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Biological Survey, U. S. Dept. Agr., Washington, D. C.

GROWTH DEVELOPMENT AND REACTIONS OF YOUNG GREAT HORNED OWLS.

BY BESSIE P. REED.

Plates II–IV.

THE material upon which this study is based consisted of four young Great Horned Owls, two of which were known to have come from the same nest in two successive seasons. In the nesting season of 1919 a pair of Great Horned Owls (*Bubo virginianus virginianus*) was found nesting in a dead cottonwood tree about two miles from Lawrence, Kansas. This tree stands almost at the outer (western) edge of a piece of pasture timberland comprising about six acres. The plot contains almost no undergrowth; the trees are mostly cottonwoods and elms with a few hickories and hackberries. A small stream flows through the eastern part, its old channel forming a dry, shallow ravine at the western edge.

The plot is about one quarter of a mile from a farmhouse and a half mile from the roadway.[1]

The particular tree chosen as the nesting site has a diameter of about two and a half feet with no branches lower than twenty feet from the ground. In 1921 the Owls used an open nest.

After 1921 they resorted to a cavity in the same cottonwood for nesting and from that time till 1924 have not used the open nest. This cavity is on the upper surface of a horizontal limb stretching to the south and about twenty feet from the ground. Sometime in the past a large branch evidently broke off from this limb and decay hollowed out an irregular opening about one foot across at its greatest extent.

From the time that the nesting site was discovered fresh pellets could be found under the nesting tree and in the immediate vicinity and on visiting the plot one or more of the adult birds was invariably flushed. On the last visit in 1923 (September 22) neither of the adults was flushed and no pellets were present nor could any other evidence be found that they were still there. However, in the nesting season of 1923 the adults were known to have nested there although no close inspection of the nest was made.

Two young were reared in 1924 at the old site and were flying about the wooded plot the last of May.

On April 2, 1921, the open nest was blown out of the tree during a spring blizzard. Evidently there was but one Owl in the brood of that season. This bird, which will hereafter be referred to as Number 1, was about five weeks old at the time and was covered by a fine, soft, down, cream buff in color. It was taken captive, the parents following at a respectful distance until the edge of the timber was reached. Close study was made of this specimen and data recorded even during the period, from five to eleven weeks, that it was in the possession of another party. From this time on during its captivity no attempt was made to tame it; as nearly as possible natural conditions were maintained. When it was four months and three weeks old (July) it escaped.

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[1] Thanks are due to Robert and James Coghill for Owls Nos. 1 and 2. To Mr. C. D. Bunker for Owl No. 3, and for kindly criticism and suggestions. To the staff of the Field Museum for access to literature. To Dr. H. H. Lane of the University of Kansas for valuable assistance in the preparation of the manuscript.

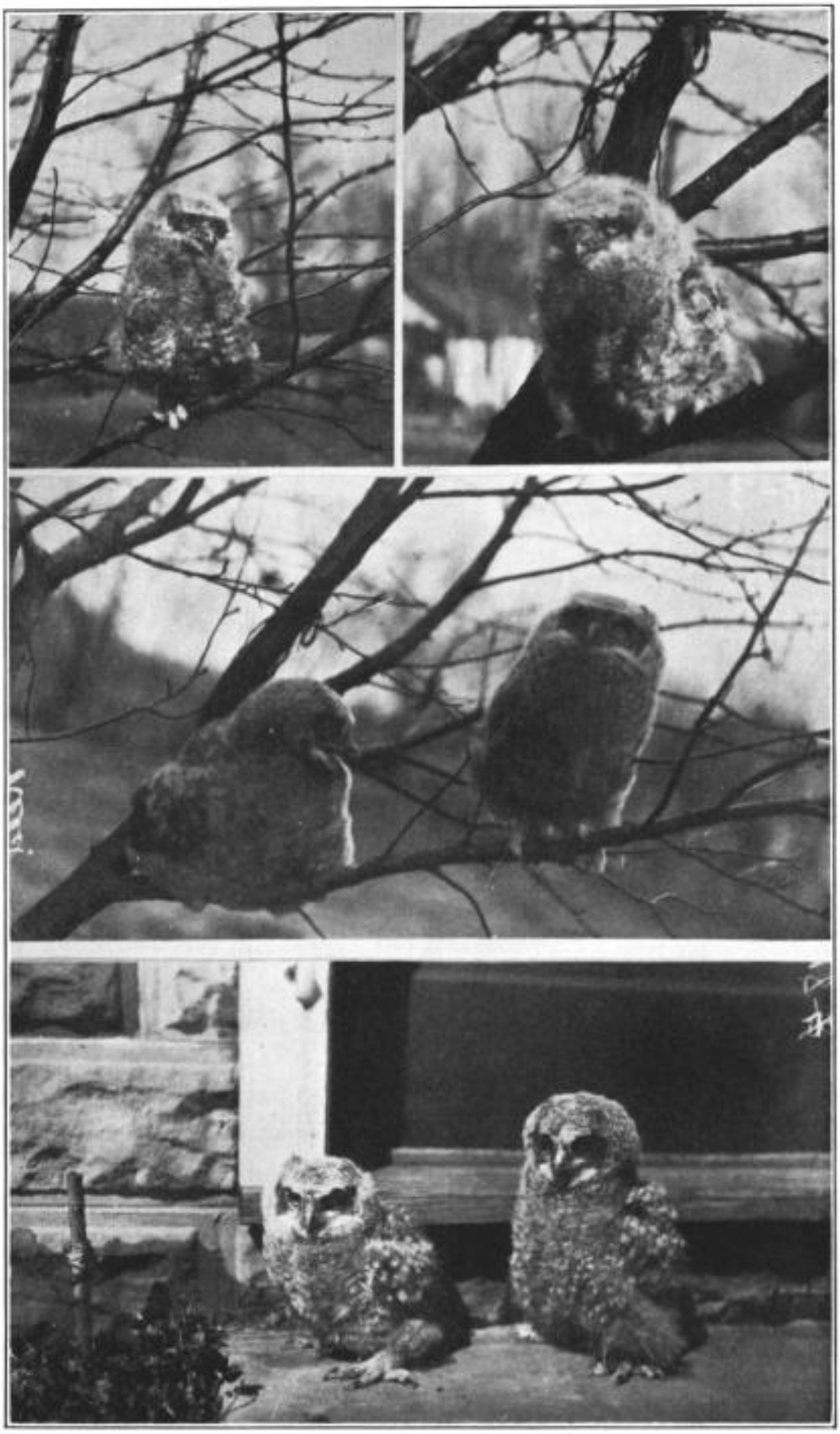
The study was not nearly completed, so the next year (1922) one of that season's brood was removed from the nest on March 19. This bird, which will be alluded to as Number 2, was estimated to be about three weeks old at that time. It was one of a family of three. When taken it weighed one and a half pounds and had a wing spread of twenty-one inches. Its covering was not so heavy as that of Number 1, since it was two weeks younger.

On March 31 of the same year when Number 2 was supposed to be five weeks old some one shipped a young Great Horned Owl from Missouri to the Dyche Museum of the University of Kansas to be mounted. It was judged too young for that purpose so it was given over for observation. It will be referred to as Number 3. It appeared to be about one week older than Number 2.

The individual hereafter designated as Number 4 was found along the roadside about one-half mile south of the nesting site about April 1, 1923. It is not known whether it came from the same nest or not, although a pair of adult birds had nested in this same tree in 1923. It seems improbable that this nestling could have traveled that distance since it was too young to fly but no other pair was known to have nested anywhere else in that region. Its age was estimated to be about five weeks.

These young Owls spent their captivity in a large shed, one side and one end of which was inclosed with woven wire. After more than a year of daily observation Numbers 2 and 3 were taken to a heavily timbered district about seven miles southwest of Lawrence and freed (April 7, 1923). Number 2 found its way back across open country to the western edge of the city. It was found roosting in a densely populated region and shot (June 4). Number 4 was taken to timberland about seven miles west of Lawrence and freed on June 14, 1923, when it was about sixteen weeks old.

The estimates on the ages of these Owls appear quite accurate when compared with the fledglings figured by Dixon (Condor, 1904, pp. 47–55). These latter had their ages definitely determined and in appearance resemble Number 2. The same comparative size along with conditions of plumage would seem to verify the estimated ages of Numbers 2 and 3.



YOUNG GREAT HORNED OWLS.

Fig. 1. Bird No. 2 about 3 weeks old. Fig. 2. Same, 4 weeks old.
Fig. 3. Bird No. 2 (right) 5 weeks; No. 3 (left) 6 weeks.
Fig. 4. Bird No. 2 (left) 6 weeks; No. 3 (right) 7 weeks.

RECORDS.

When Numbers 2 and 3 were taken an effort was made to follow their development by recording accurate weights and measurements at regular intervals, and the condensed results are shown in the accompanying tables. Weights for Number 2 were recorded weekly beginning with the estimated age of three weeks. Measurement of extent of wing spread was also begun at this time; body length was recorded for the first time at the age of four weeks. These records for Number 3 were begun at the estimated age of six weeks. All weight records were taken twelve hours after feeding with one exception,—in the case of Number 3 at the age of nine weeks when it was accidentally fed immediately before weighing. The detailed figures are given on the following page.

Changes in appearance are shown by the accompanying photographs (Pls. II–III). As is to be expected, the growth increased more rapidly in the earlier weeks, reaching a stationary stage about the thirteenth or fourteenth week. A slight loss in weight is displayed by both birds, beginning at about twelve weeks. This might have been due to improper feeding but more probably was correlated with the very noticeable change in plumage which occurred at this time. Feathers are rapid in growth and this very rapidity is exhaustive to the vital energies[1]. It is particularly noticeable that Number 2 never did attain the weight of Number 3, although the latter had the same adult wing spread and body length. Number 3 was, consequently, somewhat less active and did not learn to fly as early as Number 2. Number 2 was able to fly as much as 200 feet at the age of sixteen weeks but was not able to rise any distance in the air, while Number 3 did not fly more than fifteen or twenty feet at this age.

While it might be objected that these observations would not apply to nestlings under natural conditions it is never-the-less felt that the observations are of sufficient value to justify recording.

PLUMAGE.

At the age of three weeks the gray down described as the first covering, was replaced by soft, fluffy feathers, the horns or ear

[1] Coues, Key to N. A. Birds, 3rd Ed. 1887.

Age	Length in Inches		Increase in Length		Extent in Inches		Increase in Extent		Weight in Ounces		Increase in Weight	
	No. 2	No. 3	No. 2	No. 3	No. 2	No. 3	No. 2	No 3	No. 2	No. 3	No. 2	No. 3
3 wks.					21				24			
4 "	10.5	—			26		5		29		5	
5 "	13	—	2.5		33		7		33		4	
6 "	14	15	1		40	36	7		36	36	3	
7 "	16	16	2	1	45	42	5	6	36	42	0	6
8 "	17	17	1	1	47	42	2	0	39	42	3	0
9 "	17	18	0	1	50	46	3	4	40	56	1	14
10 "	19	18	2	0	51	49	1	3	40	52	0	-4
11 "	19	18	0	0	54	50	3	1	44	52	4	0
12 "	19	19	0	1	55	51	1	1	44	56	0	4
13 "	20	19	1	0	55	52	0	1	43	56	-1	0
14 "	20.5	20	0.5	1	55.5	55.5	0.5	3.5	42	53	-1	-3
15 "	20.5	20	0	0	55.5	56	0	0.5	44	52	2	-1
16 "	20.5	20	0	0	55.5	56	0	0	46	52	2	0
17 "	——	20	—	0	——	56	—	0	—	56	—	4
20 "	21	—	0.5	—	56	——	0.5	—	43	—	-3	—
21 "	——	21	—	1	——	56	—	0	—	56	—	0
57 "	21	—	0	—	56	——	0	—	43	—	0	—
58 "	——	21	—	0	——	56	—	0	—	56	—	0

tufts showing as little compact patches, slightly higher than the rest of the plumage. On the whole the color was cream buff with faint, indefinite streakings; the wings bore the most decided markings; the primaries and secondaries were becoming unsheathed. At the age of six weeks the wings and tail showed the most noticeable change in plumage. At the ages of eight and nine weeks respectively both birds showed the markings of the immature adult plumage although the fluffy nestling feathers were still prominent. As the feathering took place on the body, long, well marked feathers appeared in strong contrast against the nestling feathers. The climax in the change in plumage seemed to come at about eleven weeks. From that time on the adult plumage was unsheathed rapidly; the well-defined facial disk, the white throat patch and the mottled ochraceous buff color all appearing in rapid succession until at the age of twenty-one weeks the adult plumage seemed to be complete except for the horns (see Plate IV, fig. 1); these are present although not shown in the illustration, since the Owls flattened them against their heads. These horns or ear tufts attained their full growth at about twenty-six weeks. During this time the weight remained almost stationary; the food being no doubt utilized in supporting the drain made by the rapid feathering.

FOOD HABITS.

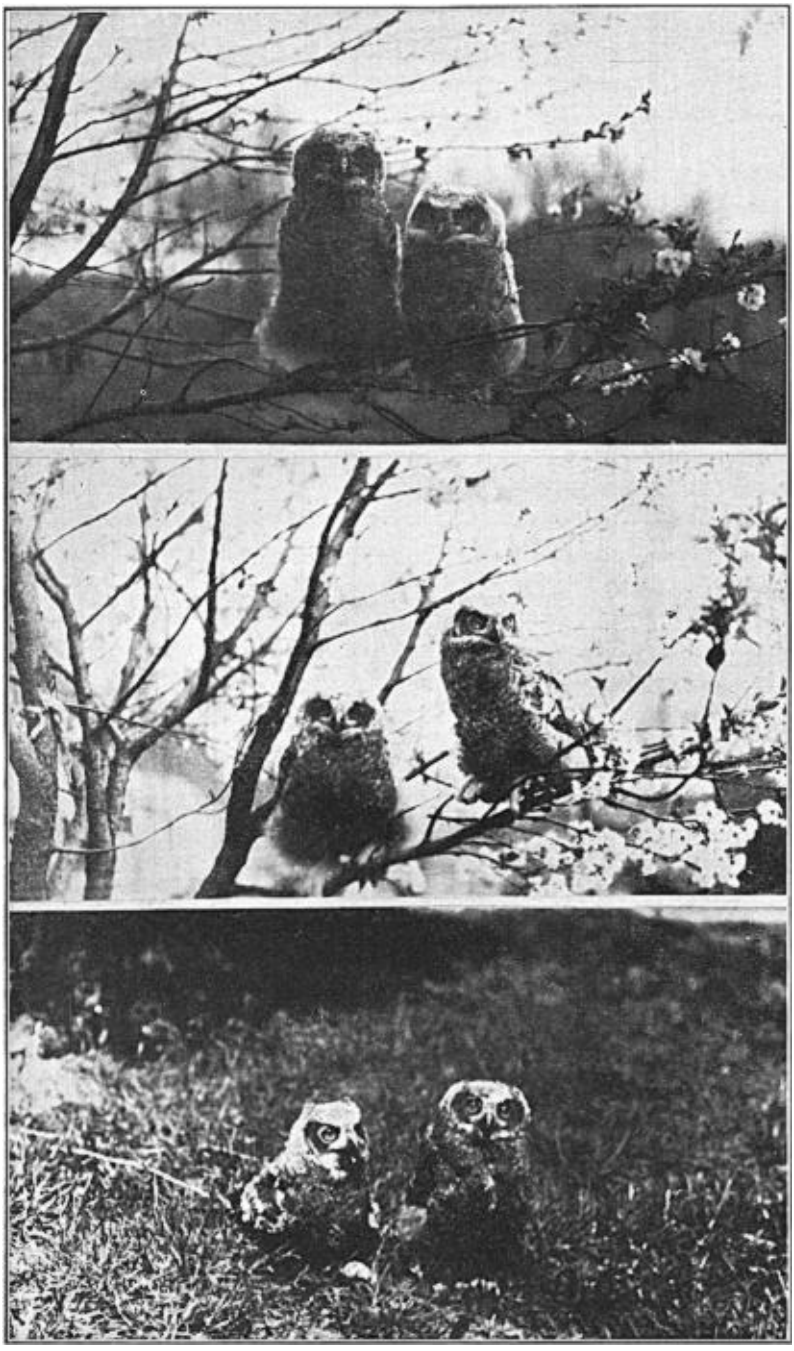
The Great Horned Owl is crepuscular in habits rather than nocturnal; but on bright, moonlight nights it might be called nocturnal. It is known to hunt on cloudy days and often, when it has young, it hunts indiscriminately day or night. As to the food of the bird studied by the writer, the particular nest under discussion was observed to be filled with bones and carcasses of various mammals especially rodents. No poultry was found in or about the nest though there were seven farmhouses within a radius of three-fourths of a mile.

From the very first, in captivity, all of these young Owls ate English Sparrows, not infrequently taking as many as eight or ten in the course of a day as well as beef kidney and liver to the extent of one-half pound each. On one occasion when about ten

weeks old Number 1 ate fourteen Sparrows and one-fourth pound of beef kidney at one feeding. Each one showed a decided preference for kidney, caring less for liver. Their appetites were more easily satisfied as they grew older.

Sparrows were easily available through the activities of a licensed trapping station, while dead guinea pigs and rabbits as well as mice and rats were obtained from laboratory experiments. Feathers, hide, and fur were always swallowed, the plucking or skinning process being evidently accomplished in the Owl stomach. These, along with the bones, were rolled into a compact mass and afterwards regurgitated, usually in about twelve hours. When living on an exclusive diet of raw meat from the butcher shop for a few days the birds readily devoured feathers from a plucked chicken in considerable quantities. A taxidermist's laboratory furnished from a Green Heron a tuft of feathers measuring ten inches in length. It was rather stiff but one of the birds swallowed it in a period of a little over one minute.

Sparrows were usually swallowed whole although the head was sometimes crushed or torn off; the body was invariably swallowed head first. It was also noticed that food was taken at definite intervals and if a pellet was about to be regurgitated no food was eaten until it was ejected. The manner of feeding was usually after this fashion: the bird would pounce upon the food, for example a Sparrow, sometimes striking it first with the beak, or perhaps with the talons, but in every case it took the bird up in its beak, lowered its head and grasped the Sparrow with a foot, usually the right. Holding its quarry thus it would glance quickly about for a possible enemy, then it might hop or fly to some other perch, always keeping a sharp lookout. At times this attitude was maintained for as much as ten minutes. If any tearing was done the prey was held down with this foot and after being minutely inspected it was finally swallowed. Guinea pigs were usually torn considerably and the skulls frequently crushed, but not always, as pellets were often discovered containing almost perfect skulls. Aside from this none of these birds was observed to crush bones with any apparent intent. Both beak and talons were possessed of great strength but the former had very little shearing power.



YOUNG GREAT HORNED OWLS.

Fig. 1. Bird No. 2 (right) 7 weeks; No. 3 (left) 8 weeks.
Fig. 2. No. 2 (right) 8 weeks; No. 3 (left) 9 weeks.
Fig. 3. No. 2 (left) 9 weeks; No. 3 (right) 10 weeks.

Surplus bits of food were sometimes left lying where dropped but more frequently they were carried to some corner and often covered with sticks or other refuse, later to be brought out and sometimes eaten but as a rule they were pulled about, played with, hidden somewhere else and finally discarded as if forgotten.

The pellets were usually coated with a thick layer of mucus and never contained any other material save feathers, hair, fur, and cleanly polished bones. Neither muscle, cartilage nor tendons was ever found attached to any pieces of bones. The latter, however, were never corroded in any way and had evidently never been acted upon by the digestive juices. The spongy epiphyses were sometimes found collapsed and broken but this apparently occurred before swallowing. Microscopic evidence showed that hair and feathers were in no way affected by the digestive juices, although the quills of large feathers were always splintered and rolled together. On a number of occasions pellets were found that contained hair of two different colors or hair and feathers in which the masses were not mixed at all but were very sharply delimited, indicating that two portions swallowed at different times were not mixed together. If a mouse and a bird were fed at the same time the fur and feathers came up mixed in the same pellet, but if fed separately at an interval of a half hour the fur and feathers appeared in the same pellet but distinctly separated. This was also true of animals of the same species but different in color. The literature gives no solution to this problem of pellet formation and study is to be continued along this line.

None of the captives had any occasion to kill their own food. Numbers 2 and 3 lived in a shed during most of the period of captivity with two Short-eared Owls which were, to the best of the observer's knowledge, never injured intentionally by them, although they readily devoured one of the Short-eared Owls which died from another cause. Widmann[1] mentions a case of a captive male eating its dead mate; he also states that a Crow lived with the pair for about a year and was unharmed. One incident is given by Baird, Brewer and Ridgway,[2] where a captive female killed and ate its mate.

[1] Birds of Missouri, Tr. St. Louis Acad., XVII, No. 1, pp. 110–112.
[2] Hist. N. A. Birds, III, p. 67.

CALLS.

The first manifestation of any call given by the four Owls was a hiss very frequently employed even when the birds were first taken. When four or five weeks old a shrill, short "yeep" similar to that of a young chicken was given which was evidently expressive of recognition or interest. Numbers 1, 2, and 4 gave this call rather persistently. Another call correlated with anger and excitement might be described as a longer and more quavering one, similar to the long-drawn night call of a Screech Owl, but more harsh and staccato. This was noticeable at the age of seven weeks whenever the birds were disturbed. The only other distinct call recognized was the characteristic hoot. Number 1 displayed this only a few times and then it was very immature, the note being shrill and high pitched. Number 2 began its attempts at hooting at five and a half months. By the age of six months it was able to hoot in rather characteristic fashion although volume was lacking. A month later it was responding to the steamboat whistle of a switch engine which regularly blew about nine o'clock each night; each blast from the engine brought forth an answering hoot. Number 3 was not inclined to hiss frequently and was seldom ever heard to give the "yeep" call. It was never known to hoot or even attempt it. It also gave the scream of anger less often than Number 2. Number 4 was very similar to Number 2 except for the hoot and it had not reached the age for that when liberated.

THE EYE.

The eyes of Number 2 at the age of three weeks showed a washed-out pale yellow iris and a milky cornea; Numbers 1, 3, and 4 still showed this to some degree at the age of five weeks. This corneal opacity did not disappear completely until the Owls were six weeks of age, and Fig. 3, Plate IV, shows how clear the eye later became. The iris gradually became more highly saturated until it reached the chrome-yellow stage at about two months. The same observations were noted on each of the four Owls as those mentioned by Coues,[1] viz., that the iris was entirely under

[1] Birds of the Northwest, pp. 302–303.

the control of the will instead of being automatically dependent, as commonly supposed, on the stimulus of light. Each Owl could readily contract or relax the quivering iris in accomodating its vision to different objects or different distances; and the two irides could move independently of each other. The birds often looked at something with one eye partly closed; Number 3 doing this more frequently than the others. Usually, on such occasions the pupils differed in size, but in all stages of contraction and dilatation the pupils remained circular.

Whenever the pupils were much dilated either from anger or some other cause, the irides (especially in the chrome-yellow stage) took on a reddish tinge. This was no doubt the result of capillary dilatation,—the dilatation of the pupils giving the blood vessels in the irides more chance to distend.

The eyesight was keen even in broad daylight, although the bright sunlight was apparently irritating and caused ciliary constriction until a pin-point pupil resulted. It was noticeable, however, especially under the ages of five to six weeks, that the eyes were quite sensitive to strong light. Number 2 when under that age would seek dark corners and Numbers 1, 3, and 4 did so to some extent even at the age of five and six weeks. When older they all preferred a shaded spot to the glare of the sun. Number 1 watched the buzzing of a fly about a basement room where the light was less than 1/10 foot candle intensity; when out in the bright light of the noon-day sun, it also followed the movements of a dog a block away and at another time it watched the flight of a Robin from a distance of 300 feet.

All four of the Owls seemed to enjoy watching the outside world from the open side of the shed. They would perch there in the daytime as well as at night. It was no unusual occurrence for them, especially Number 2, to catch sight of motion at the windows of the house forty feet away; these motions were caught equally well from the second and third stories as from the first.

All but Number 3 frequently displayed a movement of the body from side to side when looking at something. This was most apt to occur when the object was stationary or when something excited the curiosity and they were not able at once to recognize it. This may have been due to retinal fatigue or it may have been

an effort to get a different angle of vision; more probably it was the result of both. Banks[1] mentions this same motion on one occasion when the captive Owl was about to attack a cock placed in its pen and he comments that it appeared to be calculating distance. This same reaction was manifested by Number 1 when a flash-light was flashed in its eyes; it probably was an effort to see into the darkened area behind the light.

The acuteness of vision is further borne out by Coues.[2] He noticed his two fledglings follow the motions of a grasshopper or butterfly flickering several yards up in the air. On one occasion they watched, facing the glare of the sun, a pair of White Cranes floating in circles a half mile high. Our observations confirm Coues, that these birds have a very acute vision. The eye, however, seems to be adapted for movement and contrast rather than for discrimination as evidenced by the fact that each of the four Owls would seize its own wing if it happened to pass the line of vision.

This reaction to contrast was quite marked at an early age in case of Numbers 1, 2, and 4. If a dark dress with white collar and cuffs was worn near any one of them, that bird would at once begin pulling at the white area with its beak; a white shirt front exposed by an open coat would also bring a like response, the Owl running its beak up and down the shirt front along the lines of contrast formed by the edges of the coat. At different times it spent as much as ten minutes on this problem. Color did not seem to affect any one of them unless the element of contrast was great enough in light and dark. Number 3 showed interest to some degree but it never responded to anything as did the others; its nature or disposition was entirely different.

THE EAR.

Our observations verify the claims of acuteness of hearing in these Owls. It was almost impossible to surprise any one of them in the shed although the approach was made as cautiously as possible and from the side where no glimpse of the observer could

[1] Auk, 1884, pp. 194–195.
[2] Birds of the Northwest, pp. 302–303.

be obtained. Not only was it possible for them to hear the slightest sound but they could readily localize it. Experiments were made where the observer, concealed, gave various sounds and each time the direction was detected. A tapping on the attic window when one of the captives was perched at the open side of the shed invariably brought a response, the one in question focusing its vision at the origin of the noise.

The horns or ear tufts do not seem to be a part of the ear proper. So far no statement as to their exact function has been found. All of the captives showed a control over these tufts, raising or lowering them at will. Are these tufts in some way connected with the muscular control of the ear valves or are they merely a part of the protective adaptation of this species? These questions remain for further investigation.

SMELL.

The sense of smell has not been investigated in this study as thoroughly as it will be in the future. Such observations as have been made seem to bear out the statement of Bolles (1892). He made tests with fumes of camphor, ammonia and other unusual and disagreeable odors but got no reaction unless the fumes were strong enough to affect the breathing or to irritate the eyes. His captive could be ever so hungry and yet never suspect the presence of food if the latter was carefully covered so it could not be seen. He further states that it disliked putrid meat but that it always tasted it before rejecting it. This last was also true of the four Owls observed in this study. Bolles concludes that he found no satisfactory evidence of olfaction of a high degree of acuity. Further experiments will have to be completed before this study confirms this verdict as absolute.

PERCHING AND ATTITUDE OF REPOSE.

The talons are singularly hooked, acute, and highly retractile, and the outer toe opposable, but it was unusual for any of the four captives to demonstrate the opposability of the outer toe. Only on one or two occasions was it ever noticed. The ordinary way of perching was with three toes in front and one behind. This

was used to a large extent when clinging or trying to climb. When standing the claws were as a rule spread. From the very first the talons possessed great strength and this increased with age, prehension being well developed at the early age of three weeks. A grip around the finger was sufficient to cause pain even though the nails were not piercing. When full-grown the pressure from the claws would be equivalent, if not greater than, that of the hand of a strong man. It was almost impossible to open the closed claws. Each one of these young Owls seemed to like sitting back on the hocks with claws closed; that part of the leg was kept rather bare of feathers for this reason. When perching the common attitude was with the three toes hooked over the perch in front and one at the back and when entirely quiet or at rest the talons were usually closed, the body resting on the tarsus extended along the surface of the perch. At such times the head faced toward the front with both or possibly one eye closed or both wide open.

REACTIONS OR BEHAVIOR.

From the time of the capture of Number 1 until the age of eleven weeks no restraint was put upon its freedom. It roamed about the premises; climbed into dark corners under a shed roof; hid under the porch or perched in some tree. It would come in response to a high pitched call of "woo, woo, woo," long drawn out. If one talked to it in a gentle, soothing tone it would give a series of soft, quavering notes and nestle closer to the speaker. When ten weeks old it would sometimes fly as far as a mile; doing so by stopping intermittently to rest. It would be gone an hour or even a half day but it always came back. It did this one day when a flock of Crows were in hot pursuit; they seemed not to confuse it in the least. One night after its freedom had been taken away, it escaped from the shed, but instead of flying away, it came and perched on a ladder on the porch where the light from the open door was brightest. When approached it stepped upon the extended arm and submitted to capture without any protests.

After it had reached the age of about twelve weeks or more its talons had become so powerful in grip as well as piercing that heavy leather gloves were used when it had to be handled. How-

ever, there was never any occasion when it seemed to wound intentionally. It appeared to take a dislike to the gloves. These were often thrown down in its shed for ready use. Time after time, in fact every time that they were so left, the Owl would hide them in some corner or under the cushion of an old wicker chair. Again it would drag them through its pan of water and leave them soaking wet on the ground. This might have been partly an instinct to play but since it never did the same with other articles left lying about it would seem to indicate more of a dislike. Bolles (1892) mentions a captive Snowy Owl that showed great antipathy for a piece of cloth that was used for covering its head when the Owl was taken out into the open.

When Number 1 was taken out of the shed for exercise it would crouch low as birds of all kinds gathered and scolded, some even darting down for a swoop at it; its mere presence was a signal for all other birds to make an attack. At such times it showed some excitement although it might have been merely an effort on its part to get away from its enemies; this was shown by its flying up to the roof of the house or into a tree. Often when trying for some destination like that it would find itself brought to a dead stop by the rope attached to a leather band on one leg. It would invariably look back as if puzzled and often make another start; after several efforts it would give up until it was brought back and the rope's length was again available. A rather sharp instinctive response always followed the blowing upon the back of its head in imitation of the air current produced by the swoop of a bird; this was evidently a protective reaction. All of the others acted in the same manner with the exception of Number 3, which did not show quite the same reactions or rather it did not manifest them as often. When from an unseen source the call of a Screech Owl was given, Number 1 invariably localized the sound at once and made an attempt to gain sight of the one giving it.

Number 2 when but three weeks old showed a decided tendency to play. In its awkward way it would seem to measure off on the floor a certain distance and then jump; or it would sedately walk or rather wobble over to the stairs, scrutinize them carefully and then with the aid of the wings hop them one at a time, each time investigating the one just above. Its maneuvers resembled those

of a small boy. When a mounted bird was placed near by it would look at it very closely for a time and then lose interest; there was no contrast nor motion to hold its attention. Like Number 1 it was always on the lookout for a dark corner where the light was not so intense; this was true even of the artificial light at night when the bird was still very young. It was a friendly Owl and made friends with the two Short-eared Owls; not infrequently it would be found sitting or perching close to the side of one of them watching the outside world from the open front of the shed. Its overtures to Number 3 were not encouraged until after both were well grown and then there was only a very formal relation between them. When Number 3 first appeared on the scene Number 2 wobbled over to get acquainted. Its advances were repulsed repeatedly until finally Number 2 seemed to lose its good nature and became apparently so disgusted that it could do nothing but clap its beak; a series of claps following as though it could not stop. It finally turned its back to Number 3 and wobbled away, clapping as it went, and made no more advances for some days.

Of the four captives Number 2 was by far the most gentle and most easily handled. Usually if the others were quiet and did not get it excited no trouble was encountered when it was to be weighed or measured. And if it did become frightened it was, as a rule, calmed by talking to it in gentle tones and allowing it plenty of time to step upon the outstretched hand. At night when a light was in a second floor room facing the shed Number 2 would perch at the open front and begin a "lonesome" call as if to attract attention. If spoken to it would invariably answer.

Number 3 was altogether a different individual from Numbers 1, 2, and 4. All three of these had good dispositions and seemed alert and interested in everything; but Number 3 was savage and surly from the very first. Its favorite reaction to feeding and to experiments was to sit back on its haunches or lie flat on its back and attack with claws and beak. All efforts at teaching it to behave differently were futile. Its ferocity was met by various punishments. When it struck at the observer with claws, a rod was manipulated so that the talons closed about it. From this the Owl was suspended head downward. Neither swinging back and forth nor the deluge of a stream of cold water ever loosened its

YOUNG GREAT HORNED OWLS.

Fig. 1. Bird No. 2, at 20 weeks. Fig. 2. Same, showing Horn-Tufts Developed.
Fig. 3. Bird 8 or 9 weeks old showing cornea. Fig. 4. Bird No. 2.

grip. If the attack came from its beak a hot poker or lighted match received the assault but never stopped it. Holding its feet and pinioning the neck to the ground was likewise ineffective as well as boxing it to one side with enough force to upset its balance. It could be subdued for the time being but the process had to be repeated; the degree of severity of the punishments varied with the interval of time that followed each one. It seemed to remember but its savageness was not to be conquered. It also recognized the observer, as did the other three Owls. As it grew older, feeding brought the fighting response less frequently, providing no stranger attempted to perform the task. Whenever it was perched overhead, care had to be used to prevent an attack; sometimes it would fly directly at the observer. This was attributed partly to fear and dread of the touch of a human hand. Nevertheless there was always a certain viciousness about it that led to the supposition that it really desired to fight. Whenever one of the other Owls manifested any inclination to fly at the observer it was done in a fashion that plainly showed it was no direct attack, but merely a getting somewhere because of excitement or fright.

Number 3 was always surly, sullen and morose. Its responses never came as freely as in the case of the others. These facts along with its larger size and different coloring led to the belief that it was a female and that the others were males. When it came time for the placing of a band on its leg for identification it took all the force of two adult persons to hold it while the third did the banding; it was then full-grown.

Number 4 seemed more active at the age of five weeks than any of the others; it climbed higher and made better use of the perches. Like Numbers 1 and 2, it was always docile.

All of the Owls except Number 3 spent no little time playing with white rags hanging in strips from the roof of the shed. This was done after observation showed their keen interest in light and dark areas. If a quick, sudden movement was made in the direction of any one of them it brought a fluffing out of the feathers, a hiss, and clap of the beak or a series of claps and an effort to strike, But if the approach was made cautiously, giving time to puzzle the matter out, there was practically none of this reaction except with

Number 3. A surprise would often bring the clapping of the beak and Number 2 would often hoot when taken unawares. All of them would fluff out to a mass of feathers a yard wide (wings being pushed forward and dragging the ground), sway from side to side, snap the beak like a pair of castenets, and open and shut the eyes, all the while contracting and dilating the pupils in a way worthy of a Chinese dragon.[1] Possibly this attitude affords as much protection as does the one in which they assume a sleek, slender, upright position with the two tufts erect in the form of a snag or broken limb.

Each of the Owls revolved the head, describing three-fourths of a circle when attempting to keep something within the line of vision. Anything unusual when carried into the shed caused them more or less excitement. A stick, broom-handle or anything long and slender when pushed toward them threw them into a panic; which was especially true when it was moved along the ground in front of them and in their direction. This was manifested even at the age of three weeks. It was possibly some instinct of fear, though whether it had any connection with snakes was not determined. All the birds liked to bathe, although Number 1 did so most frequently, taking a daily five minute plunge. With the exception of Number 3 each liked to have the back of its head stroked.

Numbers 2 and 3 of this study showed no inclination toward courting; nor did Number 3 make any attempt at nest-building although material and a cavity were provided by way of inducement. This led to the supposition, not yet fully confirmed, that perhaps there was no mating until the second year, but that it might be possible to get them to breed in captivity providing the right sort of food in proper amounts was supplied along with favorable conditions. The observations of Bolles (1892) and Banks (1884) seem to confirm this possibility. Banks also notes the same behavior in regard to the pellets as was found true of all the four Owls in this study. Namely, that at the time a pellet was about to be ejected the bird seemed almost ill; sitting quietly and taking no food until the regurgitation took place and then

[1] Bolles, Pop. Sci. Monthly, XLI, pp. 313–328.

it was all bright and ready for its meal. His captive also manifested the same tendency to hide surplus food.

Opinions differ as to whether Great Horned Owls can be tamed. The behavior of Numbers 1, 2, and 4 would lead to the belief that some individuals could easily be tamed. While no effort to tame was made in the case of these three, they showed gentle dispositions that could easily be cultivated. (Pl. IV, fig. 4.) As far as Number 3 was concerned the natural conclusion is that there are some individuals of the same species that are not easily if ever tamed. There are individual differences among birds as well as among members of the human race.

5216 Greenwood Ave., Chicago, Ill.

NOTES ON TWO GROUND-NESTING BIRDS OF PREY.

BY CHAS. A. URNER.

WITH PHOTOGRAPHS BY T. DONALD CARTER.

Plates V–VI.

DURING the breeding season of 1923 I had the good fortune to find on the salt marsh near Elizabeth, N. J. (in fact largely within the limits of that city) five nests of the Short-eared Owl (*Asio flammeus*) and two nests of the Marsh Hawk (*Circus hudsonius*). While my observation of the histories of these seven nests and their contents was very incomplete, being limited to visits at irregular intervals, some of the facts recorded seem of general interest. Those relating to the Short-eared Owl supplement previous notes on local nestings of that species in 'The Auk,' Vol. XL, No. 1, p. 30, and Vol. XXXVIII, No. 4, p. 602.

THE SHORT-EARED OWL.

A number of Short-eared Owls survived the 1922–23 hunting season on the broad salt marsh lying between the cities of Elizabeth and Newark, N. J., and I had hopes of discovering some of the 1923 nests before the eggs were laid, and of observing their con-