COURTSHIP AND NESTING OF THE GREAT HORNED OWLS

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During the years 1933-1936 the author was engaged in a study of the Great Horned Owls (*Bubo virginianus*) for his doctor's thesis at Cornell University. Besides extensive field work at Lawrence, Kansas, and especially at Ithaca, New York, the study involved a thorough perusal of ornithological literature of the subject. The following section of the thesis presents an account of the courtship and nesting activities through incubation, emphasizing those angles of the subject in which original research has added to the fund of knowledge previously published.

COURTSHIP

On bright moonlight nights the hooting of the horned owls begins to become noticeable about a month before the actual mating begins. By the time of actual selection of mates one can go into horned owl country and be certain of hearing their notes. Then on a clear night several birds can be distinguished, calling back and forth steadily for a few hours after dusk and again toward morning. At times the hooting lasts practically all night.

The length of the courtship period has been very difficult to determine, because of the fact that the males call occasionally at most seasons of the year. However, the period when the males are hooting vigorously lasts for a month or six weeks. On the other hand the answering calls of the females are heard for only a week or two, toward the end of the six-week period. This period began in late November and lasted until about the first of January at Lawrence, Kansas. At Ithaca, New York, as would be expected in a more northern latitude, the dates were about a month later.

The actual courtship display has been witnessed and described in careful detail by Chief Red Eagle (1929). Audubon (1856) and Maynard (1881) mention varied actions and notes.

Judging from its effect upon other owls of the species and the circumstances under which it is given, hooting of the male has a threefold function. As with the songs of birds in general, hooting seems to be an expression of physical vigor and vitality. At times the male appears to hoot for the mere pleasure of hearing his own voice, and the notes produced are an indescribable assemblage of hoots, chuckles, screeches, and squawks given so rapidly and disconnectedly that the effect is both startling and amusing. Such "language" is often heard when several birds gather together during the mating season and in-

dulge in vocal battles. On rare occasions similar outbursts are heard at other seasons of the year (Forbush, 1929).

A second function of hooting is its challenge to others of his sex. In regions where horned owls are common the males do a great deal of competitive hooting from favorite perches in their territories. Thus in the creek bottoms south of Lawrence, Kansas, where one horned owl territory was often hemmed in on two sides by the ranges of other individuals, one bird would hoot and in regular sequence as many as four or five others would answer. It was seldom that two birds were heard calling simultaneously.

The third and most important function of hooting is to attract a mate. During the mating season the challenging, deep, rich tones of the males are occasionally interspersed with the higher and huskier notes of the females. I have never definitely identified the hoot of a female horned owl at any time except the mating and nesting period and doubt if they do much calling at other seasons. Even at that season they do not seem as vociferous as the males. The latter may call back and forth at regular intervals for hours at a time, while the female owl's calling periods, at short and indefinite time intervals, seldom exceed more than fifteen to twenty minutes.

Mating

Mr. Fred Hastie, of Lawrence, Kansas, has witnessed the final stages of the courtship that culminated in the act of copulation. The nodding and bowing of the birds became quite violent for a period and then they quieted down and went through many repetitions of the billing and cooing performance. Finally the female crouched down on the limb and the male mounted her back in the fashion of a barnyard fowl. A detailed account of this performance has apparently not been recorded in the literature.

Nesting Sites

There is some evidence to suggest that Great Horned Owls may select nesting sites several months before the eggs are laid. At Lawrence, Kansas, horned owls were frequently observed during the fall and winter in territories where young birds were subsequently seen. Errington (1932) likewise noted that during the fall and winter birds roosted close to stick nests which were later occupied. However, the birds did not actually move into the nest until a short time before the eggs were laid.

From the records of Bendire (1892), Bent (1938), and numerous others, it is apparent that the choice of nesting sites of the Great Horned Owls throughout their wide range includes almost every type

of situation in which birds nest, a range of variation unequalled by any other North American bird. From extreme heights of almost a hundred feet to badger and coyote dens in the ground, the situations include old nests of other birds, hollow trees and stumps, holes and ledges on cliffs, and even the open ground.

Throughout the timbered regions of eastern North America the birds have been most frequently recorded to occupy old nests of crows, hawks, ospreys, bald eagles, herons, and squirrels. Most of these situations are from twenty to seventy feet from the ground and located near the edge of fairly dense timber. Hollows in trees or limbs are often reported, especially in the southern states, and in more hilly country ledges on cliffs are not uncommonly described. Bendire (1892) quotes Captain B. F. Goss to the effect that hollows in trees and limbs were the preferred sites in Wisconsin before the cutting of the larger timber. Recent records indicate that the large percentage of birds are now using old stick nests in this region (Errington, 1932).

In western North America where small caves or niches in cliffs and mountain slopes are available, tree sites are often passed up for these more inaccessible situations. Old magpie nests are particularly favored in the Northwest.

In treeless regions such as the Prairie Provinces of Canada and the Great Plains of western United States low cliffs, buttes, railroad cuts, and even low bushes appear just as satisfactory as more elevated sites. Ground nests are occasionally reported here and appear to be more common than in other parts of this bird's range.

Bendire (1892) records that one observer noted these large birds sitting in the mouths of badger and coyote dens near the Umatilla Reservation in northeastern Oregon. This observer believed that the owls were nesting in these burrows. Other unusual sites include hay barns (Kirkwood, 1925), prehistoric ruins (Sugden, 1928) and the tower of a cathedral (Bendire, 1892).

In the deserts of the Southwest cactus plants take the place of trees and horned owls often occupy old nests among the thorny branches.

The Nest

Observations in the Ithaca region suggest that when there are several satisfactory nests in a territory the birds will choose a larger nest preferably in a fairly open situation. It is obvious that a nest completely enclosed by interlacing branches would not allow such bulky birds to approach or depart quickly in time of emergency and all nests which I have examined have been at least moderately exposed.

There is a wide range in the size and structure of horned owl nests, as may be readily surmised when one considers the diverse situations in which they dwell and the variety of original owners. Ground nests, nests in caves, on rock ledges, and in hollow trees often do not meet the ordinary concept of that term. In such situations the eggs are laid on the bare ground, wood, or stone.

In general stick nests seem to be preferred to leaf nests. This is probably due to the fact that they are larger and offer firmer foundations. However at times horned owls display little care in their selection of tree nests, adopting structures so dilapidated and flimsy that they fall apart and dump the young out onto the ground (Errington, 1932). The nest may be so small that the bird is quite conspicuous or even ridiculous when covering eggs or young. Again it may be a huge affair and the owl completely hidden from view from below.

Few data are available on preference regarding other types of nests but it appears that the same requirements hold—a spot fairly open yet concealed, which is large enough for the needs of the young until they are able to move about freely. Nests located on ledges or in niches or caves are generally sheltered from the wind, rain, and sun, although the situation permits the young to bask in the sunshine at the entrance.

A table of ten nests located in the Ithaca area probably gives a representative sampling of the types of tree nests in the northeastern part of the United States. (See Table 1).

From an examination of their nests it is evident that horned owls clear out a certain amount of debris before the eggs are laid, and also line it with a more or less complete layer of breast feathers. Beyond

TABLE 1. Nests of Great Horned Owls in the Ithaca, N. Y. Region, 1934-1936.

No.	Locality	Situation		Type of Nest
1	Ellis Hollow	Sugar maple	27 ft.	Stick—Old hawk nest (?)
2	McAllister farm	White pine	22 ft.	Stick—Old hawk nest (?)
3	Danby Pond	White pine	34 ft.	Stick—Old hawk nest (?)
4	Danby Pond	Chestnut oak	47 ft.	Stick—Crow (?) nest
5	Conn. Hill	Chestnut	29 ft.	Stick—Red-tailed Hawk nest*
6	W. Dryden	White pine	18 ft.	Stick—Crow nest
7	Lake Ridge	White oak	40 ft.	Stick—Hawk nest
8	Sapsucker woods	Beech	24 ft.	Stick—Hawk nest
9	Sapsucker woods	Beech	40 ft.	Leaf—Grey squirrel nest
10	Trumbull's corners	Beech	21 ft.	Stick—Hawk nest

*This nest was a huge affair, apparently having been used by Red-tailed Hawks for several seasons so that the accumulated mass of material produced a structure at least five feet in diameter. The owl could not be seen at all from the ground.

that there is apparently no activity in most cases. However there are a few records of horned owls repairing or practically rebuilding an old nest. Cameron (1907) discusses a pair of Montana Horned Owls that repaired an old nest in his yard in Custer County, Montana, every year and states that by spring it was "often a storm-swept fragment". Mr. G. Lang of Indian Head, Saskatchewan, (*corres.*) has found several nests that the horned owls constructed entirely. One pair built a nest in a spruce tree on his grounds, in a location closer to his home than crows will choose and Mr. Lang is positive that there was no foundation present when the owls chose the site.

The nest lining usually consists of shreds of bark, leaves, or down plucked from the breast of the incubating bird. Rockwell (1909) suggests that feathers from their prey may be added at times. G. Lang (*corres.*) states that near Indian Head, Saskatchewan, the birds occasionally build rabbit fur into their nests before the eggs are laid. The extent of the lining of downy feathers varies considerably with individual birds from a few feathers to a fluffy mass which practically encloses the large eggs. Of the Ithaca nests, the contents of No. 1 were not examined, but the other nine contained at least a few breast feathers. At Nest No. 8 the lining practically hid the eggs; at all others the eggs were quite conspicuous from above.

On the bare floor of a hollow tree or cavity in a cliff the eggs are often enclosed merely by a rim of sticks, stones, or bits of rubbish. Huey (1935) describes a nest of *Bubo v. pallescens* in Mexico "composed entirely of regurgitated pellets". The location was between two lava blocks on a rocky hillside.

Renesting After Disturbance

The selection and occupation of a second nest is a fairly common occurrence, frequently recorded by egg collectors. After their first set is taken the birds will often choose a nearby nest and lay another set of eggs. Frequently, however, the birds will continue to occupy the original nest in spite of disturbance, and Bendire (1892) mentions that Dr. Ralph found a third set of eggs in the same nest in Florida after the first two had been taken.

In some instances the second nesting is not carried to completion. The writer found a pair of birds near Ithaca, New York, in 1935 that probably had such a history. The female was discovered sitting on an empty nest on February 25. Examination of the site every few days found the bird on the nest at irregular intervals as late as March 12. On that night there was a heavy snow and the nest was practically filled by the next afternoon. The birds remained in the region for

at least two weeks thereafter but eventually they moved and were not seen there during the remainder of the season.

T. E. Randall, of Boyle, Alberta (*corres.*) describes a similar observation on the Arctic Horned Owl in Alberta. Ten days after he had collected a set of two eggs he found the bird occupying the nest again. When he climbed the tree to investigate the bird attacked him. The nest was empty, however, and no eggs were laid in it that year, nor were any young raised in the vicinity. A pair of birds observed over a three-year period by A. L. Rand (*corres.*) near White Rock, Nova Scotia, twice failed in a second attempt at nesting.

Eggs

Of the North American species horned owls are one of the first to nest in the spring. Their eggs have in fact been taken as early as late November and early December in Florida (Forbush, 1929).* In Texas they lay in January and early February. As one moves northward a direct correlation between latitude and date of laying can be observed, until the extreme is reached in Labrador where sets are often not completed until after the first of April.

In the western part of the country the correlation with latitude is often obscured by the effect of altitude upon climatic conditions.

Table 2, compiled from a mass of records of oologists and other observers, is an attempt to demonstrate this correlation between geography and the dates at which horned owls have completed their first sets of eggs.

The usual number of eggs for the horned owl is two. Along the Atlantic seaboard this number is most frequently recorded, with three eggs uncommonly found and sets of four very rare. In Florida one egg often constitutes a full set. Bendire (1892) quotes Dr. Ralph to the effect that sixty per cent of the sets in the Ralph collection contained only one egg. In central and western North America the sets appear to be definitely larger, with three and four eggs not uncommon, and five and six occasionally reported. Bent (1938) suggests that this may be due to the more abundant food supply.

Dixon (1914) notes that Pacific Horned Owls tend to lay larger sets of eggs during wet than dry seasons and suggests that it may be because the birds find food more plentiful at such times. Randall (*corres.*) found that two and three eggs to a clutch was the usual number but that in 1932 all the nests that he examined contained four

*O. E. Baynard (*corres.*) reports a complete set of eggs from middle-western Florida taken on October 27.

TABLE 2. Average Dates of Completed First Sets of Eggs of the Horned Owl throughout the United States and Canada.

Date	Geographical Areas
Late November to early January	Southern Florida.
Late December to early February	Northern Florida, southern Texas.
Early January to late February	South Carolina, Georgia, Alabama, Mississippi, Louisiana, central Texas, southern California.
Late January to early March	North Carolina, Virginia, Maryland, Delaware, New Jersey, Long Island, Connecticut, Rhode Island, Massachusetts, Pennsylvania, West Virginia, Ohio, Kentucky, Tennessee, Indiana, Illinois, Missouri, Arkansas, Oklahoma, northern Texas, Kansas, central California.
Early February to late March	Maine, New Hampshire, Vermont, New York, southern Ontario, Michigan, Wisconsin, southern Minnesota, Iowa, Nebraska, South Dakota, northern California, Oregon, western Washington.
Late February to early April	Newfoundland, Nova Scotia, New Brunswick, southern Quebec, central Ontario, northern Minnesota, North Dakota, Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, western Washington.
Early March to late April	Central Quebec, northern Ontario, southern Manitoba, southern Saskatchewan, southern Alberta, southern British Columbia.
Late March to early May	Labrador, northern Quebec, northern Manitoba, northern Saskatchewan, northern Alberta, northern British Columbia, Alaska, Yukon, District of Mackenzie, District of Kewatin.

eggs or young. He also suggests the possibility of direct correlation between the number of eggs and the abundance of food.

The interval between laying of the eggs varies from one to seven days, according to reports of egg collectors and observations of differences in the stages of development of the nestlings. Randall (*corres.*), who has collected extensively in Alberta, has found an interval of two days to be the usual period. My own observations at Ithaca indicated a similar interval. Occasionally there is a conspicuous difference in the ages of young owls in a nest. Whether such records indicate longer periods between laying of the eggs or a physiological disturbance I am unable to say.

There is apparently a low percentage of infertility in Great Horned Owl eggs. There are records of sets that were partially or completely infertile but in most cases all of the eggs hatch.

Incubation

Incubation normally begins with the laying of the first egg. As a consequence there is usually a pronounced difference in development of the young for the first week or ten days.

The length of the incubation period for the Great Horned Owl, to the best of my knowledge, has not been accurately determined. Writers have suggested various periods ranging from twenty-one to thirty-five days. The most satisfactory evidence available indicates that it is at least twenty-six and probably nearer thirty days (Bent, 1938). Dr. A. O. Gross (*corres.*) reports eggs hatching twenty-six days after being found. Dr. W. J. Breckenridge (*corres.*) made some observations near Fridley, Minnesota, which indicate a period of at least twenty-nine days.

Normally the horned owl incubates very closely, rarely leaving the nest uncovered for periods of more than a few minutes. Due to the extremely low temperatures during which this species nests in the northern parts of its range it is imperative that the eggs be protected almost constantly to prevent their chilling.

When undisturbed horned owls are inclined to be quiet and almost motionless on the nest. I have watched individuals for hours at a time which have rarely shifted the position of the body. They do take a very active interest in their surroundings, however, and even the slightest sounds attract their attention at once. The ability of owls to revolve their heads through 180° is frequently used to advantage. The most characteristic position seems to be the one in which the head is held high, eyes forward, the wings held close to the body and the tail laid out straight behind. In this position the "horns" are quite conspicuous and often give the bird's presence away immediately.

One of the most interesting and difficult problems in the study of the Great Horned Owl is the question of duties of the sexes during incubation. Bent (1938) says that both birds incubate the eggs, and suspects that the female does the larger share. Most authors suggest that the female does all the incubating while the male stands guard and brings food for his mate on the nest. In support of this hypothesis I have found numerous records of female horned owls shot on the nest but not a single instance of a male taken thus.

On the other hand pellets are seldom found beneath the nest trees, indicating that the females must leave the nests occasionally and in severe weather the other bird may take her place. Dixon (1914) observed that on certain days a Pacific Horned Owl flushed off the nest much wilder than on others. He attributed this difference in behavior

to the two birds that were taking turns in the incubation. S. F. Rathbun (*corres.*) states that male birds collected during the nesting season almost invariably have a part of their abdomens denuded of feathers, a characteristic of incubating birds. Randall (*corres.*) observed a nest occupied on one day by a "very white bird", on the next by a "medium grey bird". When the "white bird" was shot from the nest it proved to be the female.

With this question in mind I spent several consecutive nights in a blind beneath Nest 4 near Ithaca, New York. It was a period of full moon and with 10x field glasses I could see the bird on the nest clearly. On March 5, 1935, I entered the blind about 7:30 P. M., and shortly afterward heard the male bird hoot about a hundred yards from the nest. He soon flew over and alighted beside the nest. Then the regular hooting was interspersed with soft clucking notes: "*Quawk, quawk, waugh! hoo-hoo! quawk, quawk, quawk, quawk.*" These notes were accompanied by vigorous nodding by both birds and the bird on the limb bowed a few times. They also seemed to rub their beaks together. After several repetitions the bird on the nest stood up, bowed, then stepped out of the nest and he as carefully walked into it. The female flew off into the woods; the bird on the nest arranged the eggs beneath him with his bill and then settled down and all was quiet.

The female came in at 11:45 P. M., when I heard hoots and twittering notes like those a young owl makes when being fed. The female had come to the nest carrying part of some mammal, and apparently her mate was begging for food. She shared the kill with him and flew away again.

At 5:45 A. M. the bird came in and relieved her mate. There was no display of affection other than the low notes at this shifting of duties. The male flew off to an open perch a few hundred yards away and hooted a few times. His louder and clearer notes were unmistakable.

At a later stage in the incubation period the schedule of the two birds seems to have been different. Then the female was on the nest all night with the exception of a short period toward morning. In all probability there is individual variation among different pairs in their duties as well as changes in schedule at different stages of incubation.

Response to Interference

When first disturbed by man the birds usually seem quite reluctant to leave their nests and at times have to be practically lifted off them. In rare cases, judging from the observations of others as well as my

own, the birds flush from the nest as soon as they catch sight of an approaching man. More commonly they wait until the person is very close to or beneath the nest tree. Some require the additional stimulus of pounding on the tree to flush them off.

Such faithful birds usually return very soon after the climber has descended, though some individuals do not return for half an hour or more. I have had experience with three nests that were entirely deserted due to my interference. In two cases I do not believe that the birds resumed incubation after they were first disturbed. This intolerance of observation may have been due to greater shyness of these individuals or to the fact that incubation had just begun and the instinct was not well developed. The latter hypothesis is not supported by the history at Nest 4. In this case the bird came back to eggs that subsequently proved to have been fresh. It appears then that the response of the incubating owl to the approach of man varies markedly with the individual and to a lesser extent with the stage of incubation.

After the first visit the responses are usually quite different. On the second visit the owl often flies off when one is several hundred yards away and rarely allows as close an approach as on the first day. In the case of nests which have been visited daily, the birds eventually become accustomed to this interference to a greater or lesser degree and in time will tolerate a much closer approach before flying. However I have never found a bird that, after the first visit, would permit one to climb to the nest level before it left.

This increasing tolerance may be more clearly demonstrated by comparing the intervals of time between departure and return to the nest. Birds which stay away half an hour or more at the first visit may after several visits be back on the eggs in less than five minutes. The question arises, however, as to whether or not this tolerance is due to the development of the incubation instinct rather than to the acceptance of man's proximity. With the hatching of the first egg the response of flight at man's approach seems to be practically subdued by the instincts to protect the young.

Frequently, due to interference by man, crows, or other disturbing elements the eggs chill and the embryos are killed. Nest No. 4 suffered such a fate. On February 20 when I first ascended the tree the old bird was kept off for a period of half an hour, and the eggs apparently chilled. The owl sat faithfully on them for a period of at least forty-five days. The eggs upon examination proved to have been spoiled at a very early stage of incubation. On the other hand I kept birds off another nest for periods of about on hour on several days

without interfering with the hatching of the eggs. In these instances the temperature was well above freezing, though the stage of incubation may have been a factor in the ability of the eggs to withstand exposure.

Another source of interference is the harassing of crows. In this connection an interesting observation was made at Nest No. 4, located in a region where crows were numerous. The owls were seldom flushed without five to twenty of these black imps appearing to mob them as they flew off into the timber.

On several mornings I noted that the male bird usually flew in close and hooted a few times shortly after sunrise. This invariably aroused the crows and when they besieged him he flew off to a hemlock tree a few hundred feet deeper in the woods. This performance had no significance for me until one morning, after the owl had flown over into the conifers to roost, the crows began to harass his mate on the nest. Finally she uttered a few low hoots and immediately her mate appeared, alighting on a branch close to the nest. The crows at once shifted their attention to this more conspicuous enemy. After a short period of ducking and dodging this owl flew into the top of an adjacent tree in an even more conspicuous spot. Gradually he led them off through the woods by short flights and the incubating bird settled down on the nest again free of her tormentors.

This same performance was witnessed on three successive days and on several later occasions. In all probability the male's response was merely an expression of anxiety. In any event it was an effective manuever. I have never observed a similar action on the part of any other pair, nor have I found records in the literature of such a response.

Summary

1. Hooting of the males becomes conspicuous about a month before mating begins. Active courtship and mating apparently last less than two weeks.

2. Hooting of the males has a three-fold function—to express physical vigor and vitality; to warn other males of their territorial rights; and to attract a mate.

3. The hooting of the female is chiefly limited to the mating and nesting season.

4. A description of copulation in this species is recorded apparently for the first time.

5. A synopsis of the variation in general and immediate nesting sites is given. This species shows a wider range than any other North American bird.

6. The birds show considerable individual variation in the type of nest and amount of building and repair.

7. Renesting is often attempted, sometimes without a change in the nest site.

8. A table gives the average date of laying throughout Canada and the United States. showing a direct correlation between latitude and date of laying.

9. The average number of eggs varies throughout North America —one to two being the usual clutch in Florida; two throughout eastern North America; and three or four in the central and western parts of the continent. Limited evidence suggests that the number varies from year to year as well as by localities according to the abundance of food.

10. No indisputable data on the exact length of the incubation period has been found. The most satisfactory evidence indicates that it is at least twenty-six and probably nearer thirty days.

11. Great Horned Owls are close incubators unless disturbed by man. With frequent visits the birds usually develop an increasing toleration of man.

12. Both birds share in the duties of incubation. In all probability there is individual variation among pairs as well as changes in schedule at different stages of incubation.

13. At one nest the owls appeared to have found a successful method of distracting the attention of crows.

LITERATURE CITED

Audubon, J. J. 1856. The birds of America, 1:143-146.
Bendire, C. 1892. Life histories of North American birds. Vol. 1. Smithsonian Contributions to Knowledge, 28:376-389.
Bent, A. C. 1938. Life histories of North American birds of prey. Pt. II. U. S. National Museum Bulletin, 170:295-357.
Cameron, E. S. 1907. Birds of Custer and Dawson Counties, Montana. Auk, 24:268-269.
Dixon, J. B. 1914. History of a pair of Pacific horned owls. Condor, 16:47-54.
Errington, P. L. 1932. Studies on the behavior of the great horned owl. Wilson Bulletin, 44:212-220.
Forbush, E. H. 1929. Birds of Massachusetts and other New England states. Mass. Dept. of Agriculture, 2:224.
Huey, L. M. 1935. February bird life of Punta Penascosa, Mexico. Auk, 52:254.
Kirkwood, F. C. 1925. Unusual nesting site of great horned owl. Auk, 42:444-445.
Maynard, C. J. 1881. The birds of eastern North America. Newtonville, Mass, 260-262.
Red Eagle, Chief. 1929. A glimpse of owl life. Bird Lore, 31:261-262.
Rockwell, R. B. 1909. The use of magpies' nests by other birds. Condor, 11:90-91.
Sugden, G. W. 1928. A nest site of the western horned owl in Utah. Condor, 30:324-325.

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