

SOME OBSERVATIONS ON THE NESTING ACTIVITIES  
OF THE EASTERN GOLDFINCH

By

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Ypsilanti, Michigan

A report of a joint field study conducted  
as a requirement for Zoology 119

University of Michigan  
Biological Station

Submitted September 1, 1947

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## INTRODUCTION

The Eastern Goldfinch (Spinus tristis tristis) has been the subject of several studies, so that a great deal is known about its life cycle. However, certain phases have been passed over hastily. Noticeable among these is the nest-building procedure. Therefore, in hopes of adding something to strengthen this weakness we have studied the early stages of the nesting cycle with emphasis on nest-building and territorial behavior.

The study was conducted in the summer of 1947 at the University of Michigan Biological Station in Cheboygan County, Michigan. Besides a month spent in looking for nests and many brief visits to nests at odd times of the day and night, we spent 28 days in observation, with a total of 64 hours. The activities associated with four nests were followed.

Nest-building was observed from the ground with a 19-power Bausch and Lomb telescope and eight-power binoculars. To inspect the nest closely and to see inside we used an adjustable mirror on a jointed bamboo pole which had a maximum length of 21 feet. Later the activities and behavior during the egg-laying, incubation and brooding periods were observed from tall wooden towers covered with olive-drab canvas blinds.

## ENVIRONMENT

Nests 1, 2, 3, and 4 were located in the campus area of the Biological Station and each was within 20 feet of an occupied cabin.

The Station is on the south shore of South Fishtail Bay of Douglas Lake in an open birch-maple association with most of the trees 30-40 feet in height, but with concentrated areas of trees 12-40 feet in height with a notable absence of low, thickly foliated brush which is the chosen habitat in southern Michigan. (Walkinshaw, 1938-1939.) The campus is protected from the full blasts of the predominant northwest winds, but receives those from the north. All nests were located on the lake-side of their respective trees, where least protection was offered.

When the Station opened the latter part of June the trees and shrubs were in full leaf and the birch catkins, sumac berries and pin cherries were small and green. The composites were in bloom.

The chief mammals in the area are the Thirteen-striped Ground Squirrel (Citellis tridecemlineatus) and the Chipmunk (Tamias striatus). These latter were seen high in some trees but not in any in which Goldfinch nests were located. Other birds nesting in the area were the Flicker (Colaptes auratus), Eastern Kingbird (Tyrannus tyrannus), Least Flycatcher (Empidonax minimus), Wood Pewee (Myiochanes virens), Purple Martin (Progne subis), Eastern Robin (Turdus migratorius), Cedar Waxwing (Bombus cedrorum), Red-eyed Vireo (Vireo olivaceus), Baltimore Oriole (Icterus galbula), and Chipping Sparrow (Spizella passerina).

A Least Flycatcher nest was ten feet away and on the same limb with Nest 1. However, the flycatcher young had left the nest but were lingering in the same tree when the Goldfinch began building. The female Goldfinch chased the adult flycatcher from the tree several times and the family soon moved to another tree.

Nests 1 and 2 were located in trees on the level of the lake at the edge of the main thoroughfare, State Street, which is lined with Sugar Maples (Acer saccharum), White Birch (Betula alba papyrifera), Quaking Aspen (Populus tremuloides), along with some Pincherry (Prunus pennsylvanica), Apple (Pyrus malus) and sumac (Rhus glabra borealis).

Nests 3 and 4 were on Upper Drive West, about one third of the way up a steep hill, 20-25 feet above lake-level and surrounded by the same species of trees and shrubs. All four nests were in maple trees (3 Acer saccharum, 1 Acer rubrum) less than fifteen feet from inhabited cabins. Covering much of the hillside are Bracken (Pteris aquilina) and Wintergreen (Gaultheria procumbens). On top of the hill and south is an open area containing many composites, such as Devil's Paintbrush (Hieracium aurantiacum), White Daisy (Chrysanthemum leucanthemum pinnatifidum), Yarrow (Achillea millefolia), and Ragwort (Senecio balsamitae).

## TERRITORY

Territorialism in the Goldfinch is open to question. Nice (1941) in speaking of mating and nesting territory says: "The Eastern Goldfinch — sometimes comes under this category according to Drum (1939) but other observers can find no evidence of territory." Walkinshaw (1938-1939) found none.

When Drum made her observations at the Station there were seven to eight nesting pairs. However of the four nests we found only two were occupied at any one time, and we could define but three pairs of Goldfinches in the area.

In 1942 at the Station Homer Roberts (unpublished) put a caged male Goldfinch at varying distances from a nest and found that neither of the pair paid any attention until he was placed six feet from the nest. Then they showed only curiosity. At two feet, however, the female flew at the cage, but the free male did not appear. We observed the female to fly at nearly any object placed within two feet of the nest. Roberts later placed a stuffed male ten feet from the nest; the female appeared nervous and the male tore the skin to pieces. We obtained negative results in a similar experiment; neither the male nor the female showed any excitement— perhaps due to the fact that it was merely a skin and had no behavior. However, on three occasions the male of the nesting pair was seen to chase out another male. Once at Nest 1 two males engaged in physical combat. The nesting male was in its feeding tree (White Birch) one hundred feet from the nest when another male flew directly over and in the direction of the nest. The former flew at the intruder, knocking him to the ground, where they tumbled and fought for several seconds, continuously moving

eastward toward Nest 2 which was 250 yards away. They continued fighting in flight until the intruder freed himself at a point about one hundred feet on the other side of the nest and toward Nest 2. The nesting male remained in the tree at that point and sang for several minutes.

Drum (1939) reports three combats similar to this. On another occasion in our observations the nesting male gave an intruding male a poke with his bill while chasing him, but at other times he merely chased the intruder.

On the other hand, near Nest 4, two males were seen perched ten feet apart on a wire one minute after one of these chases. Finally they flew away, more or less together.

We never saw more than one pair feeding together, as Drum (1939) did. This may be due to the fact that there were fewer pairs present this year.

During nesting the male flies in a high, wide circle above the nest, undulating, and calling "Per-chic-oree" or "Per-chee-chee." Occasionally the female accompanies him. According to Drum this flight pretty well outlines the territory which the male defends. She also reports that the male's territorial instincts wane as the breeding season progresses, and he seldom drives away intruders after the young hatch.

We observed no further combats between the Goldfinches, which may be due only to the fact that no others came near the nests, or that the blinds obscured our vision.

Our estimates of size of territory are very rough since we could not be certain with how many pairs we were dealing.

Nests 1 and 2 were 250 yards apart, and definitely represented different pairs, since both were in progress at the same time.

Nest 3 was started after #1 was deserted, and was located

100 yards from it. Nest 3 was deserted before the lining was placed in it, and the next day we observed the first placement of materials for Nest 4, 27 yards away. The day before, two male and two female Goldfinches were seen in a tree near the nests, and no disturbance was noticed; but it can be guessed that the birds of Nest 4 chased away those of Nest 3.

Several times after Nest 1 was abandoned, a pair of Goldfinches was observed drinking from the lake almost even with nesting Tree 1. Then they were seen to fly in the direction of Nest 4. The behavior of Females 1 and 4 was similar enough that they could have been the same bird. They were both quite fearless, which was most unlike the female of Nest 2.

If nests 1 and 4 were in the same territory, the approximate diameter was 225 yards with both nests about 50 yards from the boundary, and 125 yards apart. From drawings made by Margaret Drum (1938) on territories of eight pairs, the diameters average approximately 215 yards. Thus Territories 1 and 4 together are about equal in size to this average territory.



## NESTS AND NEST-BUILDING

The Goldfinch builds a directly adaptive, elevated, cupped, stant nest, usually in a horizontal or vertical crotch. Of nests observed at the Station in former years by Margaret Drum (1937,38), Homer Roberts (1942) and Marcus Erickson (1945), 16 were in maples, six in oak, two in birch, one in beech, one in Quaking Aspen, and one in an apple tree. Our four were in maples and at the following heights:

Nest 1	27 feet
Nest 2	20 feet
Nest 3	35 feet
Nest 4	21 feet
Average	26 feet (approximately)

Drum reports an average of 21 feet, and a range of 7 to 40 feet. Walkinshaw (1938) records a 4 foot average in Southern Michigan, with extremes of 2 and 14 feet, chiefly in Cornus bushes. He quotes A. A. Allen as saying that Goldfinches seem to prefer maples trees. Thomas Burleigh reports heights of 6-40 feet with no particular preference as to species of hardwood in Center County, Pennsylvania. But he found that in Georgia they prefer pines.

Nest 2 contained six Goldfinch eggs and one Cowbird egg when found, so observations of construction were confined to Nests 1,3, and 4. These were begun on July 22, August 2, and August 5, respectively, which, with a computed date of July 11 for Nest 2 gives July 25 as a mean date for beginning of nest-building for the season. Means for other years at the Station are: 1937-8, July 10; 1942, July 12. This may or may not be a result of an earlier season than the one this year. As it was there were no ripe thistles for these birds to use this season. Instead, they used the pappus of some other Compositae for the lining.

All four nests were located on the north side of the tree, near an opening such as a roadway or clearing for a cabin, and were readily visible from at least one direction and usually from below. But in each case some petioles of leaves on the chosen branch were built into the support of the nest. And all were well shaded by leaves with but limited exposure to the sun at any time of the day. All were rather open to the wind from the lake. Nest 1 was supported by a long branch only  $\frac{1}{4}$ -inch in diameter, which must have been too small, because a strong wind tossed the eggs out one night, causing desertion of the nest. The supporting limbs of Nests 2, 3, and 4 were approximately one inch, one-half inch, and one-half inch, respectively; these swayed but little in the wind.

Nest 1 was discovered perhaps five or six hours after its construction was begun on July 22. If work began this day, as on ensuing days, at about 5:15 A.M., the construction took four days with an approximate total of 50 hours, and an average of 12.7 hours per day with an equal daily total except on the final day, which was five hours less.

Nest 3 was likely 10-12 hours old when noticed and it was abandoned on the following day, before a large opening in its side was closed.

Nest 4 was discovered a few minutes after the building process was started, on August 4, and it was completed in three days. Since second nests ordinarily are built faster than first ones, this gives further evidence that Pairs 1 and 4 might be the same.

Margaret Drum found in 1937 that nest-building took an average of nine days, with a range of six to 17 days. That summer was rainy and the birds worked only when the nest was dry. She also

reports that the Goldfinches were seldom seen around the nest for three days before the first egg was laid. Walkinshaw reports an average absence of two days before egg-laying, with at least one day in every case. Each nest we observed contained one egg the morning following the afternoon in which the nest was completed.

The accompanying charts show attentive and inattentive periods during building. For both nests 1 and 4 attentiveness took a sharp drop after the second day. This drop was during the lining of the nest and may have been due to the fact that lining material was located farther away or was more difficult to find. At Nest 1 more trips were made per hour in the afternoon than in the morning, but this was reversed at Nest 4. The differences were small.

Nice (1937) reported that the Song Sparrow spent almost four times as much time at the nest on the third day as it did on the first and second days.

Weather conditions were quite favorable during the building of both nests. The wind was quite strong the first day at Nest 1, but became much stronger during the laying period. Early mornings were cool-- about 55°F, but by 8:00 A. M. the temperature had risen to 70-75°F. Afternoons were quite hot (85-90°F).

By the time the birds started building the birch catkins were ripe, and these were used for both food and nest material. A few of the composites were in seed but all thistles seen were still blooming.

The male takes no direct part in nest-construction. While the female collected material and wove it into the nest, and shaped the growing structure, the male either fed in a nearby tree, sang his canary-like song, or flew overhead, uttering his characteristic

NEST #1 BUILDING PERIOD

DAY	OBSERVATION TIME (minutes)	PERIODS (minutes)				
		ATTENTIVE			INATTENTIVE	
		Actual	Mean	%	Actual	Mean
1	46	0.25-3	1.2	33	0.75-7	2.6
2	372	0.5-6	2.0	31.2	0.5-19	4.3
3	339	0.25-4	1.9	13.6	1-37	12.2
4	284	0.5-12	2.6	16.8	1.5-33.3	11.7

per-che-che or per-chic-oree. Occasionally he came to the nesting tree and fed his busy mate, who stopped only long enough to receive the regurgitated white, milky substance. Sometimes the male hopped into the nest, moved around inside as though to shape it. This action usually immediately followed the feeding. After the nest was completed the female remained on it most of the time, and all observed feedings took place there. Drum observed no feedings at the nest until the fourth egg was laid. On several occasions copulation occurred a few feet from the nest.

The completed nest had these dimensions:

Inside diameter	2 inches	Outside diameter	$3\frac{1}{2}$ inches
inside depth	$1\frac{1}{2}$ inches	Outside depth	3 inches

An analysis of materials used in Nest 1 showed the greater part to consist of weed bark, birch catkins, and sumac twigs, while the outside was partially covered with spider webbing. Some small grass stems, green grass leaves, an occasional piece of string, and rootlets made up the rest of the bulk. The lining was sparse and contained wads of composite pappus and a few fine rootlets.

#### SUMMARY

1. The Goldfinch actively defends at least a nesting territory.
2. The four nests observed were in maples and at a height of 21-35 feet in either a vertical or horizontal crotch.
3. The nest is built entirely by the female, but she is fed by the male during the process.
4. Attentive periods for the first two days of nest-construction averaged 31.4%, but only 13.6% on the third day and 16.8% on the fourth day.

This drop in attentiveness may have been due to the distance travelled for or difficulty in finding lining material for the nest.

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(Reprinted from *Jack-Pine Warbler*, April, 1948)

# THE JACK-PINE WARBLER

A QUARTERLY MAGAZINE OF ORNITHOLOGY

Published by the Michigan Audubon Society

Vol. 26

APRIL, 1948

No. 2

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Nests 1 and 2 were 250 yards apart, and definitely represented different pairs, since both were in progress at the same time.

Nest 3 was started after Nest 1 was deserted, and was located 100 yards from it. Nest 3 was abandoned before the lining was placed in it, and the next day we observed the first placement of materials for Nest 4, 27 yards away. The day before, two male and two female Goldfinches were seen in a tree near the nests, and no disturbance was noticed; but it can be guessed that the birds of Nest 4 chased away those of Nest 3.

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GOLDFINCH NEST AND EGGS

Photographed at Battle Creek, Michigan by Edward M. Brigham, Jr.

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causing desertion of the nest. The supporting limbs of Nests 2, 3, and 4 were approximately one inch, one-half inch, and one-half inch, respectively; these swayed but little in the wind.

Nest 1 was discovered perhaps five or six hours after its construction was begun on July 22. If work began this day, as on ensuing days, at about 5:15 A.M., the construction took four days with an approximate total of 50 hours, and an average of 12.7 hours per day with an equal daily total except on the final day, which was five hours less.

Nest 3 was likely 10-12 hours old when noticed and it was abandoned on the following day, before a large opening in its side was closed.

Nest 4 was discovered a few minutes after the building process was started, on August 4, and it was completed in three days. Since second nests often are built faster than first ones, this gives further evidence that Pairs 1 and 4 might be the same.

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The accompanying chart shows attentive and inattentive periods during building. For both Nests 1 and 4 attentiveness took a sharp drop after the second day. This drop was during the lining of the nest and may have been due to the fact that lining material was located farther away or was more difficult to find. At Nest 1 more trips were made per hour in the afternoon than in the morning, but this was reversed at Nest 4. The differences were small.

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Weather conditions were quite favorable during the building of both nests. The wind was quite strong the first day at Nest 1, but became much stronger during the laying period. Early mornings were cool—about 55° F., but by 8:00 A.M. the temperature had risen to 70-75° F., and the afternoons were quite hot (85-90° F.).

By the time the birds started building, the birch catkins were ripe, and these were used for both food and nest material. A few of the composites were in seed but all thistles seen were still blooming.

The male takes no direct part in nest-construction. While the female collected material and wove it into the nest, and shaped the growing structure, the male either fed in a nearby tree, sang his canary-like song, or flew overhead, uttering his characteristic "Per-che-che" or "Per-chic-oree." Occasionally he came to the nesting tree and fed his busy mate, who stopped only long enough to receive the white milky substance. Sometimes the male hopped into the nest, and moved around inside as though to shape it. This action usually immediately followed the feeding. After the nest was completed the female remained on it most of the time, and all observed feedings took place there. Drum observed no feedings at the nest until the fourth egg was laid. On several occasions copulation occurred a few feet from the nest.

The completed nest had these dimensions:

Inside diameter	- - - -	2 inches
Outside diameter	- - - -	3½ inches
Inside depth	- - - -	1½ inches
Outside depth	- - - -	3 inches

An analysis of materials used in Nest 1 showed the greater part to consist of weed bark, birch catkins, and sumac twigs, while the outside was partially covered with spider webbing. Some small grass stems, green grass leaves, an occasional piece of string, and rootlets made up the rest of the bulk. The lining was sparse and contained wads of composite pappus and a few fine rootlets.

#### NEST No. 1, BUILDING PERIOD

Day	OBSERVATION TIME (minutes)	PERIODS (minutes)				
		Attentive		Inattentive		
	Actual	Mean	%	Actual	Mean	
1	46	0.25-3	1.2	33	0.75-7	2.6
2	372	0.5-6	2.0	31.2	0.5-19	4.3
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#### SUMMARY

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2. The four nests observed were in maples and at a height of 21-35 feet in either a vertical or horizontal crotch.
3. The nest is built entirely by the female, but she is fed by the male during the process.
4. Attentive periods for the first two days of nest-construction averaged 31.4%, but only 13.6% on the third day and 16.8% on the fourth day. This drop in attentiveness may have been due to the distance travelled for or difficulty in finding lining material for the nest.

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# University of Michigan Bio Station Student Papers

**ID #:** 212

**Author:** Batts Jr., H. Lewis

**Title:** Some aspects of bird ecology of the Indian River marsh.

**Year:** 1947

**Location:** Indian River Marsh

**Shipment #** 357

**Box #** 2

**Total Pages** 15

**Greyscale images**

**color images**

**Notes:**

*nesting*  
SOME ASPECTS OF BIRD ECOLOGY  
OF THE INDIAN RIVER MARSH

Zoology 119

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July 12, 1947

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It doesn't take many trips into the field for a person with average bird-identification ability to begin to notice that certain bird species are always or nearly always to be found in certain environments. The bird association is consistent enough with other animals and plants to bring about classifications of complex units as communities on this basis. The physical features of the environment naturally take an important place in this basis for establishing communities.

To observe the interrelationships within communities and for a better understanding of the characteristics which make up these units, the ornithology class (Zoology 119) of the University of Michigan Biological Station spent the hours 6:15-11:00 A.M. of June 28, 1947 in and around the Indian River Marsh which is located at the mouth of the Indian River where it enters the southwest end of Mullet Lake in Cheboygan County, Michigan.

Years ago this river, which connects Burt Lake with Mullet Lake, entered the latter in an open bay which was nearly a foot lower than Burt Lake. This is the general direction of drainage for a series of lakes from Little Traverse Bay of Lake Michigan on the west to Lake Huron at Cheboygan on the east.

Currents on the west side of Mullet Lake, as a result of prevailing northwest winds, formed a sand spit about one-half way across the arm of Mullet Lake into which the Indian River emptied. The construction of a dam at Cheboygan and the resulting rise in the water level of the lake prevented this spit from going all the way across. Silt from



another river, the Sturgeon, and also some from the Indian River helped fill in this lake pocket cut off by a sand spit. Thus the marsh itself was formed. More recently the Sturgeon River has been diverted from the marsh, so the filling process is not so great at present— at least from this type of source. However, due to the rapid filling by plant succession, the channels of the marsh must be dredged regularly.

Originally the Mullet Lake basin was formed in much the same way as the Great Lakes, by glaciation. With the movement of five glaciers over Michigan, many craters were dug out or formed by rims of till or outwash material being deposited. When these basins became water-sealed, in a succession of progressively finer particles filling the interstices of the rocks, the basins would hold water. Thus was Mullet Lake formed. Then the swampy mud flat which is now Indian River Marsh resulted as in the statement above.

During our study of the marsh on June 28 the weather conditions were generally good with the exception of a thunder shower which lasted about 20 minutes. The lightning drove us out of the marsh for that period. We estimated the temperature at 75-80°F, the wind at 4-5 miles per hour. The sky was overcast to cloudy during the storm and very clear with sunshine following it.

In this part of the country a typical succession from open water to climax forest is composed of seven major stages which are named for the types of plants growing in those stages. And it is convenient and sufficient to incorporate into these stages the fauna accompanying them. Therefore the same name given for the plant state is given to the whole community. Where two or more communities merge or over-

lap , the area is termed an ecotone.

In the normal order of development, the open water community comes first. This was found in the marsh where the water was deepest, and included a 10 foot depth at the lake exit of the marsh up to five feet and less at the channel edges throughout its meanderings through the entire marsh. Black Terns, a Herring Gull and Tree Swallows were seen flying over this area, and a Black Duck with 10 young swam along the channel. Some submerged plants such as Elodea were observed under the surface of the water. No nests were found in this community but it serves as an important feeding area for these birds. Elodea and Potamogeton, which are in the first, are also to be found in the floating plant community. This one contained Nymphaea on the surface. In the Indian River Marsh these yellow pond-lilies were found in this area in a depth of about four feet. Perhaps the faint current in the channel or the acts of man kept them from being found in the deeper water even though they would grow there. The whole marsh is kept open by dredging the channel, cleaning out debris, etc., for the benefit of fishermen, and perhaps also for duck hunters at another season. No nests were observed in this area as such. A green species of Rana was observed sitting on the pads, eyeing the various dragon- and damsel flies. Evidently these insects form a large part of the diet of some of the marsh birds. A female Red-wing was seen carrying a freshly emerged dragonfly to its young.

The bulrush (Scirpus) community is next in order, and the first in our observations to contain nests. This, however, is still considered a deep-water area. Where the bulrush and cattail (Typha) communities

met they merged into an ecotone. This contained a few nests, also. There was no definite ending of the ecotone and beginning of a cattail community, but the latter was in somewhat shallower water, with an average depth of 2½ inches. The whole graduation from open water to high land is, generally, toward the former shore of this area of Mullet Lake, but some high places not yet dry are formed, similar to islands. Therefore this succession of communities was found out in the marsh, cut off by open water from a similar succession toward the high, dry land of the main shore.

As the cattail with its water snakes (Natrix) merged into a sedge (Carex) community with its mice (Microtus), another ecotone was formed and can be called cattail-sedge. With the shallowing of the water the sedges had moved into the area where the depth approximated one foot up to what may be called wet soil. Evidently this soil is at least moist the whole season. These areas also had their characteristic nesting birds which will be discussed more fully shortly.

As the sedge community's edge approached higher land there was an overlapping into the shrub community, thus forming a third ecotone. There were several shrub islands among the sedges, but I doubt if these would be included in the ecotone. Rather should they be classed with the shrub community proper in considering their characteristic associations and interrelationships. The predominating genera here were Myrica, Cornus, Salix, and Alnus.

The shrub community was the extent of our study, but a few notes about the surrounding habitat may be of interest. The marsh tends to succeed into a bog which supports Thuja, Picea, Juniperus, and some mixed woods including Populus and Betula. At the edge a Phoebe, Black-

capped Chickadee, Robins, and Chipping Sparrows were observed. On higher ground, where the original spruce and Thuja had been cut out and were being replaced by mixed woods, several species of birds were seen or heard. From a gravel pit, our breakfast spot surrounded by the mixed woods, we observed the following: Cuckoo, Belted Kingfisher, Hairy Woodpecker, Crested Flycatcher, Least Flycatcher, Blue Jay, Crow, Black-capped Chickadee, Robin, Willow Thrush, Red-eyed Vireo, Black and White Warbler, Oven-bird, American Redstart, Cowbird, Scarlet Tanager, Rose-breasted Grosbeak, Indigo Bunting, and Purple Finch. Near the marsh and in the depths of the spruce bog we heard a Winter Wren singing. At the edge of this bog, approaching the marsh, we saw Cedar Waxwings and a Yellow Warbler.

As was stated above, we found no nests in the open water or floating-plant communities. Nevertheless, these areas are important to the bird life of the marsh by furnishing water scorpions, flies, etc., as food for the young terns, and minnows, crayfish, small molluscs, and many kinds of winged insects for the adults. These regions supply food also for the dabbling ducks, grebes, and Coots, besides, of course, supplying a limited amount of sub-surface nesting material such as is used by the Pied-billed Grebe. The Black Duck family we saw likely fed in shallower water where the bottom or near-bottom plant growth could be gleaned for insects and larvae, tadpoles, leeches, worms, small molluscs, and spiders which are plentiful on the sedges. Small fish of the deeper water would be a food supply for the grebes we saw-- a family of one adult and two young swimming among the bulrushes. The three Tree Swallows which a member of the class saw would use these areas for gathering insects on the wing, and also for bathing purposes.

The bulrush community contained nests of Black Terns and likely Coots. However, only the former were observed, but the latter adults were heard throughout the marsh. Of the terns, Nest 1 was a typical floating platform of debris, mostly bulrushes, in which a depression had been made, and its walls heightened with more bulrushes. This mat was surrounded by growing bulrushes and thus kept in place in the 25-inch depth of water. It contained three creamy-tan eggs with dark brown irregular spots. Nest 2 was of similar construction and situation 75 feet from Number 1, but its three eggs were somewhat darker than the former. Nest 3 was about 75 feet from Numbers 1 and 2, in such a position for the three nests to be the apices of an equilateral triangle. The three eggs of Number 3 were different from the others. One was a very light blue ground color with a few spots. The other two were brownish with a few spots on one and a dark band of fused spots transversely around the middle of the other.

The bulrush-cattail ecotone supported three other tern nests quite similar to those of the bulrush community, with the difference in the presence of a few cattails around the nest and cattails and sedge leaves used as reinforcements at the sides of the nest-depression. Two of these were found on floating, but anchored, logs, with mere suggestions of nests made of a few rushes. One contained two eggs, the other, three. The third nest in the ecotone contained two wet, unattractive young of a bluish color with black bills tipped in white of the egg tooth.

Also in this region were three empty nests of the Pied-billed Grebe, averaging 200 feet apart. These are floating nests, too, but evidently there is more actual construction done on these than on the tern nests. In this 24-inch water the nests had been fashioned of wet cattail leaves as bulk and lined with finer plant materials, apparently gathered from the marsh bottom. Here the bird has used materials

both above and below water, but near at hand, and has taken advantage of the surrounding cattails and bulrushes to hold the nest in one location. It would seem a floating nest is better adapted to a marsh situation, which includes changing water levels, than are those built on muskrat houses or elsewhere, just above the surface of the water.

Scattered among the reaches of this ecotone were several cup-nests of the Red-winged Blackbird, from 10-18 inches above the water and suspended between stalks of the cattail. Evidently the presence of bulrushes had nothing to do with the selection of the site so far as nest-support or materials were concerned, but some cattail leaves were used.

Nest 1 was empty but freshly lined. Number 2, which was 40 feet from the first, contained three eggs, bluish with dark brown to black lines and irregular spots. The nest itself measured five and one-half inches outside diameter and three inches inside depth. Number 3, which was 25 feet from the tern nest with young and 30 feet from Number 2, contained four young approximately five days old with obvious feather tracts and external openings of the ears. These young offered the opportunity of observing the fecal sac and its disposition.

In a marsh such as this the Red-wings may be observed capturing insects of various kinds which they find among the cattails and sedges, particularly along with seeds and insects of more upland regions.

In a dense portion of the bulrush-cattail ecotone one of the party found an American Bittern incubating four tan eggs in a nest supported by cattails and flattened bulrushes on a hummock which protruded above the water a few inches. One of the observers put his foot at the edge of the nest, but the adult bird remained to thrust its bill at the intru-

der. Evidently this close adherence to the nest was partly due to the fact that one of the eggs was pipped, indicating this was the time for hatching. The warning notes of the bird were rasping in nature such as those made by the shrill rattle of a rattlesnake or a coarse saw blade. This is a convenient nesting site, for the bird need not go far for its diet of frogs, small fish, mice, molluscs, and insects.

Moving into the cattail community we found repeats of some nests we had already found elsewhere, and especially in the preceding ecotone. A Pied-billed Grebe nest was found with a young bird in the water nearby, plus an unhatched egg also floating in the water. The soaked chick had evidently been too near an occupied tern nest, and had suffered two obvious wounds, one on the crown and the other in the shoulder region. The nest itself was a duplicate of the others mentioned above, and was surrounded by cattail without bulrushes being present.

Farther along toward shore, but still in the cattail community, a Least Bittern was flushed near a Red-wing nest. The nest of the former could not be located but is typical for this habitat. The Red-wing nest, being similar in construction to those previously found, contained four eggs, one of which hatched while I watched. On these the mottling was confined to the large end, but was of characteristic form. A jagged cut or break appeared near the egg markings in a continuous manner, resulting in a lid being formed and thrown off by the struggling nestling.

The cattails mingled with the sedges to form another ecotone. Here we found a Long-billed Marsh Wren and several nests about a foot from the water surface, and supported by green sedge plants. Several dummy or

"cock" nests were found before one was discovered with four eggs. All were the same globular form with an opening in one side, but only the one with the eggs was lined with cattail down. The adult male wren approached us several times, seemingly without fear, but scolding constantly. These birds forage among the cattail, sedge, and rushes for newly emerged insects, or caterpillars, spiders, and even small crustaceans that may be found clinging to the stalks.

When a pure sedge community was searched for nests, more wrens were evident, and both a Sora and a Virginia Rail were flushed. Nests of the wren were located, but none of the rails. These birds frequent this area of concealing vegetation in very shallow water because they secure their food by wading and searching the sedge stalks for small molluscs, earthworms, caterpillars, beetles, other insects, and seeds of various types at certain seasons.

Soon we found shrubs spotted throughout the sedge forming an ecotone containing Myrica gale as the most frequent species. In two of these shrubs Northern Yellow-throat nests were found 12 inches above water, constructed of sedge and lined with fine grass. Each contained four white eggs speckled with brown especially at the larger end. This bird is insectivorous, with particular selection of caterpillars, beetles, small Hemiptera, and gnats, all of which are abundant among the shrub willows, gale, and others at the marsh edge. Another bird we saw here was the Swamp Sparrow, but we were unsuccessful in our search for its nest.

With a look at a Kingbird nest on top of an old dock pile our field study of the marsh habitat was finished. We did not penetrate the dense growth of trees which surrounded the edge of the marsh. The Kingbird is



usually associated with a water habitat in this region, and appropriately the nest we saw was situated 15 feet from shore and about two feet above water. It was constructed of grasses, lined with cattail down, and contained three white eggs. The insect-catching adults were chattering nearby as they performed aerial acrobatics for food

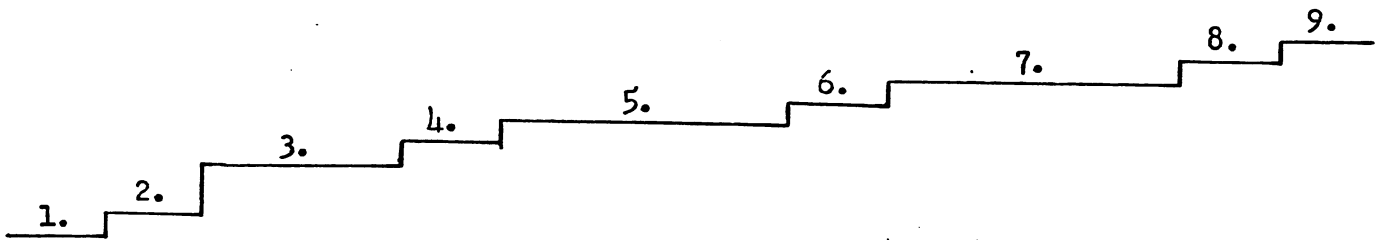
If generalizations can be allowed after such brief investigation, it may be said that the marsh birds use materials at hand for their nests and place them in or near their feeding areas. The Red-wing at certain times of the year is an exception to this last statement.

The birds are more abundant as to feeding and nesting in the ecotones than in the pure communities, due to the overlapping of characteristics suitable to members of the merging communities.

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# PROFILE OF THE INDIAN RIVER MARSH



## COMMUNITY

1. Open Water
2. Floating Plant
3. Bulrush
5. Cattail
7. Sedge
9. Shrub

## ECOTONE

4. Bulrush-Cattail
6. Cattail-Sedge
8. Sedge-Shrub

