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## A STUDY OF THE NESTING HABITS OF THE CEDAR WAXWING<sup>1</sup>

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THIS study of the Cedar Waxwing (*Bombycilla cedrorum*) was made in the vicinity of the University of Michigan Biological Station at Douglas Lake, Cheboygan County, Michigan, during the summer sessions of 1940 and 1941. Twenty-one nests were found on the Station grounds in an area 600 yards long and 200 yards wide. The activities at twelve nests were carefully recorded daily, and five of the twelve nests were observed closely from tower blinds placed four feet from the nests.

A summary of the data obtained from these observations is recorded in Table 1, a compilation of information on nest locations, materials, and nest cycle statistics.

This paper is based mainly on the data from Nests 2, 3, and 3a, supplemented by observations on the other nests and by a review of the literature on Waxwings. In addition to 74 hours of observation from blinds, considerable time was spent weighing young and watching activities from the ground.

I am deeply indebted to Olin Sewall Pettingill, Jr., and Theodora Nelson of the University of Michigan Biological Station for the valuable guidance they gave me during this study. And I gratefully acknowledge the helpful suggestions and advice of Mrs. Margaret M. Nice, F. N. Hamerstrom, Jr., and Josselyn Van Tyne in the preparation of the manuscript.

Cedar Waxwings do not ordinarily have a song, though Whittle (1928:82) reported a "distinctly musical and pleasing" song, with a varied warbling arrangement, given frequently by a pet female Cedar Waxwing which was in an indoor cage. The call of the Cedar Waxwing is normally a long drawn out high-pitched lisping and whining sound with little variation through the year. According to Maynard (1928:73) the vocal organs of the Cedar Waxwing are comparatively undeveloped.

The adult birds are relatively quiet during the nesting season. For a call of alarm they use a note louder and higher than their usual call; it is a "piercing danger note, and even that . . . sibilant in quality"

<sup>1</sup> Contribution from the University of Michigan Biological Station.



Figure 1. The male Cedar Waxwing (left) arrives at the nest and gives part of his load of food to the brooding female.



Figure 2. Both birds then feed the four-day old nestlings.

(Whittle 1928:82; Nice 1941:62). On rare occasions while attending the nest they utter a low rolling sound. The nestlings develop a sibilant lisp as a means of begging food, and after they have left the nest the feeding area becomes a bedlam of Waxwing lisps and whines.

The Cedar Waxwings that I studied did not establish either feeding or breeding territories. Throughout the nesting season I saw small flocks of Waxwings in the Biological Station area. Frequently I saw adult birds from several nests paying no attention to one another while feeding at the same time in the same pin cherry tree and visiting their respective nests at intervals with food for the young. I found families of Waxwings nesting within twenty feet of one another and showing complete toleration of one another's presence. Even when the nestlings were maturing, and moving about in the vicinity, neighboring Waxwings were unconcerned. Wandering individuals or groups of Waxwings which stopped in the nest tree did not seem to make a brooding female uneasy. And a Phoebe that perched within two feet of a nest for fully half a minute aroused no apparent concern in a female Waxwing sitting on the nest.

These findings merely support those of previous observers. A. A. Saunders (1911:323), for example, says that "the flocking habit often continues throughout the nesting period, the nests being placed, if not in actual colonies, at least in close proximity to each other, and the nesting birds often congregating in small flocks." Crouch (1936:6) reported that a pair of Waxwings did not chase away a Chickadee that ventured into their nest and picked around the eggs, though they did fly at a Catbird that approached within two feet of the nest, possibly recognizing the larger species as a natural enemy.

There is evidence, however, that Waxwings may maintain a small nesting territory. A pair under observation while building a nest drove off a Vireo, a Hermit Thrush, and another Cedar Waxwing; and later, with young in the nest, they were disturbed by the presence of a Goldfinch and "flew at it" (Post, 1916:177, 185).

During the courtship period paired Waxwings showed great affection for each other. I watched a pair who engaged in a rhythmic routine of bill-clicking and sidling back and forth on a limb on which they had already begun to build a nest. This is called a "courtship dance" by Silloway (1904:13), who writes: "Two Waxwings were sitting near each other on the lower branch of a fir, about twenty feet from the ground. They were evidently courting. He would sidle over to her, rub his breast against hers, rub his bill caressingly upon hers, and then sidle back to his former place. Then the other bird would go through a similar performance."

Although such courtship displays are usually discontinued with the laying of eggs and the increase in duties about the nest, an activity was observed at Nest 2 which might be considered as a continuance of court-

TABLE 1  
RECORDS OF TWELVE CEDAR WAXWING NESTS

Nest No.	Date found	Location	Material	Eggs	Incubation period	Nestlings	Nesting period	Eggs	Young leaving nest	Per cent success
1	6/25/40	Hard Maple A: 3.65 meters B: 1.52 meters	Small sticks, rootlets	5 Waxwing 1 Cowbird	.....	0	.....	5	0	0
2	6/28/40	Hard Maple A: 4.16 meters B: 1.93 meters	String, sticks, grass, rootlets, feathers, leaves	5 Waxwing	(3) 11 days (1) 12 days	4	18 days	5	3	60
3	6/28/40	Red Maple A: 4.64 meters B: 4.11 meters	Grass, rootlets, rag, rope, string, bark, spruce and pine needles, bur-lap raveling	2 Waxwing 1 Cowbird	11 days	1	17 days	2	1	50
4	6/29/40	Red Oak A: 4.97 meters B: 2.59 meters	White-pine needles, bark, sticks, grass	4 Waxwing	?	4	14 days	4	4	100
5	6/29/40	Red Oak A: 2.43 meters B: 2.89 meters		4 Waxwing	?	4	(2) 15 days (2) 17 days	4	4	100
6	7/5/40	Red Maple A: 3.04 meters B: 0 meters	Sticks, grass, pine needles, silky string, moss	4 Waxwing	.....	0	.....	4	0	0
7	6/29/40	Red Maple A: 3.27 meters B: 0 meters		4 Waxwing	.....	3	.....	4	0	0
8	7/17/40	Red Oak A: 2.94 meters B: 2.79 meters		3 Waxwing	.....	0	.....	3	0	0
9	7/19/40	White Birch A: 4.13 meters B: 2.43 meters		?	?	4	.....	?	4	?
10	7/18/40	Hard Maple A: 3.14 meters B: 2.38 meters	Rootlets, sticks, grass	4 Waxwing	12 days	4	15 days	4	4	100
3a	7/7/41	Hard Maple	Grass, paper, leaves, rootlets, sticks, string, plant fibers	5 Waxwing	(2) 11 days (2) 12 days (1) 13 days	5	(3) 14 days (2) 16 days	5	5	100
6a	7/13/41	White Pine A: 7.9 meters	Grass, stems, rootlets, pine needles, thread, paper, leaves, bark	4 Waxwing	12 days	4	.....	4	0	0

Explanation—"A" is the height from the ground; "B", the distance from the trunk of the tree. Numbers in parenthesis under "Incubation period" indicate the number of eggs; those under "Nesting period" the number of nestlings.

ship behavior. When the male finished feeding the female, who was sitting on the nest, the pair engaged in an affectionate routine of bill-clicking and food-passing. The female finally passed the last bit of food to the male; after some billing and mouth-tugging, he returned the morsel. This performance was repeated until the morsel was finally eaten by one of the birds. Lack (1940) has shown that courtship feeding is characteristic of many diverse kinds of birds.

The Cedar Waxwing is a notoriously late nester. The literature shows many records of Waxwings observed nesting late in September, and Herrick (1905:86) reports an instance of a Waxwing found sitting on unhatched eggs as late as mid-October. At the Station the earliest date of eggs of the two seasons was June 15 (inferred); the latest known nest was begun August 1. Though only three nests were found on the first day of their construction, I estimated from the records of 17 nests that the average date of beginning was July 3.

For its nesting area the Waxwing prefers open woodlands where the forest growth gives access to the berry bushes and trees whose fruit is necessary to the feeding of the young. Table 1 lists the locations of the nests and shows that the average height of the nests was 3.63 meters, with the highest nest located 7.9 meters, and the lowest nest 2.43 meters, above the ground.

The Cedar Waxwing's nest is bulky and of loose construction, cup-like in shape, and usually built at the fork of a branch. Its main structure is made up of grass, rootlets, small sticks, and string or paper; the lining, if one is present, usually consists of fine grass, pine needles, or moss. Waxwings use almost any kind of available material in nest building. One nest located near a wastebbox was composed mainly of paper packing material, and a nest constructed near a grapevine was made largely of the bark of grape.

In the construction of Nests 3 and 10, male and female toiled equally. The laboring birds left the nest together to search for material and returned to the nest together to share in the building process. Both birds gathered material for Nest 6a, but the female did the greater part of the building. Many observers, like Roberts (1932:160), have found that the main task of nest building was performed by the female, while the male assisted in the collection of material.

Waxwing mates took turns in nest construction work. Alternately each bird stood in the middle of the nest and worked the material into it by stretching the head over the side. The bird thrust the stick or string into place with swift dexterity, and then tucked the material in tightly with choppy actions of the bill. Rocking sidewise, and turning about within the framework, the Waxwing gave the nest the shape of its body.

An interesting episode in the history of Nest 3 occurred when the adult birds selected a diving board mat as a possible source of nesting

material. But a great deal of effort—tugging, violent twisting, and flapping jerks—was required before the strands of burlap were wrested from the mat. Shredding the mat was a tedious job, yet the persistent workers managed to extract fibers as long as 30 inches.

Six days were required for the building of Nest 3 and for Nest 6a. Five days were spent in the construction of Nest 10. These three records of the time required for nest construction are in marked contrast to Her-*rick's* record (1905:94): In two days a pair built a nest, and by six days had four eggs incubating. Ten days later three eggs hatched. This record probably concerns a pair that had lost their first nest very early in the cycle.

On the day following the completion of a nest, the first egg was laid, and an additional egg was usually laid on each succeeding morning until the clutch of four or five eggs was completed. Incubation usually began as soon as the clutch was complete. Table 1 shows that in Nests 2 and 3a, there was as much as two days difference in the time of hatching. Incubation apparently began before the clutch was completed.

Incubation and brooding were done entirely by the female, and the male fed his mate part of the time. The attention of the male during incubation was very irregular. Sometimes he brought food to the female every twenty minutes. At other times he stayed away from the nest over an hour. While feeding, the male could be distinguished from his mate by the heavier black markings on the chin, as mentioned by *Crouch* (1936:4). By marking one bird with paint *William A. Gross* (1929:181) found in the case of one nest that both parents were incubating. The impulse of the females to incubate became stronger as the incubation progressed. They left the nest at the slightest disturbance during the first four or five days, but during the last five days the female in Nest 3 remained until my hand almost touched her. *Her-*rick** (1935:60) noticed that there is "undoubtedly much individual variation with respect to the reputed timidity of the waxwing, particularly in the early stages of its reproductive cycle."

While resting on the nests the females busied themselves with preening, watching the blind, catching small insects which flew too close, and turning the eggs. They showed distress from the sun's heat by twitching their tails in rhythm with their heavy panting. When they were aware of my presence, they gaped with open mouths and raised crests toward the blind, as though expecting trouble. Their rising crests were always an index of their anxiety.

The average incubation period for 18 marked eggs was 11.7 days; the longest period was thirteen days, and the shortest eleven days. *A. A. Saunders* (1911:325) gives incubation periods of twelve days in two cases, but *William A. Gross* (1929:181), who also worked at Douglas Lake, found the incubation period to be fourteen days.

Upon hatching, the young Waxwings were naked and flesh-colored and little longer than the unhatched eggs. They were very weak and able to hold their heads up for only a few seconds at a time. The leg and foot movements were feeble. The young birds did not utter a sound. A few hours after the nestlings hatched, the skin was noticeably darker, and the subdermal feathers along the dorsal tract were evident as tiny blue pimples. A slight jarring of Nest 10 brought the young to attention for food. They were unsteady, and could only with great effort hold up their heads for a few moments as they begged for food.

The nestlings of two days were able to move on their toes but could not definitely grasp objects placed near their feet. They still held up their heads with difficulty even though their body weight was nearly double that of the first day. At this age, whenever the nest was shaded from the sun by my hand, the nestlings responded by reaching for food.

At four days the nestlings moved their wings only in feeble, indirect motions but were able to grasp with their feet. When placed on its back on a board a nestling was unable to right itself, although in the nest it used its ability for directive grasping at the side of the nest to turn itself over. The eye slits of the nestlings at four days were apparently ready to break open.

At the age of seven days the nestlings were able to right themselves from an inverted position on a flat board. The eyes on this day were almost fully opened. The nestlings were quite active and constantly reached about with their feet, as though trying to seize something. One nestling was able to hold aloft a small celluloid ruler which I placed in one foot; it was, however, still unable to support itself upon a perch.

At nine days the nestlings, placed in the blind, used their wings to advantage in crawling about the floor. Bird D showed a great display of strength by perching on my finger and made an important advance by uttering its first sound at this age. It was a lisp similar to the adult call.

After nine days the peace and quiet of the Waxwing nests was gone, with the restless young giving sibilant cries for food and receiving replies from their parents. Furthermore, there was great activity in the nests. The young Waxwings stretched their necks and widely-opened mouths upward as though engaging in a mock feeding exercise, and flapped their wings eagerly as if ready for a take-off. Sometimes the nestlings chewed against the sides of the nest during their preening and stretching. When twelve-day old young were weighed, they all showed great pugnacity by striking my fingers with their bills and lispng belligerently behind their bold, black masks. When I placed them on a limb they clung tightly and were able to pull themselves up to a sitting position when I hung them upside down.

When the young of Nest 2 were twelve days old I placed them on the nest branch several inches from the nest. The adult male, bringing

food at ten minute intervals, attempted to coax them back into the nest by lipping and making short flights from the branch to the nest. The young, heeding his coaxing, became confused in their attempts to descend the branch to the nest, so the parent had to feed them where they were.

Young Cedar Waxwings were very quiet except during feeding periods. Whitman (1919:295) has observed that "except when they may occasionally mistake a passing bird for one of their parents, the young remain discreetly silent while the old birds are away." When conscious of my observation the nestlings of twelve days and older "froze" in rigid positions.

This protective habit has frequently been observed in adults, and Cameron (1908:48) found that Cedar Waxwings "had an extraordinary characteristic, that of drawing themselves to their utmost height and standing perfectly rigid on a branch with closed eyes . . ." Concerning the "freezing" habit Roberts (1932:159-160) remarks that the striped young are thus rendered "more or less invisible" but that the solid-colored adults gain very little by it.

Preening, flapping wings, pecking at each other, and making short flights constituted the activity of the young on the last day before they left the nest.

Until the tenth and eleventh day of their nestling life, the young showed a progressive increase in weight. During the next six days there was a leveling off of the growth curve and then a slight decrease in weight. I raised in captivity one nestling from Nest 3. When it was a month old its body measurements closely approximated those of the adult male.

A mature male, trapped for banding while he was feeding young, weighed 27.9 gms., nearly five grams less than Bird D at the time it left Nest 2, even though the wing spread and body length of the mature bird were greater. According to J. Van Tyne, the weight of this adult bird is less than 38 of the 39 weighed Michigan Cedar Waxwings in the University of Michigan Museum of Zoology collection. Apparently this light weight is to be expected in adult birds feeding young. In male Song Sparrows feeding their young, Nice (1937:26) found a 9 per cent loss of their normal weight; in male Tree Sparrows feeding their young Heydweiller (1935:9) found a 20 per cent loss.

After leaving the nest the young climbed and fluttered about the nest tree, and finally took short flights to neighboring trees. It is my impression that the young remain in the vicinity of the nest for some weeks. I often observed the banded young of Nest 2 feeding in nearby pin cherry trees until they were at least one month old.

The average nestling period for 21 young was 15.5 days. The longest period was 18 days; some of the nestlings left the nest at the age of 14 days. In the case of fourteen-day old fledglings, those in Nest 4



were disturbed by my banding activity, but those in Nest 3a were not disturbed by either banding or weighing and left the nest with their sixteen-day old brothers. In three of the nests observed by A. A. Saunders (1911:327) the young had nestling periods of 14, 16, and 18 days.

The attendance and concern of the female reached a maximum on the last day of incubation and first day of nestling life. From then on her time spent on the nest decreased, while the male, who heretofore had been rather indifferent in his attention to the nest, showed a great burst of activity, and assumed the leading role as food-getter for the young.

Both adults were active in feeding the young. The female made more frequent trips for food, but the male carried greater quantities. When the nestlings were very young and required the attention of the female during the greater part of the day, the male obtained most of the food and brought it to the nest, where the female aided in the feeding activities. When the nestlings required less attention, the female spent more time obtaining food. The female of Nest 3a did a remarkable job in obtaining all of the food for five nestlings when the male failed to appear after the young were ten days old.

TABLE 2  
FEEDING FREQUENCY OF FIVE NESTLINGS IN NEST 3A

	Nestlings 1-2 Days	Nestlings 4-5 Days	Nestlings 7-8 Days	Nestlings 11-12 Days
Food supplied by male (trips) . . .	18	15	25	
Food supplied by female (trips) .	8	18	21	41
Total number of feedings . . . . .	26	33	46	41
Average feedings per hour . . . . .	2.1	2.7	3.8	3.4

Table 2 shows the number of feedings required by the five nestlings in Nest 3a at different ages; each figure represents the number of feedings for the thirteen hours between 4:15 A.M. and 5:15 P.M. Up to the time the nestlings were seven days old, each individual was fed at every feeding trip. Later, when the nestlings were older and taking whole berries, I estimated that the average number of young fed per feeding trip was at least 3.5 nestlings. The working day of the adult bird, that is, the period during which nestling-feeding took place, was a little more than fourteen hours. Each young bird was fed on the average from two to three times per hour, or from 28 to 42 times per day.

TABLE 3  
ATTENTIVENESS OF FEMALE AT NEST 3A

	Nestlings 1-2 Days	Nestlings 4-5 Days	Nestlings 7-8 Days	Nestlings 11-12 Days
Total hours of attendance.....	10.96 hrs. 87%	6.46 hrs. 59%	4.91 hrs. 38%	2.93 hrs. 25%
Total hours of absence.....	1.56 hrs. 13%	4.46 hrs. 41%	8.05 hrs. 62%	9.08 hrs. 75%

Table 3 shows the attentiveness of the female at the nest in relation to the age of the nestlings. By attentiveness I mean the time spent at the nest, including feeding, as well as the time spent in actual brooding. This information on attentiveness is based on 48 hours of observation at Nest 3a, in four periods of 11 to 13 hours each, during the 1941 season. The table reveals particularly a progressive decrease in female attentiveness as the nestlings grow older. The attentiveness of the female on a given day became less as the heat of the day increased. The male was present irregularly, and only during the short feeding sessions; when the nestlings were eight days old, he was present at the nest 9 per cent of the time during an observation period of 13 hours.

At Nest 3a there was a gradual increase from 2.17 feedings per hour, at the nestling age of two days, to 3.65 feedings per hour at twelve days. As the nestlings increase in age, the frequency of feeding increases, and there are peaks of feeding both in the morning and early afternoon.

The two-day old nestlings in Nest 3a were sheltered without interruption by the female Cedar Waxwing during a severe rainstorm, which lasted an hour and a half. Meanwhile, the male twice succeeded in bringing food and feeding the young while the nest was tossed about by the high wind and rain. During the middle of a very hot day (maximum temperature 93° F.) the feedings ceased, but the female remained at the nest for an hour and forty minutes to shade the five-day old young from the sun. During this time the male did not attempt to bring food.

Generally when males brought food to the nests, they regurgitated indistinguishable masses of fruit and insect material and passed a share of it to the females, who swallowed it. Both sexes then proceeded to regurgitate and to put the food down the gaping mouths of the nestlings. Herrick (1905:92) writes about feeding: "It is all a matter of nervous reaction. The food is not simply placed in the mouth, but pressed well down into the sensitive throat, which promptly responds unless the gullet is already full. The old bird watches the result intently, and if the food is not taken at once it is passed from one to another until a throat with the proper reaction time is found."

At first all food was crushed; but small whole pin cherries were fed to four-day old young, and whole June berries and blueberries were fed

when the nestlings were seven or eight days old. Six June berries comprised the maximum load of food carried by the male.

It is noteworthy that the feeding frequency of the Cedar Waxwing was greatest, not when the young birds were making rapid strides in weight increase, but after the eleventh day, when the activity of the birds was rapidly increasing and the development of the contour feathers was progressing. The food consisted mainly of June berries, pin cherries, blueberries, and various insects and spiders. Of 93 feedings in which the food could be distinguished as it passed to the nestlings, 81 consisted of berries, so that we can assume that about 87 per cent of the food was vegetable matter.



Figure 3. The sanitation of the nest is carried out by both adult birds.

While I was trapping the adult birds of Nest 9 for purposes of banding, I caught three adults that were trying to feed the young Waxwings which were serving as bait in the spring-trap.

Sanitation of the nest was carried out by both adults, since defecation usually occurred after each feeding session. One instance was noted of the persistence of this instinct after the young had left the nest. The male at Nest 2 continued to take the fecal sacs from the twelve-day old

young even though the young were perched on a limb two feet from the nest. Just as if the young birds were in the nest, the parent watched carefully as they posed in a defecating position and swallowed the excrement as it appeared.

Since I found that the Waxwings at the Station made so late a start and since I find no contrary evidence from banded birds, I conclude that, in northern Michigan at least, Waxwings raise but one brood a season. Maynard (1928:76) believes that it is a single-brooded bird, whereas Crouch (1936:7) suggests that as many as three broods are probably raised each season.

The Cowbird parasitized two of the twelve nests. Nest 1 was abandoned for reasons unknown after it was parasitized. Nest 3 was parasitized after two Waxwing eggs had been laid, but on the following day I could not find the Cowbird egg in the vicinity of the nest; I assumed that the Waxwings had removed it. I placed another Cowbird egg in this nest, and it was incubated, though it failed to hatch. Friedmann (1929:234) says that the Waxwing is an uncommon victim of Cowbird parasitism because the Waxwing nesting season starts after the Cowbird laying season has passed its height.

Almost all the birds in the area were compatible with the Cedar Waxwings. The brooding female of Nest 2 paid little attention to the Purple Martins and Kingbirds, which very frequently called overhead, though she did occasionally raise her crest in alarm at their activities. The Red-eyed Vireo, Goldfinch, Least Flycatcher, and Robin were close and peaceable neighbors of the Cedar Waxwings at all of the nests, and at no time was any interspecific strife observed. But Eugene Castle, a student at the Station, saw a Sharp-shinned Hawk make an unsuccessful strike at a group of Cedar Waxwings as they dashed into some low brush in the area.

Of the twelve nests in which activities were recorded daily, seven completed the nesting cycle. There were 44 Waxwing eggs laid in eleven of these nests (data on Nest 9 incomplete), and 29 of them hatched. Twenty-eight young reached the age of five days, and 25 the age of ten. Twenty-one fledglings left these nests, that is, 47.7 per cent of the eggs laid produced fledglings.

#### SUMMARY

Twenty-one nests were found in an area 600 yards long by 200 yards wide. The activities at twelve nests were recorded.

The nests were found in oak, maple, pine, and birch trees at an average distance of 3.63 meters from the ground and 2.06 meters from the trunk. The nest was a bulky cup-like structure of loose construction.

Six days each were required for building two nests; five days were required for building a third nest.

At two nests both birds shared the nest building activity equally. At a third nest the female was the chief builder.

The average incubation period for eighteen marked eggs was 11.7 days. The maximum period was thirteen days, the minimum eleven. The average clutch was 4.0 eggs.

The nestling stage averaged 15.5 days. The maximum period was eighteen days, and the minimum fourteen.

The female Waxwing did all the incubating and brooding.

As the nestling grew the feeding rate increased, the brooding time decreased, the duties of the male became more important, and the female spent less time at the nest.

The fledglings apparently remained in the vicinity of the nest until they were at least one month old.

Of the 44 eggs laid in eleven nests 47.7 per cent were successful in producing fledglings.

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Some years ago on a remote island off the Welsh coast, R. M. Lockley turned from farming and shepherding to bird watching and writing. No one since Hudson has, I think, combined the latter activities so satisfactorily and so well. As a professional writer who must keep one eye on the public taste, Lockley exhibits none of the glittering superficiality of Peattie. He has Selous' love of truth and Howard's caution. Writing as easily as Burroughs or Hudson, he is sensitive to character in both birds and men. Still young, and unknown to most Americans, he is a man to watch and an author to read.

The present volume brings together the author's observations on the Manx Shearwater, hitherto scattered in English periodicals. The result is essentially a life-history study, set in a popular framework. Personal in its approach, it lacks the scientific trimmings of full references, graphs and clear summarization. Near the end there is a slight loss in continuity. For the most part, this is an intensive study based on but a few pairs of banded birds. Carried on with increasing penetration over a ten-year period, the observations yielded new and fundamental facts which help to explain the lives of other Procellariiforms—surely one of the more abundant and least known families of birds in the world. The two sexes are found to mate for life; they may relieve each other of incubation duties at periods as long as nine days, and during such intervals they may forage over 500 miles away.

Among the birds studied were Adam and Ada, Bill and Bess, Carol and Caroline. Each had its own personality, but the anthropomorphic twist is never overdone. Youngsters like Hoofti and Toofti lighten the pages. Homing experiments stir one's imagination. The end product is delightful reading and good ornithology.

Attention should be called to the distribution price in America. It is, to say the very least, discouraging.—J. J. Hickey.