BIRD STUDY AND SEMI-CAPTIVE BIRDS: THE ROSE-BREASTED GROSBEAK

BY H. R. IVOR

SOME fifteen years' study of a number of species of song birds in a semi-captive state and comparison of their behavior with that of the same species in the wild, have shown me that observation of semi-captive birds is an important and dependable method of investigating specific patterns of innate behavior. This statement is illustrated by a detailed study, made in 1939, of two pairs of Rose-breasted Grosbeaks (*Hedymeles ludovicianus*) kept in semi-captivity near Erindale, Ontario. The results are here presented,[1] not as an exhaustive account of the species, but as a short general history of one breeding season of semi-captive Grosbeaks, to be used for comparison by those who have studied this and related species in the wild. "By semi-captivity I mean that any pair of birds which nest in the aviary are given day-time liberty during the period of egg laying and incubation and full-time liberty . . . during the time of rearing the young. . . ." (Ivor, 1941:415). For other results from semi-captive birds, see Ivor (1943 and 1944).

Early Song

The Rose-breasted Grosbeak begins singing about the middle of March, but like many native passerines, it does not come into full song until later. The early song is so faint that one has to listen carefully, even at a distance of three feet, to hear it. It is typically Rose-breasted Grosbeak, but, unlike the songs of a later date, it is continuous for as much as two or three minutes. Many of the low, sweet notes of the courtship song run through it. It is, in fact, much more like the courtship than the territorial singing. For about two weeks this faint song continues; then gradually, day by day, it becomes stronger until near the middle of April it can be heard quite distinctly at a distance of some 30 feet, though it is still uttered with the bill closed. It continues to develop, and about the first of May the bird is in full song.

Territorial Behavior

During the latter part of April (1939) there was some fighting in the winter aviary among the female Rose-breasted Grosbeaks, and the males became decidedly pugnacious toward one another. This fighting was due to competition, both for mates and (presumably) for territory, although gaining evidence for the latter is necessarily difficult in an aviary. The males drove the females with some ferocity during this period, but courtship chasing did not become unmistakably evident until later.

[1] The writer makes grateful acknowledgement to Margaret M. Nice who for a number of years has given me her support and encouragement in my studies of controlled birds, and who, with Josselyn Van Tyne, was of inestimable help in preparing the present paper. Thanks are also due to Hugh M. Halliday for the photographs which accompany the text.

I was unable, in the main, to distinguish between the territorial songs of a hand-reared male and a trapped wild male, except that at times the latter added two or three long-drawn high-pitched notes at the end of his song. The song of the hand-reared bird was, to my ears, typical of those I had heard in the wild state. (Territorial behavior during nesting is described below, under "Extent of Territory.")

Mating

Toward the end of April, I moved the birds I was keeping under observation (about 25 species, comprising some 75 individuals) to the summer aviary. This was a wire-mesh structure, 26 by 30 feet in area and 7 feet high. The main flight compartment, which was 10 feet wide, was in the center of the aviary with breeding compartments on either side. During the period of mating, this flight extended the full length of the aviary, north to south, but later its northern end was partitioned off for nesting compartments. (In the restricted space of an aviary where a large number of species desire territory and nesting sites, it is necessary, of course, to allocate these.) Hawthorn and arbor vitaes were growing in the main flight, seven-foot arbor vitaes in each of the nesting compartments.

As soon as it was possible to identify mated pairs, I placed pair No. 1 of the Rose-breasted Grosbeaks in a compartment, 6 by 16 feet, on the east side of the main flight; pair No. 2 in a compartment, 8 by 10 feet, on the west side. The birds of pair No. 1 were hand-reared, the male was four years old, the female three; this was their third mating together. The male of pair No. 2 was a trapped wild bird, not less than three years of age; his mate was a three-year-old, hand-reared. (The female of pair No. 2 was from the same brood as the male of pair No. 1; the others were not related.)

Courtship Song and Display

The courtship song and display of the Rose-breasted Grosbeak are of indescribable beauty, but they have apparently not hitherto been recorded. When pair No. 1 had been placed in the nesting compartment I saw the male fly to within two feet of the female, who was on the ground close beside me. He spread and drooped his rapidly quivering wings so low that the tips of the primaries grazed the earthen floor. His body was held in a crouching position with the breast almost touching the ground; his tail partly spread and slightly elevated; his head retracted so far that his nape lay against the feathers of his back. The mating song poured forth from his open beak as he moved toward the female, weaving his head and body in an erratic dance in which he resembled some magnificent butterfly rather than a bird. The downward and forward sweep of his wings revealed in striking contrast the blacks and whites of the separated flight feathers, the vivid rose of the underwing coverts, and the white of the rump. The song, quite different from the territorial song, was soft, low, and continuous, with a

great variety of notes; some of the sweetest notes were so faint that I had to listen intently to hear them even though the bird was only two feet away. The songs of the Hylocichla thrushes are of extreme beauty, but for pure rapture I cannot recall any song which equals the courtship song of the Rose-breasted (and the Black-headed) Grosbeaks.

As the song ended, he rushed at his mate, seized her primaries in his bill, and held on so long and so tightly that I was afraid he would break them. He repeated this action three times with no resistance on the part of the female until he let go; then she tried to bite him. Suddenly the female crouched, pointed her bill toward the sky, and spread her tail. Coition followed. Immediately afterward the female shook herself vigorously, and the pair touched beaks. At once the male began again to display, whereupon the female flew at him and closed her bill on his tail. He jerked away, flew to a branch, and began his territorial song.

I observed this courtship ceremony many times during the next seven days. There were times when the female after copulation would repeatedly mount the male, taking hold of his bill before she did so. Usually the behavior of the male was one of ecstacy, while that of the female was more subdued, but sometimes her excitement also was great. After the excitement had passed, however, it was usual for her to become quite ferocious toward him—even pulling whole tufts of feathers from his body. The courtship of pair No. 2 was similar.

Since I have never heard the mating song of this species in the wild, I am unable to compare it with that of male No. 1. However, the mating song of male No. 2, the wild bird, seemed to be like that of male No. 1. There was probably some variation, for it is unusual for any two birds to sing exactly alike, but because of the great variety of notes in the Grosbeak song it would take a trained ear to distinguish differences.[2]

Nest Construction

Since the majority of the Rose-breasted Grosbeak nests I had found in the wild were built in arbor vitaes, I placed clumps of branches of this tree in each nesting compartment. These and the 7-foot arbor vitaes growing in the compartments were examined by both male and female Grosbeaks, but more particularly by the females. In 1937 and 1938 I had had several times to change the locations of the various clumps in the compartment of pair No. 1 before the female would settle on a nest site, but this season (1939) she quickly chose the site

[2] During the lives of the progeny of pairs No. 1 and No. 2, a male Black-headed Grosbeak has been in the aviary. In 1940 and 1941 the young Rose-breasted males sang the typical song of the species. In 1942, all but one began to acquire some of the Black-headed notes, and by 1943 had lost their own song so completely that at times it was difficult to tell whether it was one of them or the Black-headed Grosbeak singing. The one male retained the song of his kind, with the addition of some Black-headed Grosbeak notes.

of her 1938 nest. Female No. 2, after examining both the growing arbor vitaes and the various clumps of branches, chose one of the former.

It had been my experience that the wild bird used dead hemlock twigs of varying degrees of fineness for building and lining the nest. I carefully collected similar twigs of this tree in sufficient quantity to allow for a large choice. Although I have observed these birds in the wild break the twigs from the tree instead of gathering them from the ground, I scattered over the ground in the nesting compartment most of the twigs I had gathered; the others I placed on the arbor vitae.

The female immediately began to examine these twigs with great care. Some were merely glanced at; others were tested in the beak. Many were discarded. When a suitable twig was selected, it was taken to the nest site and carefully placed in position. Twigs were chosen much more often from the ground than from the arbor vitae.

To show that these females had, in captivity, lost nothing of the nest-building ability of the species or the knowledge of the exact quality in a twig which is important, I may say that I had to gather fresh bunches of twigs several times. Unsuitability of the remaining twigs was evidenced by the bird continually picking them up and discarding them and even flying to the wire of the enclosure when I approached. As soon as I entered the compartment with a fresh lot, she would fly to my hand immediately and begin taking twigs from it before I scattered them.

Female No. 2 finished her nest on May 22 (I do not know the exact date she began). Female No. 1 began building on May 22, laid the first egg in the unfinished nest on May 23, and finished the nest on May 24. During previous years, male No. 1 had helped in nest building, but this year neither male did so. This year, male No. 1 entered the nest, at times when the female was away collecting twigs, and seemed to examine it.

I inspected the nests continually not only while they were being built, but also after they were finished, and could detect no difference between them and those of wild Rose-breasted Grosbeaks.

Incubating and Brooding

The eggs were incubated by both male and female. They were rarely left uncovered for more than the time required for one bird to leave the nest and the other to enter it. At times the sitting bird left the nest as the returning one entered the gate. At other times the sitting bird was reluctant to change places with the one returning. If the mate remained away for an unusual period, the sitting bird would sometimes show restlessness. It then might get off the nest to drink, but left the eggs uncovered only for the length of time necessary to go to the drinking dish and back. The eggs were turned often, and since the birds sometimes returned to incubating with the feathers somewhat

damp from bathing, the eggs were kept moist. The female invariably incubated the eggs during the night. During brooding of young, both parents carried on their activities for the first few days in much the same manner as when incubating.

Figure 1. Female Rose-breasted Grosbeak being fed on the nest. About June 2, 1942.

Both parent birds gave a signal song when returning to the nest to exchange places (cf. Allen, 1916:54). These songs were shorter and much fainter than the territorial song. The birds also sang on the nest while incubating or brooding. The nest song of the tame and the trapped males seemed to be alike, but one must be very close to hear the female's nest song. (The female also sang while hunting food in the trees—a song similar to her nest song but louder. In general, she did not sing nearly so often as the male.)

Eggs and Nestlings

In their first nests three eggs were laid by female No. 1, four by No. 2. The eggs varied slightly in size, very little in color. Burns (1915: 285) gives 14 days for the incubation period, but I found 12 and 13 days (see Table 1). All seven young were reared to maturity. A slight variation was noted in the length of down between the nestlings of the

TABLE 1

INCUBATION OF SEMI-CAPTIVE ROSE-BREASTED GROSBEAKS
ERINDALE, ONTARIO, 1936–1939; 1942

	Nesting		Egg laid	Egg hatched[a]	Period[b]
Pair No. 1	1936	1st egg	May 26	June 7	
		2nd	27	8	12 days
	1937	1st egg	June 12	June 25	
		2nd	13	26	13 days
	1938 *A*	1st egg	May 27	June 8	12 days
	1938 *B*	1st egg	June 22	*broken*	
		2nd	23	July 5	
		3rd	23	5	12 days
	1939	1st egg	May 24	June 7	
		2nd	25	7	
		3rd	26	8	13 days
Pair No. 2	1939	1st egg	May 23	June 6	
		2nd	24	6	
		3rd	25	6	
		4th	26	7	13 days
Son of pair No. 2	1942	1st egg	May 26	*broken*	
		2nd	27	*broken*	
		3rd	28	June 10	13 days

[a] Since the eggs were not marked, it is not positively known that eggs hatched in the order of their laying, as tabulated here.
[b] Calculated from the laying of the last egg to the hatching of the last.

two pairs, but otherwise they seemed alike. So far as I have been able to ascertain, the exact age at which the egg tooth disappears in the nestling of the wild bird is not known; with the young in the aviary it had entirely disappeared 13 days after they hatched.

When the young of both pairs were within a short time of being ready to leave the nest, both females began to build again, outside of the aviary, leaving the care of the young almost entirely to the males. When I found and examined these second nests (nests of pair No. 2 on July 3 and July 10; [3] nest of pair No. 1 on August 1), they seemed to me typical of the species. In each, three eggs were laid, and three nestlings reared to maturity. I moved the nestlings to the aviary before they could fly. Thirteen young (nine males and four females) were reared this season, and all were perfectly normal. Thus two pairs of semi-captive birds hatched 100 per cent of their eggs and reared 100 per cent of their young. Five years later (1944) I still have in the aviary four males and one female from these broods and two of their offspring (females).

[3] The July 3 nest of female No. 2 was abandoned. The bird was on the nest when I discovered it, but there were no eggs. The nest may have been robbed.

Food Habits

When the first egg was laid in the nest of each pair, I made a small gate, two by three inches, in the wire mesh enclosing each compartment, and placed a shingle platform in the opening. In a very short time all four Grosbeaks found these gates and started visiting the woods surrounding the aviary to seek natural food. Even then the eggs were

Figure 2. Rose-breasted Grosbeak male No. 1 feeding young twelve days old. June 18, 1939.

never left uncovered for more than a few moments, only one bird of a pair leaving the aviary at a time. During incubation, the usual food (a great variety of seeds and grains, fruits, vegetables, mealworms, and crushed shells) was placed before the birds, but they ate very much less of it than before they had had their freedom. They now took only their favorite foods, such as mealworms, raw peanuts, and sunflower seeds, for insect life was plentiful in the surrounding woods, and the Grosbeaks had lost none of their natural ability to recognize and secure them as food.

Just before nest-leaving, the parents fed the young a small amount of "nestling food," a quite wet paste made up of various ingredients, which I supplied. But except for this, they did not use artificial food in feeding the nestlings. To the newly-hatched young they gave very small amounts of soft-bodied insects that had been broken up and rolled around in the mouth until heavily coated with saliva.[4] They inserted the food into the throats of the young with extraordinary gentleness and extreme care. I was able to watch all of the activities of the three hand-reared adults as closely as I desired; but male No. 2, the trapped bird, was very wild and flew at me, screaming, if I approached the nest while he was there. I could handle the eggs and young of pair No. 1 (both hand-reared birds) without arousing any resentment on their part; but female No. 2 (also hand-reared) showed that she preferred that I not handle the young by gently taking hold of my finger with her bill. She showed real mistrust, however, only when I attempted to feed the nestlings. Either she would snatch the food off the food-stick as I was putting it into the mouth of a nestling, or, if I succeeded in inserting the food, she would take it out of the nestling's mouth and place it there herself much more carefully than I was able to do.

As the young grew, the parents fed them a greater number of insects, and larger insects, than before, but they showed just as great care in feeding them as when the young were newly hatched. When a large caterpillar was given, it was first well beaten, then one end was held in the beak of the parent until a secure grip was taken by the nestling and the act of swallowing was evident. The caterpillar might be withdrawn several times before the parent seemed satisfied that the nestling would have no difficulty in swallowing it. So far as it was possible to see (and with the exception mentioned above), the young were fed entirely on insects, a small amount of green stuff (apparently a tree-leaf), and at times, a little earth.

Nest Sanitation

When the young were newly hatched and during the first hours of their life the feces were not contained in a sac, but were ejected very weakly, in a small, almost thread-like string, after each feeding. The parents were exceedingly careful to see that all of the excrement was passed, even to the extent of pulling it from the vent. At this stage they always ate, and even competed for, the feces.

After the sac was formed, the parents were just as careful that it be removed immediately. After feeding they watched for the movement of the nestling which indicated that evacuation was about to take place and usually took the sac in the beak before it could drop into the nest.

[4] This great care in the preparation of food may in some measure explain the statement of Esten (1935:400) that the Rose-breasted Grosbeaks he observed "always regurgitated all foods given." I am quite convinced that these Grosbeaks do not regurgitate at any time.

At first they usually ate the sacs, but as the young grew older and the sac larger it was eaten less often. When not eaten, it was carried some distance before being dropped.

Independence of Young

When the young of pair No. 1 were 27 and 28 days old, the father began to feed them less often, and with growing reluctance. The mother, who now returned only at rare intervals to the compartment, struck at them with her beak if they coaxed for food. When they were 30 days old the father also became exceedingly ill-humored. He brought insects to the compartment, but when feeding the young, he literally jabbed the food into their mouths and immediately afterwards struck them on their bills. His irascibility was so great that they became decidedly afraid of him. Neither parent was seen to feed them after that age. I had first seen the fledglings taking seed for themselves when they were 28 days old.

The young were not allowed liberty during this year. But when they were learning to fly (at about 12 days of age), several of them were coaxed out of the aviary by the parents. All but one (a female) were found within a day or two and placed back in the compartment. I was unable to find the young female, but when she was 26 days old the father showed her the way into the aviary (or she may simply have followed him in). She had been at liberty for 14 days. When the young were put back in their compartment, I placed a guard over the entrance on the inside so that the young could not find their way out. This guard was complicated, but the parents had no difficulty in solving it.

Extent of Territory

During the time the birds had their liberty, it was quite easy to plot their territory roughly. The boundary line between the two territories was the main compartment of the aviary (extending north to south between the two nesting compartments) and a partly undetermined line running north from the aviary through the woods. The territory of pair No. 1 (whose compartment was on the east) was east of this line: the territory of pair No. 2 was west and southwest. Although the gates to the nesting compartments were alike, I observed almost no territorial trespass. What little there was occurred when male No. 2 (the trapped bird) neglected his brood for a time while his mate was busy with her second nest. On several occasions during the period of neglect, male No. 1, having arrived at his own entrance with food for his own nestlings, heard the brood of pair No. 2 literally screaming for food. He flew over the top of the aviary to the gate of pair No. 2, entered, and fed the young.

Since the second nestings were outside the aviary, it was more difficult to determine the territories exactly, but the boundary line between them seemed to be a continuation of the line between the earlier

territories. This was natural, since the males were for a time taking care of the first broods. The distance between the two second nests (somewhat more than 100 feet) was considerably greater than that between the two first nests. Female No. 1 built the second nest 115 feet north of her first; female No. 2 built 60 feet west of her first. I observed no fighting or chasing during either nesting.

Roosting

In sleep the head was placed on the back, either to the right or left, in varying positions. The positions varied from one in which the beak and most of the head were buried in the scapulars and lying alongside the wing, to one in which the beak and lower part of the forehead were buried under the wing about half an inch back of the elbow. The head might be placed in any position between these two extremes. Sometimes the whole beak, sometimes only the tip of the beak, was placed under the wing. The bird raised its wing slightly when placing its head in the extreme position (beak and lower forehead under the wing), and also when withdrawing the head from this position. (Although the whole head was never placed under the wing, the expression "with its head tucked under its wing" is, in my opinion, not entirely a misconception.)

Alertness

During the breeding season, a pair of Cooper's Hawks nested within about a hundred yards of the aviary. Screech Owls, which here prey extensively on smaller birds, also nested in the vicinity. That hawks killed many wild birds was evident from the feathers of their prey found on two or three stumps in the woods not far from the aviary. It is clear, therefore, that my birds, when allowed their freedom, needed all the natural alertness of the species.

When the young from the second nest of pair No. 2 were just beginning to fly, the father (the wild male) was killed by one of the Cooper's Hawks. Part of his body and his feathers were found a short time later on one of the above-mentioned stumps. He had been in perfect health, exceedingly alert, and quite untameable. Yet he was the only one of the 4 adults and 13 young that was killed. The male of pair No. 1 lived for nearly eight years, at last being killed by a Sharp-shinned Hawk. One of the females lived for seven years, the other for five.

Homing Instinct

As noted above, when gates were made in the aviary walls, all four Grosbeaks discovered them within a short time. Since three of these birds had not had natural food for 8 or 10 months, their first visit to the woods, where they gorged insects, was somewhat protracted. None had any difficulty whatever in finding the aviary again, nor any difficulty in finding its own compartment and entrance gate. With both

pairs, it was the male that went out of the aviary first. Upon his return, the male took his place on the nest, and the female went away to the woods. After the first departures from the aviary the length of outside visits became normal. For example, on June 12, when the young were four and five days old, the male visited the nest with food at 5:56, 6:09, 6:23, 6:27, and 6:35 A.M., the female at 5:44, 6:16, 6:19, 6:30, and 6:50 A.M. These may be considered normal for the nestling period. During incubation, returns to the nest had been less frequent.

Molt

It might be contended that the artificial food supplied to these aviary birds would affect the duration of the molt. In my opinion, however, such is not necessarily the case. Not only are the birds very adaptable, but the food supplied to them approximates that which they get in the wild. During the time they are kept entirely in the aviary, weed seeds supply a large part of their requirements, and the seeds are supplemented by various other foods such as fruit, flower buds (hawthorn, apple, etc.), and greenstuff. During the nesting season, which may cover a period of three months, they live almost exclusively on the natural food which they secure in the same habitat as the wild birds do theirs.

My records over many years show a consistent period of almost four months for the prenuptial molt. Some changes in plumage can be seen early in January, and the molt is finished toward the end of April. This molt is not complete: in the adult, the primaries, secondaries, and rectrices of the previous year are retained; but in the young, some of the flight feathers are renewed during the first prenuptial molt. Some of the young then acquire entirely new tails, others only one or more pairs of new rectrices; some acquire two or four new primaries and two new secondaries on each wing. The third prenuptial molt (spring of the bird's third year) perfects the body plumage.

The postnuptial molt begins toward the end of July and is complete by about mid-September. In the young, the second postnuptial molt (July of the bird's third year) produces the full adult plumage in the male.

Migratory Tendencies

In order to reach a definite conclusion about whether or not migratory instinct is dulled or obliterated by keeping birds captive, a very difficult series of experiments would have to be carried out. As each migration season approached, my captive Grosbeaks showed a decided restlessness, flying from perch to perch in the aviary all night. They continued this for a longer period than the migration of the wild birds would cover. I observed a certain amount of night restlessness in male No. 1 until the time of his death, at the age of nearly eight years, and

in the two females for at least five years. However, as the years passed, the restlessness became less pronounced and lasted for a shorter period. A similar decline should perhaps be expected to occur in wild as well as in captive birds, and to be evident, not only in the expression of the migratory instinct, but in all forms of natural behavior. As old age approaches, both physiological and psychological processes are slowed down.

Birds of the second generation also showed restlessness in the aviary during migration seasons, but there seemed to be some diminution. So far, I have been unable to determine whether or not this applies to the third generation of my Grosbeaks, but restlessness in them seems to be confined to wakefulness on moonlight nights.

Comment

The above observations agree with my experience with some sixty species of native song birds which I have studied under controlled conditions. And they support the conclusion that the patterns of innate behavior of a bird kept in semi-captivity may remain fundamentally unchanged. I should like to emphasize, however, that the conclusion does not necessarily apply to all species of birds, and that it is only birds kept in a proper environment that will yield valuable results in behavior study. Birds kept caged under completely unnatural conditions will, of course, behave unnaturally (see Scott, 1904).

The comparatively close quarters of even the largest aviary may magnify antipathies, which can result in much more severe fighting than would be usual among wild birds. This, however, is only an exaggerated form of natural behavior, not a fundamental change. Preliminary selection of territory and its defense also modified in an aviary. But it is clear from the above Rose-breasted Grosbeak history that, with these possible exceptions, the innate behavior of my semi-captive birds did not differ from that of wild birds to a greater extent than could be caused by individual variation. That a controlled bird will differ from a completely free bird is self-evident, but it differs simply by the addition of learning to innate behavior. Since this paper deals only with innate behavior patterns, no description has been given here of the innumerable instances of learning, nor of the insight into bird psychology gained through the study of controlled birds. Such study does not take the place of observation of wild birds, but is supplementary to it, and yields exact and detailed knowledge that is otherwise difficult or even impossible to obtain.

Summary

To illustrate the value of semi-captive birds in the study of bird behavior, an account is given of detailed observations, made in 1939, on two pairs of Rose-breasted Grosbeaks (*Hedymeles ludovicianus*) which were kept in semi-captivity near Erindale, Ontario.

Song is not fully developed until about the first of May, but a faint

early song, different from the later territorial and courtship songs, begins near the middle of March. Territorial behavior is evident during the latter part of April. Courtship song and display (here first described in detail) begin in late April or in early May.

One female laid four eggs, the other three eggs, in the first nests of the season (built in the aviary in the latter half of May); three eggs were laid in each of the second nests (built outside the aviary).

All 13 eggs hatched and all 13 young were raised to maturity.

The parents shared in incubating, in brooding, and in the care of the young. When the females started the second nests, the males took almost complete charge of the first brood.

The incubation period was 12 to 13 days; nestling period, 10 days; period of dependence of young after nest leaving about 20 days.

The parents used a signal song when exchanging places on the nest, and also sang on the nest while incubating and brooding.

When allowed freedom after the first eggs were laid, the birds regularly visited the woods to feed on insects, ceasing almost entirely to use the artificial food provided in the aviary.

The young were fed insects, greenstuff, and a little earth (a small quantity of artificial nestling food was given them just before nest leaving).

The excrement was eaten by both parents during the first days of the nestling period; later, it was sometimes eaten, sometimes carried away.

Both pairs observed territorial boundaries.

One male several times fed the nestlings of the other male, when these were neglected by their parents.

The Grosbeaks lost none of their natural alertness in semi-captivity.

They found the entrances to the aviary without difficulty after foraging in the woods.

The prenuptial molt (not complete) extends from January to April, postnuptial molt (complete) from July to mid-September. In the first prenuptial molt some flight feathers are renewed, but the adult retains the flight feathers from the previous year. The third prenuptial molt perfects the body plumage, the second postnuptial molt produces the full adult plumage in the male.

At the time of spring and fall migration, the captive birds showed night restlessness, which decreased as the birds grew older.

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