NESTING HABITS OF THE CLAPPER RAIL IN NEW JERSEY

BY EDWARD L. KOZICKY AND FRANCIS V. SCHMIDT

THE northern clapper rail, *Rallus longirostris crepitans* Gmelin, locally called "mud hen," is one of the most common and important game birds on the coastal saltmarshes in New Jersey, from April to November. Consequently, to understand better the nesting habits and to devise a census method for the species, a study was inaugurated as a component of Pittman-Robertson Project, 16-R-2, "An Evaluation of the Wildlife Populations in the Tuckahoe-Corbin City Area," in the spring of 1948. The writers are indebted to Mr. L. G. MacNamara, New Jersey Division of Fish and Game, for encouragement during the course of the investigation, and to Dr. George O. Hendrickson, Iowa State College, for valuable suggestions in the preparation of this manuscript.

The study areas were located on the saltmarsh in the vicinity of Ocean City, Cape May County, New Jersey. The vegetation consisted mostly of: saltmarsh grass, *Spartina alterniflora;* salt meadow grass, *Spartina patens;* black grass, *Juncus gerardi;* salt grass, *Distichlis spicata;* glasswort, *Salicornia* spp.; and marsh elder, *Iva frutescens*. The scientific names of plants follow Muenscher (1944). The areas contained numerous tidal creeks and were mechanically ditched as a mosquito-control measure several years prior to the study.

Of the 63 nests found, 56 contained eggs, and seven were not utilized for egg-laying or were inactive. The value of the data on nests was enhanced by their distribution in six localities. The six sites (total 430 acres) varied in area from 20 to 160 acres and were separated by distances of one-half to one mile.

The nests, marked with a stake and plotted on a map, were visited on a semi-weekly basis. Notes were taken on numbers of eggs, nest dimensions and construction, types of vegetation, and stages of incubation. When eggs were pipped, some nests were visited daily. To avoid disturbance of nesting cover, different directions of approach and departure were used by the observers, when possible.

MIGRATION

Migration records maintained for more than 20 years at Cape May, New Jersey, indicate that March 15 is the average time of first arrival of the clapper rail (Stone, 1937). This species was first recorded by the observers on April 18, 1948, at Ocean City. The fall migration occurs during September and October. However, there are several midwinter records (Stone, 1937; Chapman, 1940).

DATES OF LAYING

The first nests of clapper rails were found May 26, 1948, the first date of nest-hunting. Bent (1926) gave 21 records of egg dates from May 24 to June 21 and 11 records from May 30 to June 5 for New Jersey and Long Island. Stone (1908) pointed out that complete sets of eggs may be found in New Jersey from May 25 to June 10, and later, when the first nest has been destroyed. Two nests found July 23, 1948, probably were attempts at renesting.

Of the clapper rail in New Jersey in 1812, Wilson wrote, "About June 1 the people of the neighborhood go off on the marshes, *an egging*, as it is called. So abundant are the nests of this species and so dexterous are some persons at finding them that 100 dozen of eggs have been collected by one man in a day" (Bent, 1926). June 1 was also the date of the peak of the nesting season in 1948, based on the hatching dates of 50 clutches.

STRUCTURE OF NESTS

Measurements to the nearest half-inch were taken on 63 nests following Pettingill's method (1947), except that outside depth was considered as from the ground to the rim of the nest and that the height of the arch or cupola over the nest was taken as the inside depth plus the distance to the under surface of the arch. A statistical summarization of data on nest measurements is given in Table 1.

TABLE 1

MEASUREMENTS OF NESTS OF NORTHERN CLAPPER RAILS, OCEAN CITY, NEW JERSEY, JUNE, 1948

	Number of nests	*Mean (inches)*	*Standard deviation*	*Range (inches)*
Inside diameter	63	5.6 ± 0.09	0.72 ± 0.06	4.0– 7.0
Outside diameter	63	9.3 ± 0.16	1.26 ± 0.11	6.0–12.0
Inside depth	63	2.1 ± 0.07	0.56 ± 0.05	1.0– 4.0
Outside depth (ground to rim)	63	9.0 ± 0.40	3.15 ± 0.28	1.0–16.0
Height of arch above nest	57	7.2 ± 0.18	1.38 ± 0.13	3.0– 9.0

Fifty-seven (90.4 per cent) of the 63 nests had an arch, but some of the arches consisted merely of a few leaves of saltmarsh grass bent over the nest. Forty-three (68.4 per cent) of the nests had a ramp or runway constructed from the elevated nest to the ground.

The nests were constructed of dead plant material which generally reflected the type of vegetation at the site. Saltmarsh grass was utilized more than any other species. The nest, an elevated platform, was built on the ground between the stems of plants. The highest

nest was 16 inches above the ground. Two nests were in plant debris, accumulated by wind and tidal action, on top of living saltmarsh grass.

LOCATION OF NESTS

The preference for saltmarsh grass (more than two feet tall) as nesting cover is indicated in Table 2. The marsh elder type was

TABLE 2

DISTRIBUTION OF 63 NESTS OF NORTHERN CLAPPER RAILS IN VEGETATIONAL TYPES ON SALTMARSH NEAR OCEAN CITY, NEW JERSEY, JUNE, 1948

Cover type	*Height of vegetation*		*Number of acres*	*Number of nests*	*Percentage of nests*	*Number of nest successful*	*Percentage of nests successful*
	More than 2 feet tall	*Less than 2 feet tall*					
Saltmarsh grass, *Spartina alterniflora*		X	326	2	3.6	2	100.0
Saltmarsh grass, *Spartina alterniflora*	X		46	41	73.2	36	87.8
Saltmarsh grass-salt meadow grass, *Spartina alterniflora-S. patens*		X	9	4	7.1	4	100.0
Black grass, *Juncus gerardi*		X	4	1	1.8	1	100.0
Marsh elder, *Iva frutescens*	X		40	8	14.3	7	87.5
Salt meadow grass, *Spartina patens*		X	5	0	——	—	——
Total			430	56	100.0	50	89.3

preferred to a lesser extent for nesting cover, and the utilization of other plant types appeared to be accidental. It was interesting to note that, although salt meadow grass was closely associated with saltmarsh grass, no nests were located in salt meadow grass.

The saltmarsh grass (more than two feet tall) type was prevalent along the banks of tidal ditches and in many instances offered the only cover that was not submerged by high tides. The marsh elder type was on higher ground and was seldom inundated by normal tidal action.

Forty-five (71.5 per cent) of the 63 nests were situated within 12 feet of a tidal or mosquito ditch. This association was an apparent reflection of the preference by the clapper rail for saltmarsh grass (more than two feet tall) as nesting cover. This vegetational type usually flourished within 12 feet of a tidal ditch and dropped to a height of less than two feet at greater distances. One nest was found about 60 feet from a tidal ditch, but this nest was in the marsh elder type. Seven (11.1 per cent) of the 63 nests were located within 12 feet of a mosquito ditch. The mosquito ditches, one foot wide and two to

three feet deep, were dug mechanically. Tidal ditches furnished a better habitat for the growth of saltmarsh grass than did mosquito ditches.

The minimum distance between two nests on the same side of a tidal ditch, with no intervening natural barriers, was 75 feet. The majority (92 per cent) were more than 150 feet apart. The minimum distance between any two nests was 42 feet; however, there was a ten-foot tidal ditch between these two nests. Stone (1937) stated that clapper rails, crowded together at times of high tides, sometimes fight viciously.

EGGS

The mean number of eggs per nest based on observations on 104 nests was 9.97 ± 0.21, with a range of four to 14 eggs (Table 3). Bent (1926) gave an excellent description of egg coloration.

TABLE 3

MEAN NUMBER OF EGGS IN NESTS OF CLAPPER RAILS, CAPE MAY COUNTY, NEW JERSEY

	Nests observed in 1948	*Stone (1937)*	*Total*
Number of nests	61*	43	104
Total number of eggs	614	424	1038
Mean number of eggs	10.05 ± 0.26	9.86 ± 0.24	9.97 ± 0.21
Standard deviation	2.03 ± 0.18	2.20 ± 0.24	2.10 ± 0.15
Range	5–14	3–14	3–14

*Includes 56 active nests on study area and five other nests.

During the course of the investigation, 29 eggs were measured. These eggs were selected from different nests or were found on the marsh. The measurements may be considered a random sample as not more than one egg was selected from any one nesting site. The mean dimensions were 43.9 ± 0.37 by 31.5 ± 0.19 millimeters; all egg measurements were taken with calipers. No abnormally shaped eggs were observed.

Data gathered on four nests indicated that the rate of laying was about one egg a day. The history of the four nests was as follows: seven eggs in eight days, five in five, eight in eight, and 11 in 15. Walkinshaw (1937) found that the Virginia rail, *Rallus limicola*, laid approximately one egg a day.

INCUBATION

Bent (1926) stated, "The period of incubation is said to be about 14 days." Observations on six nests (Table 4) indicated that the incubation period was about 20 days with extremes of 18 to 22 days.

An effort was made to determine accurately the first day of incubation, but the extremes in the length of the period might have been due to a miscalculation of the commencement of the incubation period, which was considered as starting when the last egg was laid and ending when the first chick hatched. Walkinshaw (1937), working with the Virginia rail, related that incubation may start the day before the laying of the last egg. The delay of 24 to 48 hours in the hatching of these eggs might be considered an indication that incubation started a day prior to the laying of the last egg. Once incubation had started, the eggs under observation were always warm, until they hatched or the rail abandoned the nest.

The reaction of an incubating bird to disturbance varied with individuals. As a rule, the bird would leave before the observer approached the nest. A few birds, however, remained on the nest

TABLE 4

LENGTH OF INCUBATION PERIOD, EGGS OF CLAPPER RAILS, NEW JERSEY, 1948

Date incubation started	*Date first chick hatched*	*Incubation period (days)*
June 6	June 26	21
June 9	June 30	22
June 9	June 27	19
June 11	July 1	21
June 12	June 30	19
June 19	July 6	18
		Average 20 *days*

until the observer was within two or three feet, and some feigned injury. There was no apparent relationship between the variation in behavior and the stage of incubation.

HATCHING

The height of the hatching period was between June 16 and 21 (Table 5). Twenty-five (50 per cent) of 50 successful nests hatched during this period. Hatching was observed from June 5 to July 9, 1948. Eggs in one nest, probably a renesting attempt, were observed hatching on July 29, 1948; Stone (1937) recorded a nest with nine eggs on August 3, 1930. The eggs were usually pipped about 48 hours before hatching, and the clutch required from 24 to 48 hours to complete hatching.

On three different occasions two birds were seen near a nest during the hatching period. On one occasion both birds feigned injury, although one bird was more active than the other in this display. In one instance, the two adults were observed at a nest with eight chicks

and two eggs. On the second day, the chicks and one adult were not evident in the vicinity of the nest, but the other adult was still incubating the two remaining eggs which hatched within the next 24 hours. No signs of either adult or chicks could be found in the surrounding vegetation on the third day. In addition, two birds were flushed from the vicinity of an incubating nest on four different occasions. Pettingill (1938) observed six broods, each with two parents, during an exceptionally high tide at Cobbs Island, Virginia. Field data, therefore, indicate that both parents apparently share in the nesting duties.

TABLE 5

DATES OF HATCHING OF 50 NESTS OF CLAPPER RAILS, CAPE MAY COUNTY, NEW JERSEY, 1948

Date	*Number of nests*
June 1–5	1
June 6–10	8
June 11–15	4
June 16–20	25
June 21–25	4
June 26–30	5
July 1–5	2
July 6–10	1

One of the most interesting observations was the disposition of shells after the chicks hatch. The fact that the egg hatched in the same manner as a chicken, *Gallus domesticus*, egg was substantiated by field observations on four different occasions. The egg shells, however, were quickly removed from the nest. Billard (MS, 1947) observed the same disappearance of egg shells of the Virginia rail. A nest in which every egg had hatched usually looked as if the eggs were gathered by man, but a thorough examination of the nesting material revealed the presence of small pieces of egg shells. The shell membranes were not found. Occasionally, a piece of egg shell, which probably was from the last egg to hatch, remained in the bottom of the nest. This phenomenon was checked in 15 nests during the hatching period.

NESTING LOSSES

During the study, 56 active nests were kept under observation to determine their hatching success. If one egg hatched, the nest was considered successful. Fifty (89.3 per cent) nests hatched successfully, which was exceptionally high for a ground-nesting species. Kalmbach (1939) reported the nesting success of 13 species of waterfowl, based on 7,600 nests, as being 60 per cent.

Two nests were believed to have been destroyed by crows. They contained egg shells that showed characteristic crow damage to eggs

(Sowls, 1948). Egg collectors were probably responsible for destruction of two nests. Two nests were destroyed by undetermined means.

The greatest cause of nesting loss in the clapper rail is thought to be a high tide in conjunction with a northeast storm. Bent (1926) quoted Wilson (1832), "After the greater part of the eggs are laid, there sometimes happen violent northeast tempests that drive a great sea into the bay, covering the whole marsh. . . . On an occasion of this kind I have seen, at one view, thousands in a single meadow, walking about exposed and bewildered, while the dead bodies of females, who had perished on or near the nests, were strewed along the shore. . . . The disasters do not prevent the survivors from recommencing the work of laying and building over; and instances have occurred where their eggs have been twice destroyed by the sea; and yet in two weeks the eggs and nests seemed as numerous as ever." Stone (1937) stated that it was questionable whether the clapper rail raises any broods in nesting seasons when such calamities occur. Pettingill (1938) recorded the destruction of three broods during such abnormal tides.

A comparison of the highest tides from May 15 through June 30, 1948, with records from 1938 through 1947 did not reveal any apparent statistical difference. Nevertheless, a difference of two or three inches may be critical to nesting rails, especially during the hatching period.

The tidal records were obtained from the Atlantic City, New Jersey, station of the Coast and Geodetic Survey.

The tolerance of incubating eggs to inundation by a high tide was witnessed on June 4, 1948. Nest number 43 was flooded by a high tide, and the eggs were about three-fourths submerged. Records showed that the tide reached a crest of 9.4 feet on that date and 10.1 and 10.3 feet on June 8 and 9, 1948, respectively. Nevertheless, the five eggs hatched on June 19, 1948. It may be that the most destructive action of high tides and strong winds is the washing of eggs out of the nest. The submersion of eggs during the critical hatching period would undoubtedly be very destructive.

In the 50 successful nests, a total of 513 eggs were laid; however, only 448 eggs (87.3 per cent) hatched. Thirty-two (6.2 per cent) of the eggs were infertile or addled; four (0.8 per cent) were pipped but not hatched; 11 (2.2 per cent) were lost and 18 (3.5 per cent) died in various stages of incubation. Of the last group (18 eggs) that died in various stages of incubation, 11 were in one nest of 12 eggs. The nest contained one chick and 11 pipped eggs when the rail was flushed during a hard rainstorm. The next morning the eggs were warm and the one chick was dead, but the rail deserted the nest within the next

two days. Examination revealed that the embryos were dead; the nest was later destroyed by crows.

Occasional eggs were lost from nests during the incubation period. These eggs might have been removed by the rail. Pettingill (1938) has observed the ability of the clapper rail to carry eggs.

During the course of checking rail nests, 34 rail eggs were found on the marsh. Seventeen of the eggs appeared to have been destroyed by crows; 15 were intact and, upon examination, three were found to be in various stages of incubation; two eggs were destroyed by unknown predators. These eggs were found in greatest number through the first week in June, which was the height of the nesting season. The large number (34) of eggs found in the course of general observation was not reflected in nesting failures.

There was no evidence to indicate that a female rail reared more than one brood. A nest census on 71 acres of saltmarsh during the first week in June revealed 16 nests of clapper rails; a similar census on July 23 showed only two nests which were probably renesting attempts. The new nests contained eight and nine eggs, respectively, and were not considered in the computations on nesting data in this paper.

CENSUS METHOD

It became apparent during the course of the investigation that an annual nest count had possibilities of furnishing an index to population trends. The nests were easily located, and two men could cover a census area of 75 to 100 acres in a day.

If there are no mechanical changes instituted by human effort, ecological changes are comparatively slow on the saltmarsh. Nevertheless, two or three census areas should be established to safeguard against the possibility that the indicated increase or decrease in the rail population may be due to a vegetational change and not to a change in the number of rails. The census area should be mapped and nest locations (at least 10) accurately plotted. June 1 appears to be the ideal census date. Two such census areas were established in New Jersey in the spring of 1948.

SUMMARY

1. The nesting habits of the northern clapper rail, *Rallus longirostris crepitans* Gmelin, were investigated in Cape May County, New Jersey, during June and July, 1948.

2. June 1 was considered the height of the nesting season. This date has apparently been relatively constant since early in the nineteenth century.

3. The following mean measurements and standard deviation in inches were recorded for 63 nests of northern clapper rails: inside diameter, 5.6 ± 0.72; outside diameter, 9.3 ± 1.26; inside depth, 2.1 ± 0.56; outside depth (ground to rim), 9.0 ± 3.15. The mean height in inches of the arch above the nest was 7.2 ± 1.38 for 57 nests.

4. The majority (74.5 per cent) of the nests was in the saltmarsh grass type (more than two feet tall).

5. Forty-five (71.5 per cent) of 63 nests were located within 12 feet of a tidal ditch.

6. The mean number of eggs per nest was 9.97 ± 0.21 based on 104 observations.

7. The rate of laying was about one egg per day according to detailed observations on four nests.

8. The incubation period, based on six nests, averaged 20 days with extremes of 18 and 22 days.

9. Field observations indicated that both parents probably were together during the incubation period.

10. Twenty-five (50 per cent) of 50 nests hatched between June 16 and June 21, 1948.

11. The eggs in a nest were usually pipped about 48 hours before hatching, and the clutch required from 24 to 48 hours to hatch.

12. Fifty (89.3 per cent) of 56 clapper rail nests hatched successfully.

13. A nest of five eggs hatched successfully after being inundated by a high tide.

14. Egg shells and shell membranes usually were not found either in the nest or in the immediate vicinity of a successfully hatched nest. When they were found in the nesting materials, remains of egg shells constituted only a remnant of the potential shell debris.

15. Numerous eggs were found on the saltmarsh during the early part of the nesting season.

16. The feasibility of indicating trends in the numbers of clapper rails by an annual nest census on a given area is discussed.

LITERATURE CITED

BENT, A. C. 1926. Life histories of North American marsh birds. U. S. Nat. Mus. Bull. 135, 490 pp.

BILLARD, RUTH SAWYER. 1947. An ecological study of the Virginia rail (*Rallus limicola limicola*) and the sora (*Porzana carolina*) in some Connecticut swamps, 1947. Iowa State College Library, Ames, Iowa, Unpublished M. S. thesis, 83 pp.

CHAPMAN, FRANK M. 1940. Handbook of birds of Eastern North America. (D. Appleton-Century Co., New York), 581 pp.

KALMBACH, E. R. 1939. Nesting success: its significance in waterfowl reproduction. Trans. N. Amer. Wildl. Conf., 4: 591–604.

MUENSCHER, WALTER C. 1944. Aquatic plants of the United States. (Comstock Publ. Co., Ithaca), 374 pp.

PETTINGILL, OLIN S. 1938. Intelligent behavior in the clapper rail. Auk, 55: 411–415.

PETTINGILL, OLIN S. 1947. A laboratory and field manual of ornithology. (Burgess Publ. Co., Minneapolis), 108 pp.

SOWLS, LYLE K. 1948. The franklin ground squirrel, (*Citellus franklinii* Sabine), and its relationship to nesting ducks. Journ. Mamm., 29 (2): 113–137.

STONE, WITMER. 1909. The birds of New Jersey. Annual Report N. J. State Mus. for 1908, pp. 11–347, 409–419.

STONE, WITMER. 1937. Bird studies at old Cape May. (Acad. Nat. Sci. Phila.), 2 vols., 941 pp.

WALKINSHAW, LAWRENCE H. 1937. The Virginia rail in Michigan. Auk, 54: 464–475.

Iowa Cooperative Wildlife Research Unit, December 15, 1948.