per cent of all nests (Table 1). Both flooded and deserted nests resulted from extreme variations in the water level. The receding water level of 1940, following a shortage of precipitation, left some nests without water under them and seven of them were deserted. Rapid rises in water levels caused nests to be flooded in 1938 during a rainstorm.

Because the Ruddy Ducks chose to nest in the vegetation above water, predation from terrestrial predators was reduced to a minimum. Within the area of study the common mink (*Mustela vison*) was responsible for two destroyed nests and possibly a third. Eastern Crow (*Corvus brachyrhynchos brachyrhynchos*), a minor predator on Redhead nests, was not known to destroy the nests of the Ruddy Duck. Caution was necessary in deciding the fate of a nest, for eggs in deserted nests were sometimes eaten by predators after desertion.

No more than one undeveloped egg was found in any nest and of 38 eggs left in nests after normal hatching had occurred, eight, or 1.5 per cent, showed no evidence of development. Such undeveloped eggs were distributed throughout the nesting season and could not be correlated with adverse climatic conditions or other factors. Eggs unaccounted for were very few and probably represented those pushed from the nests by females.

Egg laying began soon after the nest site was chosen and a flimsy nest foundation laid. Phillips (1923) noted that the cavity of the nest may be so small as to allow only two or three eggs on one level. Data from the present study indicate that eggs were often piled in a nest in several layers before incubation began. However, once incubation started, the eggs were placed on one level. Often eggs laid over a period of several weeks in an abandoned or destroyed nest were piled in several layers. Incubation commenced after most of the clutch was deposited, but sometimes before the last eggs were laid, with the result that hatching of all the eggs often did not take place at the same time. These late eggs were left in the nests when the females departed with the first-hatched juveniles. Examination of thirty (5.5 per cent) of these deserted eggs showed embryos in which the degree of development varied from several days in some eggs to full-term embryos in others. Some of the embryos were still alive four to five days after the female had abandoned the nest.

The act, often referred to in the literature (Phillips, 1923; Bent, 1923, 1925), of one female laying eggs in another female's nest was observed in this investigation. Ruddy Ducks deposited eggs in other Ruddy Duck nests as well as in Redhead and American Coot nests.

TABLE 1

NEST HISTORY OF RUDDY DUCK IN IOWA

Year	Total nests	Successfully terminated	Unsuccessfully terminated			Total eggs	Eggs per nest	Numbers hatched	Unsuccessful			
			Flooded	Preyed upon	Deserted				Undeveloped eggs	Dead embryos	Eggs in unsuccessful nests	Eggs unaccounted for
1938	21	16 (76.19)	4 (19.05)	1 (4.76)		169	8.1	107 (63.39)	1 (0.56)	19 (11.19)	42 (24.86)	
1939	27	22 (81.50)			5 (18.50)	210	7.4	163 (77.62)	4 (1.90)	7 (3.33)	34 (16.19)	2 (0.96)
1940	23	14 (60.87)		2 (8.69)	7 (30.44)	167	8.8	109 (65.28)	3 (1.79)	4 (2.39)	49 (29.35)	2 (1.19)
Totals	71 (100)	52 (73.24)	4 (5.64)	3 (4.23)	12 (16.90)	546 (100)	8.1	379 (69.42)	8 (1.48)	30 (5.50)	125 (22.86)	4 (0.73)

Again, each of eleven nests (12.6 per cent) of the Ruddy Duck contained from one to four Redhead eggs. The amount of promiscuous egg laying was directly proportional to the amount of unsuccessful nesting during each season of study. None of the parasitic Redhead eggs hatched even though the incubation periods of the Redhead and Ruddy Duck are comparable.

Six Ruddy Duck nests which were under observation prior to incubation and were followed through to hatching, gave an incubation period of 25 days for four clutches, and 26 days for two clutches. Phillips (1923) quotes 21 days as the incubation period, while Bent (1925) says, "Incubation . . . is probably not far from 30 days." The size of the eggs, large for the bird, substantiating the measurements given by Bent, averaged 62.3 by 45.6 millimeters.

The Ruddy Duck, in common with the Redhead and the Canvasback, constructs its nest in the emergent vegetation growing in the water of the marshes and lakes. Often the nest was placed on top of the broken and matted vegetation but more frequently it had a solid foundation of matted material that extended down through the water to the soil. Details of the construction of nests are presented in Table 2. The nests were located at an average of 80 yards out on the marshes, extremes of 0.33 to 250 yards, from the existing high-water mark. One nest hatched even though the water receded from it, but in the main such nests were deserted unless incubation was far advanced. The nest site which the Ruddy Duck chose varied from one yard to 133 yards (average 32 yards) from open water free of emergent vegetation.

The tolerance of the Ruddy Duck for other nesting birds was greater than that of the Redhead. One Ruddy Duck's nest was located in the center of a Black-crowned Night Heron rookery not over a yard from a heron's nest, while another Ruddy Duck availed itself of a Redhead's nest from which a brood had hatched. American Coot nests were appropriated and Bent (1923) states that Western Grebe (*Aechmophorus occidentalis*) nests have been used by the Ruddy Duck.

The water over which the Ruddy Duck nested averaged 13.5 inches deep with a maximum of 36 inches. The depth of the water varied considerably within the nesting habitats during the three years. The choice of nesting sites was governed primarily by the existing water depths, which in turn affected the vegetation. Since the water level fluctuated during the nesting season and varied from year to year, the height of the nest above the mud was taken. An average of 19.8

inches was recorded for the top of the nests above mud, with extremes of 7 and 41.5 inches.

Measurements from one side of the nest to the other ranged from 8 to 16.5 inches and from 4 to 12 inches on the inside of the bowl, averaging 12 inches outside diameter and 7 inches bowl diameter.

The Ruddy Duck constructs a cupola or an overhead protection for the eggs by bending the surrounding vegetation over the nest. Approximately two-thirds of the nests were equipped with cupolas. Apparently for greater ease when entering or leaving the nest, the birds often built runways or ramps of coarse vegetation from the edges of the nests to the water. Twenty-five (35.2 per cent) of the nests had ramps.

The Ruddy Ducks normally built their nests of dead, dry vegetation of the previous year but availed themselves of the green vegetation of the spring to a greater extent than did the Redhead. Some nests were built entirely of green vegetation, but in the average nest 75 per cent of the materials was dead and dry. The vegetation in which the nests were located was rated as dense, medium or sparse depending upon the protection afforded the nest. From 50 to 100 culms of bulrush, 50 to 150 stalks of sedge and 8 to 15 stalks of cat-tail to one-half square meter were considered medium cover; vegetation with fewer stalks to a half square meter was considered sparse; while vegetation with greater numbers of stalks was considered dense. Forty-two (62 per cent) of the nests were located in dense cover, twenty-one (31 per cent) in medium cover, and four (6.0 per cent) in sparse cover.

Nesting Cover Preferences

A cross-section through the favored nesting habitats of the Ruddy Duck in Iowa revealed that the vegetation consisted primarily of lake sedge (*Carex lacustris*) 25 per cent, hard-stem bulrush (*Scirpus acutus*) 10 per cent, and narrow-leaved cat-tail (*Typha angustifolia*) 12 per cent. Slender bulrush (*Scirpus heterochaetus*), awned sedge (*Carex atherodes*), water sedge (*Carex substricta*) and whitetop (*Fluminia festucacea*) were the more important of the minor plants. No nests were located in the reed grass (*Phragmites maximus*), sweet flag (*Acorus Calamus*) or bur-reed (*Sparganium eurycarpum*), which in the aggregate made approximately 15 per cent of the available emergent vegetation; however, these species, as components of the juvenile rearing cover, were of some value. Although vegetation of the nesting cover often occurred in mixed stands, the nests were classified as occurring in the dominant plant species in which each

TABLE 2

DETAILS OF NEST CONSTRUCTION OF RUDDY DUCK IN IOWA

Year	*Top of nest above water (inches)*			*Top of nest above soil (inches)*			*Depth of bowl (inches)*			*Inside nest diameter (inches)*			*Outside nest diameter (inches)*			*Water depth at nest site (inches)*		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
1938	2.5	8	5.3	7	41.5	26.4	2	5	3	4	8.5	5.9	8	15	11.8	0	36	21.1
1939	3	10	6.7	8	32	16.7	0.5	5	3.1	4	9	7.2	9.5	16.5	12.3	2	26	10.6
1940	4	8	6.1	10	21	16.5	2	5	3.2	6	12	8	10	15	12	1	15	8.5
3-yr. Avg.	3.2	9	6	8	31.5	19.8	1.5	5	3.1	4.7	9.9	7	9.1	15.5	12	1	25.5	13.5

Year	*Distance to open water from nest site (yards)*			*Distance to shore from nest site (yards)*			*Distance from other ducks' nests (yards)*			*Per cent dry nesting material*			*Density of cover at nest site (no. nests)*			*Nests having ramps*	*Nests having cupolas*
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Dense	Medium	Sparse		
1938	.33	200	40.5	0	250	65	20						8 (38.0)	11 (52.0)	2 (9.5)	10 (47.6)	18 (85.7)
1939	1	100	27.7	10	125	64	7			100		74.3	17 (73.91)	6 (26.09)		8 (29.63)	16 (59.26)
1940	2	100	29.5	10	250	116				100		78	17 (73.91)	4 (17.39)	2 (8.70)	7 (30.43)	9 (39.13)
3-yr. Avg.	1.1	133	32.5	6.7	210	81.5	13			100		75	42 (62.68)	21 (31.35)	4 (5.97)	25 (35.21)	43 (66.19)

was located. Table 3 was prepared to show the relative importance of the plant species as regards Ruddy Duck nesting and to show the success and failure of the nests that were placed in the different kinds of plant cover. From the standpoint of total numbers of nests the lake sedge held 21 (40 per cent) nests; hard-stem bulrush was second with 17 (33 per cent) nests; while narrow-leaved cat-tail, third in numbers of nests, was chosen by 10 (19 per cent) of the nesting Ruddy Duck. The data, expressed in density of nests to a cover type, revealed that one nest was constructed to 5.5 acres of the available hard-stem bulrush, one nest to 10 acres of lake sedge, and one nest to 11 acres of narrow-leaved cat-tail. Though limited in area, the 13 acres of slender bulrush held one nest to two acres, and the 12 acres of whitetop held one nest to three acres.

Several factors contributed to the success of the various plant species as nesting cover, including the suitability of the plants for nest construction, the degree to which they decomposed and matted beneath the water, and the availability of the plants to the birds. Since the nesting cover for the Ruddy Duck in Iowa was conditioned not only by the amount of the plant cover but also by the presence of open water, the available amount of each cover species depended upon the existing water level during the nesting period of each year. The presence or absence of nesting vegetation was not substantially affected by water fluctuations over a period of only a month or two, but the selection of a nest site was governed to a large extent by the water depth at the time of nesting. Thus, a shift of the nesting from the hard-stem bulrush in 1938 to the sedges in 1939 and the shift in the same direction in 1940 (Table 3) is correlated with an increase in the water level during the nesting seasons of 1939 and 1940 which rendered the sedges more available and the bulrushes less available than in 1938.

The change in the value of the hard-stem and slender bulrushes from one nest to 8 acres in 1938 to one nest to about 35 acres in 1940 was counterbalanced by a change in the value of sedges from one nest to 75 acres in 1938 to one nest to 15 acres in 1940. These figures, although based upon comparatively small numbers of nests, are sufficiently accurate to indicate a definite change from one cover type to another in direct response to fluctuation of water level.

Thirteen (76 per cent) of the nests in the hard-stem bulrush, seventeen (81 per cent) of the nests in lake sedge and five (50 per cent) of the nests in narrow-leaved cat-tail terminated successfully.

Fresh materials were constantly being added to the nests to compensate for a gradual settling resulting from decomposition of the

TABLE 3

NESTING COVER DATA ON THE RUDDY DUCK IN IOWA

Vegetation in which the nests were located	*Total nests*				*Successful nests*				*Unsuccessful nests*			
	1938	1939	1940	3-Yr. total	1938	1939	1940	3-Yr. total	1938	1939	1940	3-Yr. total
Hard-stem bulrush (*Scirpus acutus*)	12	4	1	17	10	5		13	2	1	1	4
Slender bulrush (*Scirpus heterochaetus*)	1	3	2	6		3	1	4	1		1	2
Lake sedge (*Carex lacustris*)	3	7	11	21	2	7	8	15	1		3	4
Awned sedge (*Carex atherodes*)		3	2	5		3	1	4			1	1
Water sedge (*Carex substricta*)		3	1	4		3		3			1	1
Narrow-leaved cat-tail (*Typha angustifolia*)	3	3	4	10	2	1	2	5	1	2	2	5
Whitetop (*Fluminea festucacea*)		2	2	4		1	2	3		1		1
Reed grass (*Phragmites maximus*)	1			1	1			1				
Sweet flag (*Acorus Calamus*)	1			1	1			1				
Bur-reed (*Sparganium eurycarpum*)		1		1						1		1
Creeping spike-rush (*Eleochris calvis*)		1		1		1		1				
Totals	21	27	23	71	16	22	14	52	5	5	9	19

under part of the nests. Nests well hidden at first were often later exposed because the surrounding vegetation was torn down and incorporated into the nests. During periods of heavy rain, the water level rose several inches, and at such times the ducks were compelled to add materials very quickly to the nests and continue to do so until the water reached the highest level. The capacity to add materials rapidly to the nests when the water level was rising often determined the success or failure of the clutch. The cover species in which the nests were located determined, in part, the ability of the Ruddy Ducks to build the nests sufficiently high to avoid flood waters. During the 1938 season nests constructed of the fine-leaved sedges were almost invariably flooded. The nests located in bulrushes, reed grass, narrow-leaved cat-tail, or other coarse-leaved plants were readily built up high enough, in most instances, to avoid the flood waters. During the 1939 season, when no flooding occurred, little difference was detected in the qualities of the plant species used in nest construction. Vegetation of the previous year provided the nesting cover and materials for slightly over 75 per cent of the nests. Nests built after about June 1 were predominately of green plant materials.

Plant species which decomposed or matted beneath the water during the fall and winter or which shed their leaves leaving only coarse stalks standing had little value as nesting cover. Hard-stem and slender bulrushes stood up well throughout the winter, and yet were pliable enough to be readily used by the nesting ducks. Bulrushes, cat-tails and reed grass were tall enough to be available for nesting even though the water level rose 15 to 18 inches during the nesting season. Sedges, though fine-textured and susceptible to flooding as in 1938, were otherwise excellent nesting cover and nesting materials. Reed grass had little value as nesting cover, while bur-reed and sweet flag were available only late in the season since the old stalks were matted into the water in fall and winter. In contrast to the culms of hard-stem bulrush, the stalks of river bulrush (*Scirpus fluviatilis*) were stiff and tough, and Ruddy Duck nests were not observed in growths of this plant.

Summary

An investigation of the Ruddy Duck in northwestern Iowa during three years (1938, 1939, and 1940) revealed that the most important nesting habitat held stands of hard-stem bulrush and lake sedge occurring either alone or intermixed. The choice of nesting cover was determined not so much by a preference for certain plant species as for a cover type having a desirable water depth. The favored loca-

tion for nest construction was in vegetation growing in 10 to 12 inches of water. A 71 per cent successful egg hatching was recorded for the Ruddy Duck during the study. Predation was negligible because of the selection of nest sites above water.

The most destructive factor to Ruddy Duck nesting was fluctuations in the water level; rapid rises in the water level flooded nests, while the recession of the water level caused nest desertion. Acquisition and stabilization of the water within the nesting habitat appears to determine efficient production of the Ruddy Duck in Iowa marshes.

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Iowa Cooperative Wildlife Research Unit
Ames, Iowa