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THE DAILY LIFE OF THE AMERICAN EAGLE: LATE PHASE.

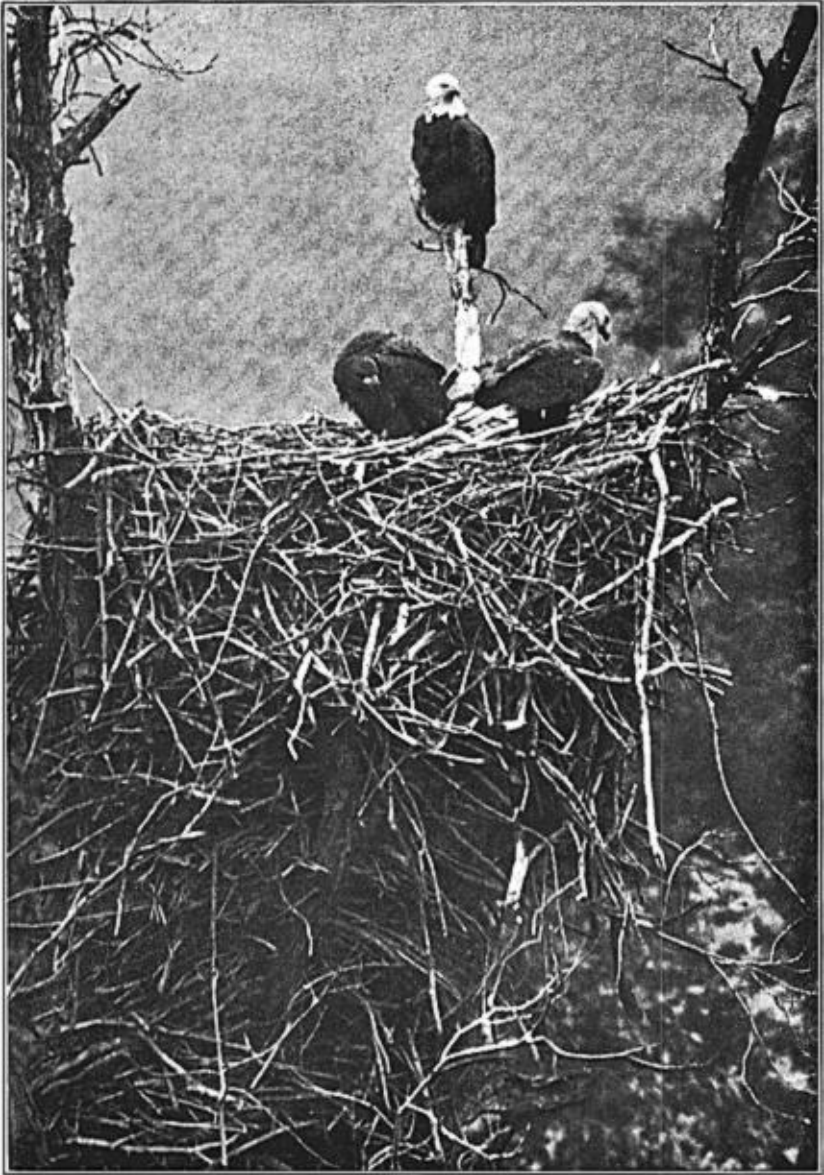
BY FRANCIS H. HERRICK.

Plates XXI-XXVI.

IN earlier papers¹ I have given an account of the observatory erected at Vermilion, Ohio, in 1922-23, and of the nest and nesting habits of the American or White-headed Eagle (*Haliaeetus leucocephalus*), as observed on the southern and eastern shores of Lake Erie. I will now record the results of our studies of the domestic life, the instincts and habits of the Eagle, made at Vermilion in the summers of 1922 and 1923.

Our best policy at the start, though contrary to our desires, was to put the cart before the horse and begin detailed observations at a comparatively late phase of nest-life, since we could not afford to interfere in any way with the eggs or newly hatched young until the habits and idiosyncrasies of this particular pair of Eagles were better known. We have succeeded thus far in avoiding any serious accident or mishap, but a third season will be needed to carry out our plans. In the spring of 1924 I hope to make this record more complete in the earlier stages, of which only a rough reconnaissance has thus far been made.

¹See "The Eagle as Emblem." 'Western Reserve University Bulletin,' Vol. XXVI, Cleveland, 1923. "An Eagle Observatory," 'The Auk,' Vol. XLI, and "Nests and Nesting Habits of the American Eagle," 'The Auk,' Vol. XLI, 1924.



FAMILY GROUP AFTER FLIGHT OF FIRST EAGLET, JUNE 28, 7 A. M. MALE
ON NEST HAS BEEN FEEDING THE YOUNG BIRD.

In 1923, if our estimate of the incubation period is correct, Eaglet No. 1 spent seventy-two and Eaglet No. 2, seventy-four days, in this case continuously, in the eyrie. Allowing then from 10 to 11 weeks for the life of the young Eagles in the nest, about one-half of this period, or five weeks, is passed in the white and gray down stages and the other half in the juvenal dress. Mid-May marked the transition stage here between the last two plumages, the heads of the Eaglets being then enveloped in gray down while their bodies were sprinkled with dark brown, sprouting, contour feathers, and the wing and tail-quills were then fairly developed. In late May the full juvenal dress was established, and it is this final phase, lasting approximately five weeks, or up to the time of independent flight, which will engage our attention in the present paper.

Whenever the nest of a wild bird is accessible from the ground it is usually possible to conduct a certain number of simple experiments, such as to mark and weigh the eggs, and ascertain the time of hatching of each, to mark, weigh and measure the young as they issue from them, to gather data for determining their rate of growth, and to test their reactions at different ages, but in the present instance the field of direct experiment was almost completely barred. By placing our construction, with its platforms, ladders and tent, so close to the eyrie, we produced, of course, a rather striking change in natural conditions, but if tolerated at all its effect was bound to be transitory, and we were never at a loss to know when the behavior of the old Eagles was untrammelled and free. Accordingly we must be content to observe and record the behavior of old and young birds from the supreme vantage-point which the elevation of our tent affords, assured that at least we can mark the rise and surge of instinct and watch the play of habit under conditions of nature's own making. By maintaining continuous observations throughout the day, or from about five o'clock in the morning until seven at night we have been able to obtain very complete records concerning food-habits of a particular Eagle family at a certain time and place, as well as of activities of old and young birds at the eyrie and within a radius of about a mile from it in all directions.

The stage for action, the flat top of the great eyrie, which has

an area of nearly 60 square feet, being unalterably set, the reader must imagine the observer as able to look down upon it from a fixed point, 100 feet from the ground and 19 feet above the margin of the nest itself (See Pl. XXVI.), and as concealed at all times except when entering or leaving his tent; with an eye commonly fixed at a forward peek-hole he stands over the camera, with note-book ready and binoculars at hand. Other peek-holes are also available and they command the country for many miles in every direction. His efforts are mainly directed to following the activities of the old Eagles as they sally forth from their habitual perches to the lake or to the fields for their prey, and as they return to the eyrie with their quarry, when the nesting scenes take on the liveliest interest, in noting the character, treatment and service of the food and the final return of the parent birds to their perches.

The Eaglets, at first rather sluggish in their movements, become daily more active as the close of their nest-life approaches. To follow the rise of aquiline instincts, the reactions of the Eaglets to their food, their parents and to one another, as well as to all other objects which enter their effective environment, their preening, their play and all the varied exercises by which nature gradually fits them for independent flight and the serious business of later life, has proved no less interesting than watching the behavior of the old Eagles themselves. In all such instinctive acts we see the primitive patterns on which behavior has been delicately modelled by heredity and other evolutionary factors; but while the Eaglet in its every act follows in general the model to which the adult also conforms, like his elder he is also adaptable and his behavior at this phase is never perfectly stereotyped. He cannot remain a reflex automaton for long, and those instincts which are most deeply ingrained soon become shaded or in some degree altered and refined by experience; intelligence in the form of habits has begun to modify the web of his instinctive life. As a consequence you can never predict what variants may arise in the nesting scenes, or what the day or the hour may bring forth. As the effective environment of the Eaglets expands their attention is more and more directed from the nest and its contents to all moving objects which come within the range of their vision. When they are finally tempted to leave the eyrie under their own power, they will be well

fitted to deal with their prey and to bear it aloft in their talons; so perfect will the coordination of muscles and nerves have become, and so complete their mastery of the air, by daily practice, that to make a mile in their first sustained flight will be an easy task.

The Vermilion eyrie, that has just entered upon the thirty-fifth year of its history and has a direct line of predecessors which can be traced back for ninety years, stands in an open grove one mile to the south of the shore of Lake Erie, and thirty-eight miles due west from Cleveland, Ohio. An observer at the tent-front faces north by east and looks directly down upon the top of the eyrie which at that height is seen projected upon cultivated fields that extend half a mile or more to the Lake Road; beyond are railroad lines paralleling the shore which can be followed from Lorain Point to a wooded section near the town of Vermilion on the west; in other directions the eye encounters buildings in a farming country liberally sprinkled with hardwood forest.¹

II. THE EAGLE AT REST.

During the breeding season the Eagles' day is divided into periods of comparative repose or apparent indolence, when resting on their perches, and of lesser intervals of great activity when stirring abroad in search of food or when delivering this at the nest. The perch may be the top of any tall tree, preferably a dead one, and the taller the better, from which they can watch for prey and guard the nest. The shore, the island, the river-bank and all points where Eagles congregate or nest, are certain to harbor such favored posts; there we may often see an old Eagle perched, perhaps when a mile away, and there it may spend many hours in watchful waiting particularly if the nest be near. The favored perch is the one which has proved its use by experience and it is adhered to by habit.

At Vermilion five perches were in common use in 1923, all being in plain view from our tent, and all on the easterly side of the grove at distances of 300 to 600 feet or more from the nest-tree. The easterly position of all these sentry-posts was clearly determined

¹ As stated in an earlier paper, I was ably assisted in 1922 by Mr. Everett C. Myers, and in 1923 by Mr. Elbert J. Humel, and our combined notes, covering a period of 36 days, have been incorporated in the account which follows.

by experience, for upon that side was a lane, on which regular or irregular visitors to the grove, whether men or cattle, were daily passing. To the perches in general use it became necessary to give distinctive names, as 'Tall East Perch,' the dead top of a pignut hickory, the highest and most favored of all, that stood at the easterly entrance to the grove itself and commanded the whole neighborhood, 'Horizontal Fork,' 'North' and 'South Forks,' on which it was not unusual to see both Eagles perched at the same time and on the first of these standing close together on the same branch. In every case the perch was a dead limb which commanded an unobstructed view of the great nest. In addition to these tree-perches there was also a nest-perch, to be presently described, but when no particular perch is mentioned the reference will be to one in the grove at a distance from the nest.

Since the female is noticeably larger than the male, the sex of the perching birds was readily determined whenever the two were together, and at the nest we could distinguish the female by her perpetual frown, imparted, as it seemed, by the great development of her supraorbital processes. Such means of ready distinction seldom failed, except when the perches were deserted and the visiting bird came to the eyrie and left it with extraordinary speed. The heads of the pair were equally white, and in either case lightly stippled with brown, but of the two the male seemed to have the whiter tail.

When standing before us in full sunshine either bird presented an admirable picture of strength and self-reliance, every feather which clothed its powerful form lying unruffled in its place; its white head and tail cut off, as it were, from its trim, compact body, its yellow shanks and toes and corn-colored bill-hook were in sharp contrast with the plumage and the darker polished talons; while those restless yellow eyes in the male showed that no one was trusted, and as plainly in his mate that from no one would any nonsense or interference be tolerated. With the glasses we could count the flick of the "third eyelid" or nictitating membrane which, as in the case of the Eaglets, registered from 17 to 23 per minute.

When two Eagles are perched together one is often leisurely engaged in making its toilet while the other stands guard; it goes

over all its feathers, routing the loose ones, and perhaps drops one wing and then the other the more effectively to comb out the long quills with its bill, precisely as we shall see the Eaglets doing at the nest; the operation often ends by erecting and shaking the feathers of the body so as to permit each to settle nicely into place. Such exercises are apt to be broken by frequent pauses, when the bird comes suddenly to attention, casts an eye about and at her mate, whose vigilance is never for a moment relaxed. If you use a glass you will see that the guarding bird is not quite as motionless as it seemed for its head is constantly turning either way through an angle of one-hundred and eighty degrees; on occasion a glance is cast to the sky overhead, and no moving object is ever likely to enter the range of its vision unperceived. Towards the close of their life in the nest the Eaglets become almost equally responsive to their surroundings. I was once much impressed after one of them had suddenly cocked its head and gazed directly into the sky, for upon drawing back the canvass of the tent, an old Eagle was seen circling half a mile or more above the nest.

I was surprised at the time spent on the perches, and am convinced that often the Eagle's working day did not exceed three or four hours, a circumstance to be taken as good evidence of the abundance of food. We endeavored to follow the movements of individual birds as closely as possible throughout the day, noting when one took a given perch, left it and returned to it again. The following incident will show to what remarkable lengths the apparent immobility of a perching Eagle, when alone, will sometimes extend: as I approached the grove in going my usual rounds one morning towards the end of June, the female left the tall east perch and flew to the lake while her mate, as was afterwards found, was standing guard on the south fork. Though in all probability not unperceived, I managed to enter the tent without disturbing him, and at 8:45 A. M., examined him carefully with the binoculars, noting particularly his position on the forked branch as he stood facing a light breeze from the south; the glasses were turned on him repeatedly in the course of the forenoon, and he was still standing there at twelve o'clock when I was relieved for lunch: for three and one half hours he had not

apparently moved and had not been seen to lift even a foot. I might add that we were then in the midst of a very uncomfortable hot-wave which later sent both birds to the shade. It drove them from the tree-top to the branches below, but so far as we observed in only one tree, that called the "Tall East Perch," which had a horizontal limb about forty feet from its top from which, as later events clearly showed, the nest was visible.

Although it seemed probable that one of the Eagles might occupy the nest-perch for the night, or may have done so at an earlier time, we never found either there after dark. Following a night spent in the tent, on the morning of June 28, at 4:58 o'clock, ten minutes before sunrise, we saw the female Eagle take the south fork; as the sun was rising she moved over to the tall east perch, rested an hour longer and at twelve minutes after six made her first sortie of the day. She had undoubtedly passed the night in the grove and not far from the south fork where she appeared just before dawn.

The heat and humidity to which I have referred, aside from causing the Eagles old and young, to gape as if panting for air, the common response seen in many of the higher animals, or driving them to shade when this was available, produced what we may call the "heat-reflex" (See Pl. XXV.), which is clearly a signal of distress. It is not to be confounded with another reflex, also evoked by heat, that may prompt a bird to spread its wings in order to enjoy a sun-bath.¹ It is a direct response to rather intense heat and perhaps humidity combined, and takes the form of a complete relaxation of those muscles which hold the wings folded against the sides of the body; the wings are not fully spread, as is often the case in sun-bathing or in drying off after a wetting. If the bird is perched both wings droop, and hanging as far down as the force of gravity and the tension of relaxed muscles permit, give it a decidedly odd and languid appearance. At 8:30 A. M., on June 22, the fifth day of the hot wave, when our thermometer, though the sides of the tent were raised, registered 100°, the female Eagle was trying to hold to her high perch, but had both wings down and was later driven to the shade of the branches below.

¹ For a notice of this reflex, see 'The Home Life of Wild Birds,' 2d. Ed., p. 178.

The Eaglets at the nest rather frequently showed the same response in the hottest part of the day, and I have seen one of them hold this position for two hours at a stretch gaping much of the time. When this altitude is assumed upon the eyrie, the wings swing slightly outward, and resting upon their outer margins expose the whole under surface of the body to the air.

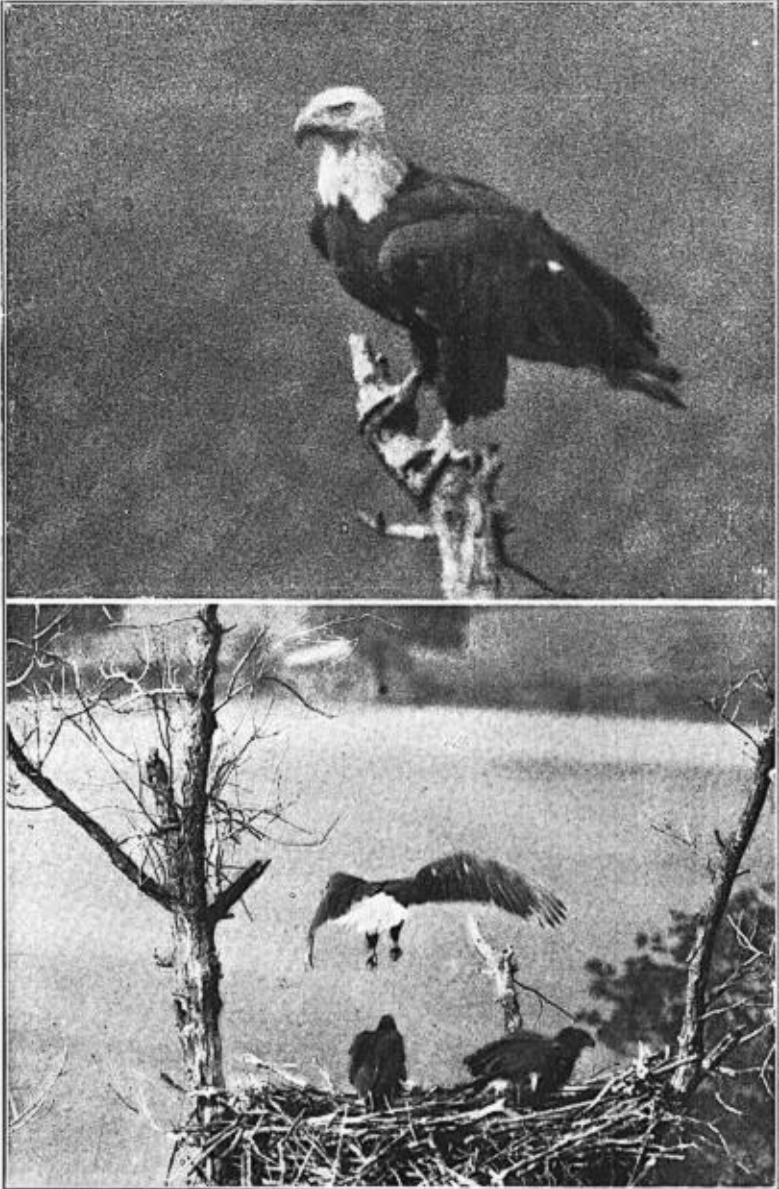
I have seen an Eagle in captivity take a pose somewhat similar to that just described, the wings being relaxed in such a way that the angles stood well out and their long tips hung down and crossed over the tail; a Screech Owl also, which I had alive for a number of days, when perched, would sometimes drop one wing at a time and let it hang, completely relaxed at the side; since this was in cold weather it may have been merely the result of fatigue.

When standing listlessly on the perch the Eagle will occasionally execute a very good yawn, and like the Hawk is given to standing on one leg, the other with toes clenched being drawn up under the feathers; or, like the Hawk also, when thus standing he will lower the other leg until its shank or heel comes to rest on the perch. After feeding, the Eagle usually cleans its bill by rubbing it on any stick or branch at hand, and when busy either with feeding or preening it may be seen to pause for a moment to scratch its head with its claw.

III. THE NEST-PERCH.

The adoption of the "nest-stub" or perch in 1923 altered in important ways the polity of nest-life, as by holding one of the old Eagles at the eyrie for a considerable part of each day, and by making the young content to remain in it after they had proved their ability to fly; and incidentally, on more than one occasion, it brought the whole family together at dinner. For a time the Eaglet seemed to derive the same satisfaction from hopping on the nest-perch as from an independent flight to a distant tree.

After the delivery and service of food the usual course of an old Eagle, when its behavior was free, was as follows: to fly up to the stub, which projected about three feet beyond and above the far side of the nest, clean its bill, and begin a period of guard-duty which might last from two minutes to two hours or longer,



1. FEMALE EAGLE IN GUARDING ATTITUDE ON NEST PERCH.
2. SAME BIRD SHIFTING TO TALL EAST PERCH; FEET WERE DRAWN UP
A MOMENT LATER.



BILL TO BILL FEEDING BY FEMALE, STANDING ON FISH AND PASSING
PIECES TO YOUNG. FIVE FOOT STICK IN FOREGROUND WAS A
PLAYTHING FOR THE EAGLETS.

according to conditions which could not always be fathomed. Very rarely they would drop back to the nest for a second course of food and again return to their post; on one occasion the female remained on the perch while fish were twice brought and served by her mate. If the time spent on the nest-perch was brief they would usually go to another perch in the grove, or if extended, would sally forth direct to the fields or the lake for their quarry. The preening and all other activities noticed on the tree-perches were observed here and of course to much better advantage.

The following incident will illustrate the tenacity with which an old Eagle would sometimes hold to its perch at the nest; at 5:30 P. M., on June 22, the female landed a fish and took the nest-perch at once; standing there, erect, her head constantly turning either way she keenly surveyed her nest and the whole situation; an hour passed, but she had not changed her position nor so much as raised a foot. She then ventured to make her toilet, coming frequently to attention in the process, yawned, turned an eye skyward and resumed her usual guarding demeanor. A railroad train thundered past, but such sounds were beneath her notice. At 7:30 P. M., she appeared to have settled down for the night and to have made her supper, while mine was overdue; not wishing to show myself on the platform I tried to frighten her off, at first by shouting and then by pounding with a hammer, but it was three minutes before she finally moved, and then only to take her favorite position on the tall east perch.

In tabulating our records of 60 visits to the nest from June 15-30, 1923, (See Table I.), I find that the nest-perch was taken 43 times, and that the time spent on the nest itself tended to increase, while that passed on the perch showed little change. The total time spent by both birds upon their eyrie, when they might be feeding on their own account or serving the young was one hour and forty-three minutes, while the aggregate time passed upon the stub over the nest was eight hours and twelve minutes. The adoption of the nest-perch by the Eaglets with the result of prolonging their stay in the nest at the close of the season will be noticed in a later section.

IV. RECONNOITERING.

When an Eagle has done guard-duty on a tree-perch for an interval, whether long or short, and the spirit moves him, he is likely to inspect the nest before leaving for a foray in search of prey. He flies past the nest, twenty-five feet or more to one side and one hundred feet or less beyond, before making off direct to the fields or to that great reservoir of their food, the shore and surface waters of Lake Erie.

By "reconnoitering" I mean making a tour of inspection of the eyrie without coming in contact with it; it might take them casually over it at a considerable height, or even completely around it, when they would fly between tent and nest, and the greater the anxiety of the old birds for the safety of their young the more frequent did such sallies seem to become. More than once we have seen an Eagle, as if for assurance, leave its tree-perch, encircle the nest and return to the point it had left but a moment before. In making such a reconnaissance from the tall east perch we have seen an old Eagle describe a figure eight, the nest being enclosed by the loop nearest the perch. The common habit on leaving this post was to fly past the far side of the nest, wheel and go direct to a different perch. Only once or twice have I known an Eagle to break its habitual silence on such occasions by giving a piercing scream as it passed its young.

While the mighty Eagle was thus sailing about its eyrie it was often attacked by the plucky little Kingbirds; and whatever ideas we might be inclined to read into some of the acts, described as "assurance," "anxiety," "welfare" and the like, there can be no doubt that pursued and pursuer were here impelled by similar instincts,—the little monarch to guard his home-territory, on which his nest was placed and the big one, his young, which command his daily care for upwards of ten weeks.

These reconnoiters, or little journeys to the vicinity of the eyrie, evidently correspond to those visits of inspection to the nest itself, which Macpherson¹ found common in the late nest-life of the Golden Eagle in Scotland, especially by the female,

¹ See Macpherson, H. B., 'The Home-Life of the Golden Eagle.' London, MCMIX.

who never stayed long, however, except when feeding or sheltering her young. It should be added that such visits might also be made for cleaning the nest, an act which I have never witnessed in the American bird. Out of 49 visits recorded in 1922, four were entered as "empty-handed" or more properly "empty-footed" because we saw no evidence that food or any other object was delivered, and my first idea was that the birds had come to the eyrie as to a common dining table to feed. In the following year when the conditions for exact observation were much improved, out of 60 visits not one was of this character. It is therefore safe to say that at this late phase, barring activities which center about the nest-perch, contact with the eyrie is seldom made except for the purveyance of food. Perhaps we shall find that in the white and early gray down-stages the practice is somewhat different, and I can well believe that a hungry bird might repair to the nest when too indifferent or too indolent to go to the primary source of supplies. At this stage then, reconnoitering takes the place of visits of inspection to the eyrie itself, but it may be also brought into play for a very different purpose, as will be shown in a later section.

Guarding the nest is an instinct, the urge of which rises and falls according to the varied experiences of the day or the hour, and even of the moment. Just as sight of an Eagle arouses the fiery pugnacity of the Kingbird, so events which transpired on the ground, and of which we could not always be cognizant, affect the Eagle whether at rest or in action. On certain days they would leave their tree-perches without troubling to inspect the nest, and we then knew that behavior was free and that all was well. This is illustrated in the following by no means unusual record: at 4:30 P. M. both Eagles occupied a common post, but five minutes later the female moved up to the tall east perch and after a rest there of twenty minutes, started off to the lake with a small Hawk in pursuit. The male, after having spent an hour and a quarter at his first station, at 5:45 P. M., moved up also and took the place lately vacated by his mate; after a further respite there of twenty-five minutes he also flew to the lake. At half after six o'clock the female returned with a fish and after landing it on the eyrie took the nest-perch; resting there but five minutes she re-

turned to the tall east perch from which she had been absent forty-five minutes, and when we closed our tent at seven o'clock the male had not returned. Here we see a series of simple events, which are more or less chained or interdependent, and illustrate the normal aquiline activities which are centered at this stage about the nest. Where, as in this case, the urge of hunger was to all appearances stronger than the impulse to guard the young, they may be deserted by both birds, though never, so far as we have observed, for any great length of time.

V. FOOD-HABITS.

In the question of its food the American Eagle is as adaptable as in all other matters, for its one rule is to live off the country and to take whatever its hunting territory affords. Since the Eagle is inordinately fond of fish it was no surprise to find that the Vermilion birds drew their sustenance almost wholly from the great storehouse close by their door. In 1922 seventy per cent of the food, delivered at the eyrie, and in 1923, ninety-six per cent for the period in question consisted entirely of fish. The number of visits, totalling 109 for these two seasons are summarized, and those of 1923 recorded in detail in Tables I-II. Out of those 109 visits food was brought 102 times, and in this task the female was nearly twice as active as the male. The daily number of such visits varied from 2 to 8, and averaged nearly 4 per day in 1923. Although the feedings may be exceptionally bunched at almost any time, three or more coming in rapid succession, or may be scattered through the day, they were on the average about twice as numerous before 9 A. M., and after 3 P. M., as at any other time. If we divide the day into four periods,—5-9 A. M., 9 A. M.-12 M., 12 M.-3 P. M., and 3-7 P. M.,—in 105 recorded visits the proportion was 36-20-15-24.

TABLE 1. FOOD-HABITS OF AMERICAN EAGLE. DAILY RECORD OF VISITS TO EYRIE.

No.	Date	Time	Bird	Material delivered	Time at nest	Time on Nest-perch in min.	Reconnoiters	Observation period
1	June 15	6.20	?	Fish	5-10 s.	5		9.25-11.30 3.00-7.00 ¹
2	16	5.56	?	Oak-leaves	5 s.	27		(6 h. 5 m.)
3		6.29	♀	Small pike	1.5 m. 10 m.	19.5 25		
4		7.51	?	Small cat-fish	3 m.		8.05 9.25	
5		11.25	♀	Fish	5 s.	63		
6		4.10	?	Small fish	5 s.	2		
7		5.03	?	Small pike	5 s.	2		
8	17	11.50	♀	Fish (?)	5 s.	5	11.45	5.05- 5.50 (12h. 45 m.)
9		11.58	♀	Fish	5 s.	15		
10		1.13	♂	Small fish	2 s.			
11		2.12	♀	Sheeps-head	2 s.	2		
12		2.37	♀	Fish	3 s.	11		
13		2.50	♂	Small perch	5 m.	2		
	18						1.30	5.05-10 1.30-2 (6 h. 25 m.)
14	19	10.14	?	Large fish	3 m.		10.49	5.03- 4.15 (11h. 12m.)
15		10.50	♀	Large fish	2-3 s. 5 m.	2 60		
16		10.53	♂	Fish	2-3 m.			
17		11.25	♂	Fish	1.5 m.			
18		3.48	?	Fish	1-2 s.			
19	20	5.39	♀	Fish	2 m.			5.05- 7.00 (13h.55m.)
20		8.55	♀	Fish	1-2 s.	3		
21		9.08	♀	Fish ?	1-2 s.	2-3		
22		1.04	♀	Fish	1-2 s.	2		
23		2.00	♂	Small fish	1 s.	1		
24		6.44	♀	Fish	4 m.			
25	21	1.35	♀	Fish	½ m.	1.5	2.01 4.23	5.06- 7.35 (14h.15m.)

¹ Bold face type indicates P. M., light face A. M.

TABLE 1. (Continued.)

No.	Date	Time	Bird	Material delivered	Time at nest	Time on Nest-perch in min.	Reconnoiters	Observation period
26		4.34	♀	Fish	1-2 s.	4		
27	22	7.41	♀	Small fish	1-2 s.	1		
28		8.52	♀	Small fish	2-3 s.	3		
29		9.48	♂	Fish ?	3-5 s.		10.23 11.35 11.47 12.58	
30		11.53	♂	Fish	1 m.			
31		1.19	♀	Fish	1 m.	6		
32		2.01	♂	Fish	2-3 s.	2	2.32	
33		2.27	♂	Large fish	1 m.	4		
34		5.30	♀	Fish ?	2-3 s.	120		
35	23	12.57	♀	Fish	2-3 s.	4	5.10	4.57-7.48 (14h.45m.)
36		6.07	?	Fish	¼ m.			
37	24	5.54	♀	Small fish	2-3 s.	2		5.05-3.45 (10h.40m.)
38		7.04	♀	Fish	2-3 s.	3		
39		7.12	♀	Fish	2 m.	2		
40		7.21	♂	Fish	11 m.	11		
41		3.35	?	Fish ?	?	?		
42	25	6.14	?	Small fish	1-2 s.	1		5.06-7 (13h.54m.)
43		7.13	♂	Small fish	7 m.	3	10.12	
44	26	6.50	?	Fish	2 s.	2	11.12	5.04-7 (13h.56m.)
45		3.24	♀	Fish	1-2 s.	11		
46		3.43	♀	Large fish	4 m.	8		
47		4.53	♂	Fish	2 m.	28		
48	27	5.50	♀	Small fish	1 m.			5.10-7.50 10.25-12 (16h.35m.)
49		7.28	♂	Small fish	14 m.	3		
50		5.42	♀	Fish	1 m.			
51	28	6.40	♀	Fish	½ m.	34.5	6.53	1-5.05 (17h.5m.)
52		6.58	♂	Plover ?	6 m.			
53		4.04	♀	Fish	1-2 s.	2	4.25	
	29						5.18 8.18 4.25	5.20-6.30 (13h.10m.)

TABLE 1. (Continued.)

No.	Date	Time	Bird	Material delivered	Time at nest	Time on Nest-perch in min.	Reconnoiters	Observation period
54		4.36	♀	Fish ?	2-3 s.	4		
55		5.09	♂	Fish	2-3 s.	2		
56	30	5.55	♀	Large sheeps-head	1 m.			
57		7.30	♀	Fish	1.5 m.			
58		8.43	♀	Chicken	5 m.	5		
59		6.15	♂	Large sheeps-head	1 m.			5.50-7.30 (12h.30m.)
60		6.57	♂	Small fish	12 m.			

TABLE II. SUMMARY OF FOOD-RECORDS AND OTHER ACTIVITIES:
1922-1923

	1922	1923
Observation period	June 13-July 4	June 15-July 1
Total time	21 days (215 hrs. 4 min.)	17 days (205 hrs. 36 min.)
Average daily observation-time	10.7 hrs.	12.8 hrs.
Daily period of expected aquiline activity	13.7 hrs. (5.20 A. M.- 7. P. M.)	12.8 hrs.
Total number of visits to eyrie:	49	60
By male		15
By female		28
In doubt		17
Average number of visits with food for 13 days, when observations extended to 10 hours or more per day	2.5	4.
Greatest No. of visits in single day	6 (June 19)	8 (June 22)
Greatest No. of visits with food in single day	5	8
Earliest and latest visits with food recorded	5.24 A. M.: 6.42 P. M.	5.39 A. M.: 6.57 P. M.
Reconnoiters without food	20	15

TABLE II. (Continued.)

	1922	1923
Reconnoiters with food	4	0
Analysis of food brought:		
Fish	30—certified, 27 inferred, 3	57—certified, 52 inferred, 5
Chickens	12—certified, 7 inferred, 5	
Other food	1	1
Visits with materials other than food (green leaves or stubble)	2	1
Empty-footed visits	4	0
Records of last full day:		
Visits to eyrie	0	5
Reconnoiters	4	0
Reconnoiters with food	3	0
Record of last day:		
Reconnoiters with food	1	0

Remarks: Total number of visits recorded, 109; total observation-time, 38 days: In 1922, when there was no "nest-perch," the flight of the first Eaglet occurred after 12.30 P. M., July 2, and that of the second at 5.15 A. M., July 4. The second Eaglet was starved out, having received no food for 4 hours, and was finally lured away by successive reconnoiters by the old birds, the food being showed but not delivered.

In 1923, when a nest-perch had been made available, and had been adopted by old and young birds, there was no luring or starving of either young. Eaglet No. 1 left on June 27 and returning on the 29th, remained 27 hours to depart finally on the thirtieth. The second bird made its first flight from the nest at 5:30 A. M., on July first.

The food as delivered consisted of 87 fish (certified, 79; inferred, 8); chickens, 13 (certified, 8; inferred, 5), and a small animal, possibly a Plover. On four visits, described as "empty-footed," nothing whatever appeared to be brought to the eyrie. Among the fish, which were of various sizes up to a possible weight of 3 or 4 pounds, and in any case often lacked the head, we recognized the lake and common catfish, sheepshead, sand and blue pike, carp and perch,—all common forms which can be found almost any day, and in great numbers after northerly storms have cast them up on the beach. All the larger fish and other objects were carried well down in both talons but often the wary and more



MALE BRINGING IN LAST FISH ON LAST DAY OF EYRIE LIFE, JUNE 30,
6:57 P. M. WHITE OBJECT IS A SHEEPSHEAD BROUGHT ON PREVIOUS
VISIT.



1. EAGLETS WITH WINGS DROOPING FROM HEAT.
2. EAGLET STRETCHING WING; LEG ON CORRESPONDING SIDE IS NOT RAISED.

timid male would enter the eyrie with a ridiculously light load, represented perhaps by the tail-end of a fish held in one foot. (See Pl. XXIV.)

The Eagles were often seen perched on poles where the fishermen had strung their nets far from shore, and are regarded by them as poachers. They must also be credited with the ability of submerging and on occasion of taking their prey from the water alive as will be noticed later, but I have never seen the Vermilion Eagles immersed, and am confident that their regular habit was to search the surface for floating dead fish or to resort to the beach.

The chickens brought to the eyrie were commonly white, to judge from the few remaining feathers, and of broiler size; these were always plucked nearly clean, and as with the fish they were often lacking the head. The farmers naturally resent the loss of their chickens, and are commonly sworn enemies of the Eagle in consequence; but when we consider the wide area over which these birds range in the course of the season, and the relatively small number of domestic fowl destroyed, only one in sixteen days in 1923, it is evident that individual losses are bound to be small.

Mrs. F. E. Ranney, who is well acquainted with these Eagles, told me that one day as she happened to be looking out of a window on a strip of land where a number of white chickens were running about, an Eagle suddenly appeared, flying low; her husband, who was standing near, remarked: "Now watch him! He is going to get a chicken!" No sooner said than done, for at that instant the Eagle stooped, selected his bird, and pausing only long enough to strike its talons into its vitals bore it off to the woods. The Eagle was not so successful when Mrs. Buehring happened to see the wings of a large bird flapping above the top of a knoll near her house; the raptor who was found to have one of their fowls in its grasp and was pulling out the feathers, was promptly driven off; when he arose, he left an amazing trail of white feathers behind him, and although the rescued fowl hastened to join the flock it was mortally wounded and did not long survive.

The American Eagle is often credited with being excessively shy, and Macpherson says of the Golden Eagle in Scotland: "of all our shy birds the Eagle is the most timid," yet as I have explained in an earlier paper such judgments ignore certain vari-

able factors of which experience is of the first importance. Under certain conditions Eagles become very bold when they not only venture to approach buildings but even to pick off a lamb or a chicken under the farmer's very eyes. The Danbury Eagles' nest, which I have already described,¹ stood in the top of a dead shell-bark hickory, on the edge of a grove, about a quarter of a mile distant from the buildings of the owner; according to the story which was told me by the farmer's son, shortly before our visit on July 5, as he was feeding the chickens close by the house, one the Eagles appeared, flying very low as if headed for the orchard; but of a sudden it swerved, stooped to the ground, and picking up the one stray member of his flock not forty feet from where he stood bore it away to the nest.

We have seen the Eagles at Vermilion feeding regularly on the dead fish which are swept on the shores of the lake; their preference is undoubtedly for living prey, but like all raptors they take readily to carrion when nothing better is at hand and in this respect perform a useful service. Our Eagle also accounts for large numbers of waterfowl and of more or less destructive mammals, as rats, squirrels, rabbits, raccoons, skunks and opossums. Though too fond of domestic poultry, and in certain cases of mutton chops and suckling pig to ever become popular in farming communities, such depredations are rather exceptional and scattered over a wide area. It is probably true that under certain conditions all small mammals and the young of the larger ones are subject to attack.

The Eagle, though devoting most of his day to idleness when the living is good, is capable of prodigious and long sustained exertion, of prolonged fasts and exposure to intense cold; and, having intelligence enough to learn from experience to avoid his enemies, he can adapt himself to almost any conditions. The numerous records relating to depredations of both the American and Golden Eagles in different parts of the country, particularly among young pigs and lambs, prove that these birds are capable of lifting considerable weights. Cameron² records a case of a Gol-

¹ See "Nests and Nesting Habits of the American Eagle," 'The Auk,' Vol. XLI, April, 1924.

² E. S. Cameron. "Nesting of the Golden Eagle in Montana." 'The Auk,' Vol. XXII. Cambridge, 1905

den Eagle in Montana carrying off a lamb, and J. E. West¹ saw a Bald Eagle alight at the mouth of Neuse River, N. C., with a small lamb in its talons. Cameron also speaks of the Golden Eagle carrying a Jack Rabbit which weighed 7 pounds and he thought that 18 pounds, the weight of a large jack rabbit, might represent the limit of the bird's carrying capacity. This however I believe to be far too high and that when such large animals fall into the Eagle's clutches they are divided before being taken to the eyrie as Macpherson's careful and detailed studies clearly showed. At Danbury, Ohio, Mr. Tibbels once saw the White-headed Eagle flying very low and carrying a carp which appeared to be larger than the bird itself and to have weighed 6 to 8 pounds.

That the Eagle might seize and carry off a small child is perhaps possible though extremely improbable since it is not likely that this bird can lift a body much in excess of its own weight. The weight of the female Eagle, the larger sex, varies from 8 to 13 pounds, but a bird of 12 or even 10 pounds is exceptional, whereas 10 pounds is not a very excessive weight for the human infant at birth and by the time such an infant is ever likely to come within the range of an Eagle it is bound to be too heavy for it to master. Though it might conceivably be attacked it certainly could not be carried off. It may be doubted if a single authentic case of an unprovoked attack by an Eagle upon a child or an adult has ever occurred in this country, for fabrication in dealing with this matter has become to such an extent a habit that no accounts can be accepted unless based upon verifiable evidence which seems to be invariably lacking. One account is of a boy about five years old at Belleville, Ont., in whose dress an Eagle fixed his talons but was unable to rise with him and was driven off. A somewhat similar incident was given by Alexander Wilson at the beginning of the last century. Both of these however came to their narrators second hand and any one who is familiar with the habits and instincts of the Eagle will readily perceive that at one important point at least, the internal evidence is fatal to the acceptance of either story. When an Eagle stoops at an enemy or at his prey, and is deterred at the striking point, he will immediately rise, and might carry off a cap, as has been known to occur when the attack was upon a

¹ See "Forest and Stream." Vol. IV. New York, 1875.

man who had invaded the nest, or "a fragment of a frock" if a child were assailed; but whenever he strikes in earnest and endeavors to master his prey and rise with it in the air, as is said to have been the case in the instances given above, his action is very different. His aim then being to maim or kill, the Eagle instantly drives his talons with all his power into the body of his victim. If danger is scented he will make every effort to lift his prey bodily from the ground and bear it to a place of safety; but if the place and time are propitious he tries to finish the business on the spot by repeated thrusts of beak and claw, often "treading" his quarry, until its vitals have been reached and resistance is at an end. It is evident that an Eagle, with claws nearly two inches long, or more if measured on their curve, could not strike a child of whatever age and strive to bear it away, without the certainty of inflicting grievous injuries, irrespective of the success of his efforts.

The following remarkable experience of Mr. Turner Turner, sportsman and amateur fur-hunter of British Columbia, was given by Mr. C. J. Cornish,¹ in 1899, belongs in another class and so far as I am aware it is unique in aquiline literature. In this case the attack was made not by the American but by the Golden Eagle, and in the open, not near its nest, when the ground was covered by six inches of snow on which a man was a conspicuous object. "Presently I was surprised," he said, "to see how close the bird was approaching, but concluded that it must have mistaken me standing still for a stump and would immediately discover its error. It never deviated from its course or changed its position (*sic*), except to drop its legs slightly when about ten yards off, and in line with my head. These it quickly drew up again, flying directly at my face, which so took me by surprise as to leave me hardly time to throw up my rifle as a guard, and to wave my left hand. This caused the Eagle to pass above me with the rush of half a dozen rockets. Up to this time the thought of harming the bird never occurred to me. But I then faced about and fired at my retreating foe. Then with a rapid wheel it turned to renew the attack, this time making an undoubted and intentional stoop at my head, in which it would have been successful had I

¹See "Eagles and their Prey," 'The Cornhill Magazine,' Vol. VII, N. S., London, 1899.

not suddenly ducked." It was thought that the Eagle, which was subsequently shot, was aiming at the eyes, the most vulnerable parts, seeing in the man only an animal which it could thus blind and have at its mercy.

That the Eagle can be amazingly swift or deliberate, as conditions demand, in securing its prey, was well illustrated by two incidents which occurred at Vermilion. In the spring of 1922 a man was ploughing with a tractor close to the Eagles' tree, all unconscious no doubt of the keen eyes which were watching him from a perch in the grove. Suddenly he started a rat which began running for dear life along the furrows; and at almost the same instant the Eagle shot from his lofty perch with the speed of an arrow, picked up the astonished rat in his talons, and under the eyes of the equally astonished ploughman promptly bore it to its eyrie. The other incident occurred early in June of last year; the male Eagle had taken the favorite tall east perch, which commanded the region very fully, at forty minutes after six o'clock; ten minutes later, when he seemed to have detected a moving object amidst some growing corn, upon which we looked directly down from our elevated station, he left the perch and flew past the nest; then, instead of moving off to the lake, according to his usual schedule, he dropped down over this field, and began to circle about it; slackening his speed as if in an effort to cover every part of the field in his search, he gradually contracted his circular path, as he descended nearer and nearer to the ground, until with elevated wings he came to rest very gently upon the brown earth. With the glasses we could see that he had struck his quarry, and for some minutes he stood there treading it with his feet, and could be seen to bend down and apply his bill-hook, the white head of the bird alone marking the spot where its brown body seemed to melt into the dun earth. Then, as deliberately, he rose and came to the nest bearing in his talons the prey which was small and mutilated beyond all recognition. Since Kildeer Plovers were nesting in that field one of their young was possibly the victim.

At Danbury, Ohio, according to Mr. Tibbels, many Eagles resort to East Harbor in autumn to pick up any stray waterfowl, particularly Coots and Ducks, which have been crippled by hunters, and where, if successful, they will often spend the day standing

about for hours on the ice; in spring they may be seen there also around the open pools, where wounded Ducks have been impounded and where they often vainly attempt to escape by diving under the ice.

According to Mr. Dale Bonnycastle¹ the American Eagles congregate in great numbers in spring on the sand-spits and tide-flats of Denman's Island in the Straits of Georgia, many remaining to breed; and he speaks of seeing one hundred and twenty of these great birds "feeding, circling and screeching" along seven desolate miles of that coast. Though not a plunger or strictly a diver, yet the Eagle was able to take many fish alive with little wetting of his plumage. Their duck-hunting was quite wonderful; an Eagle, according to this observer, would sit well concealed in the bushy top of a fir; a flock of Bluebills or American Scaup may be swimming along shore, and the moment they enter water not over a foot deep they are doomed; the Eagle shoots from his hiding place; the Ducks dive and circle back and forth under the water in vain; the Eagle follows every turn of his chosen bird, which after swimming under water for a minute rises only to fall into the Eagle's talons. "A venturesome Crow that picked up a cockle and flying a few feet in the air, dropped it on a rock, was driven away from the neatly opened shell by an adjacent Eagle." They picked up every bit of edible flotsam, said Mr. Bonnycastle, and not a single fish taken by the Osprey or by a Hawk ever reached its "interior department."

The habit of the White-headed Eagle of pursuing the Osprey and compelling it to drop the fish that it has just caught which is then recovered by the Eagle before it touches the water, is well known, but the Eagle has been recorded also as doing his own fishing. Hardy² describes one which descended in a spiral over the Penobscot River, Me., "then taking a wide circle he suddenly darted down obliquely and stretching forth both legs to their full extent he trailed them for several feet along the surface; finally making a quick thrust with the right foot and seizing a small fish near the head, he bore it away." Audubon³ also mentions

¹ See 'Country Life,' Vol. XV. New York, 1909.

² 'Bull. Nuttall Ornith. Club,' Vol. VIII, p. 242. Cambridge, 1883.

³ *Op. cit.*, p. 163.

having seen our Eagle taking red-fins alive in the Perkiomen Creek, Pennsylvania, "by walking briskly through the water, and striking at them with his bill."

At Cobb's Island, Virginia, as reported by Brewster¹, Brant and Geese once formed the principal food of the Eagles: "when close upon its quarry the Eagle suddenly sweeps beneath it, and turning back downwards, thrusts its powerful talons into its breast. A Brant or Duck is carried off bodily to the nearest marsh or sand-bar, but a Canada Goose is too heavy to be thus easily disposed of. The two great birds fall together to the water beneath, where the Eagle literally tows his prize along the surface until the shore is reached. In this way one has been known to drag a large Goose for nearly half a mile." Mr. Brewster also noted that more than once the keen eyes of the Eagle had been deceived, when he had approached the "stools" or wooden decoys of sportsman, lifted them from the water and carried them a number of yards before discovering his mistake.

There is an account of a White-headed Eagle at Little Rock, Ohio, pursuing Geese on the White River in plain view of passengers on a ferry boat. He would strike a bird but was unable to rise with it and the Goose by diving dragged the Eagle in the water and forced him to relinquish his hold. Other Geese were then struck with the same result.

Batchelder has described an Eagle on the St. Johns River, Florida, attacking Coots (*Fulica americana*). So long as they remained close together they escaped but finally separating the flock, the Eagle pursued a single bird until he secured it, once following it under water when it dived and remaining for some seconds and finally emerging with the Coot in his talons.

The Eagles have often been seen to drive Vultures from their prey and when food was scarce to even attack them and compel them to disgorge. Audubon describes an Eagle driving Vultures away from a dead horse and pursuing one which had a piece of the entrails dangling from his bill, finally killing the bird and devouring the morsel.

The question has often been raised whether birds ever designedly come to the aid of a companion in distress, and has often been

¹ 'Bull. Nuttall Ornith. Club,' Vol. VI, p. 122.

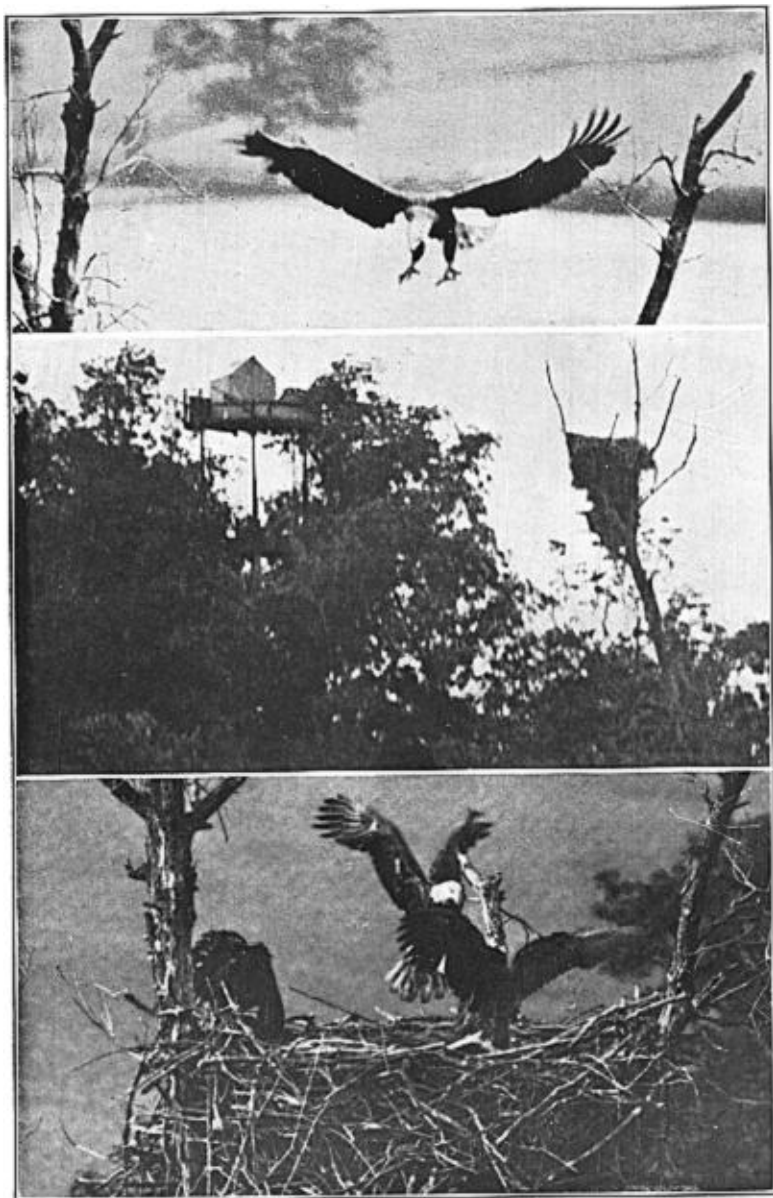
answered in the affirmative, as in the incident which follows:¹ according to this reporter, one of four Eagles was wounded on the marshes of Green Bay, Wisconsin, and lay fluttering on the water, but before it could be reached its three other companions had come up to it, and catching hold of its wings did their best to carry it off; they managed to drag it a considerable distance, which the writer thought "showed their friendly intentions just as well as if they had succeeded in flying off with it." On the other hand, knowing how weaklings and cripples are treated among domestic fowls and many gregarious animals, and that a young Eagle has been known to perhaps kill and certainly to eat its nest and cage-mate, as occurred in the case which I reported at Danbury, Ohio, in 1921, we might raise the question whether such actions on the part of this wounded bird's companions, as noticed above, were really as friendly as at first sight they might appear.

Macpherson states that on one afternoon, when a young Golden Eagle was about three weeks old, three Grouse were brought to the nest inside of five minutes, two by the female and one by the male, while a little later the male delivered a fourth, all of these birds having been previously plucked according to the usual habit. It was later found that the Eagles had accumulated a store in a steep rock close to their eyrie, which accounted for such quick returns. It was also found that during the first two months of nest-life the eyrie was kept remarkably clean, all the discarded carcasses, castings of the Eaglets and other refuse being scrupulously removed by the old birds and deposited in a definite place, which was not the same as that used for plucking or caching their prey.

At Vermilion we once had three deliveries of fish in the course of 17 minutes, between seven and eight o'clock in the morning, but there was no evidence that the food was ever cached, and nothing was removed from the nest from at least the second week in June until the young were on the wing. At a little later time, however, the accumulated refuse of many weeks was pretty generally cleared away.

A journey in air-line from the Vermilion nest to the beach of Lake Erie and back is approximately two miles, but as the Eagles

¹ Bull. Nuttall Ornith. Club, Vol. VI, p. 122.



1. EAGLE FLYING OVER WITHOUT PREY IN TALONS.
2. RELATIVE POSITIONS OF OBSERVATORY AND NEST.
3. FEMALE BRINGING IN FISH JUNE 20, 6:44 P. M. NOTE DIFFERENT
RESPONSES OF EAGLETS.

were apt to go out far from shore, or for a mile or more either way along the beach, their average trip for fish could have been hardly less than three miles. The following record, made on June 17 when the identification of sex was positive, will illustrate the speed with which the Eagle can sometimes accomplish the business in hand. When first observed both birds were on the tall east perch; at eight minutes after two o'clock the female flew northwest to the lake, and in 4 minutes was back at the nest with a large sheepshead, 12-14 inches long; two minutes later, or six minutes from the time she left her mate she was again at his side. Eighteen minutes now elapse, when at 2:32 P. M., the same bird makes another sortie, again going northwest to the lake, and in five minutes she has landed her second fish; and after delivering this she hops to the nest-perch and begins a period of guard-duty there. No sooner is the female well settled at this post than the male, at 2:40 P. M., jumps off the tall east perch, and makes direct for the lake; and now the female, having doubtless sensed her mate under way to the eyrie, once more returns to the favorite lookout point which he had just abandoned. Two minutes later, or ten minutes from the moment of starting, the male has landed his fish, but being both hungry and suspicious he wavers for fully four minutes, while the struggle of competing impulses goes on within him, cautiously peering about before venturing to feed. Finally, when fear has been vanquished in the struggle, having planted one foot on the fish, he ripped up its belly with a swift stroke of his bill, ate most of the entrails, and after opening up the gills began work at the head; pausing at this point for a moment he picked up the tail-end of another fish and swallowed it. Seven minutes were spent at the nest and nest-perch, and in 19 minutes from the time of leaving it, he was with his mate again at their favorite station. There was now a rest of nearly an hour for both birds; at 3:50 P. M., the female was off for the lake for the third time, and three minutes later the male also made a move, this time going to the south-east perch. Thus when behavior is focussed at the nest and perfectly free, we see the closely related activities of the mated birds proceeding from minute to minute, from hour to hour and from day to day.

VI. GENERAL BEHAVIOR, NESTING SCENES AND SERVICE OF FOOD.

Although it is impossible to divorce the interlocked activities of old and young Eagles at any time, it will be convenient to consider the complex behavior of the Eagle family first, as exhibited in the course of parental visits at the eyrie, and the interesting and often extraordinary activities of the Eaglets, when left to their own devices, in a following section.

After watching the behavior of these Eagles at the nest for many consecutive days and weeks we were not surprised to find that while their actions followed very closely the models which heredity had prescribed, and in a considerable proportion of cases could be predicted with a fair degree of precision, they were rarely, if ever, quite stereotyped at every point; on the contrary, a faithful transcript of what occurred at a number of consecutive visits, was always likely to show variation, and particularly the modifying influence of habit. This should not be surprising when we consider the number of influences which are certain to be more or less constantly at work, such as fear, hunger in both adult and young, and the mutual reactions called forth in an ever changing environment, one and all tending to effect kaleidoscopic changes in those conditions which determine eventual response.

As a rule both birds would approach the eyrie and leave it in absolute silence, and to my surprise it was very seldom that we heard the yelp or alarm-call of the male, which is given by opening and closing the mandibles, as if to bite off each note and at a moderate rate of speed. At any time of day and often at frequent intervals the scream of an Eagle would come to our ears, now from one of the perches close at hand, or from the lake and distant fields, but very rarely when reconnoitering or when actually upon the nest. These wild cries, so far as we could see, were in no way connected with their irregular visits with food for their young. The scream at times seemed to take on the quality of an alarm, although appearances, as in the following incident, may have been deceitful: as we were passing down the lane one morning one of the old Eagles was seen to go to the nest; the other bird was perched in the grove, and the moment we were detected off it went

with a forceful scream, which seemed like a warning note sounded for the benefit of its mate at the nest. These weird enlivening cries, when mellowed by distance, possessed a tone and quality quite pleasing at least to our indiscriminative ears. Towards the close of nest-life, when the young Eagles were alive to all unusual sights and sounds in their immediate neighborhood the parental scream never failed to touch a chord of sympathy, and we daily watched the evolution of this cry in them from a feeble bleat or *cheep* to a thin wiry squeal, which hunger, discontent, or the approach of a parent was always likely to evoke; until, when on the wing, the Eaglet's scream had much the tone and quality of that of an adult bird.

The variability in behavior referred to above will appear in a number of concrete cases which follow. At ten minutes after five o'clock on the afternoon of June 13 an Eagle was seen coming at great speed from the lake, and bearing an object held low in both talons; a little Kingbird was in pursuit, and like a pestering wasp now and again darted at his head, but it could not stand the pace and soon dropped behind; on reaching the nest the Eagle slowed down, hesitated, and then passed into the grove where for a minute or two it circled over the tree-tops; returning it entered the eyrie from the west side and landed a good-sized fish; after taking a number of steps it stood stock still and for some minutes its keen eyes surveyed the situation on all sides; it then cautiously moved to the margin of the nest, and dropping off rose to take a stand on one of the perches. It was clear enough that we were then dealing with a very suspicious bird whose behavior was anything but free. This did not, however, affect the excited Eaglets, both of which were crouched and squealing when the parent appeared; at the first opportunity one of them snatched the fish, and spreading over it, with feathers erect and head extended downward until its bill was nearly in contact with the food, continued for some time to squeal, thus claiming the quarry as its own and warning off its nest-mate; but as commonly happened there was no interference, and for a quarter of an hour Eaglet number one stood with both feet planted on the fish and continued to feed; sinking its bill in the white flesh, with upward jerks it released small sections which were swallowed with avidity; meantime, the second

Eaglet, with head extended, was standing near keenly watching every move and patiently awaiting its turn. This behavior-formulary of the hungry Eaglet in the presence of food is thoroughly characteristic, as it is of young Hawks at a similar stage of development; but this does not mean that it is invariable for, as will be later seen, there are degrees of hunger when the patience of the waiting bird gives out. An occasional variant from the standard reactions just described was to raise the wings above the back instead of dropping them (See Pl. XXVI.), and this response to the parent with food was not concerned with their maintenance of balance, nor occasioned by the presence of the other Eaglet, for it might occur on either nest or perch and when there was but one bird in the eyrie.

At this time we had not learned to distinguish with certainty the sex of the visiting bird, but from subsequent events we were assured that the visit just recorded was by the male, and that it was the female which, towards six o'clock, came to the eyrie with a brown chicken, partly plucked, dangling from its talons. The moment it touched the eyrie, the Eaglet which had had second chance at the fish began spreading and squealing in regulation style, seized it and was soon busily engaged in stripping off the breast meat and working at the drumsticks. Upon landing, the old bird came immediately to attention, and turning her head quickly from side to side sent a stern glance at our tent and now at her young and the food. Presently she walked up to the carcass of a fish which an Eaglet had appropriated, and planting a foot on it began to help herself. The Eaglet we designated as "number one" now lay down beside the mother to rest and await his turn. Having derived little satisfaction from the remains of the fish the old Eagle advanced towards the young one engaged with the chicken, but only to receive the characteristic warning,—squealing, and spreading with erected feathers; for a moment she hesitated, then without forcing matters found an outlet for her emotion by seizing a stick in her bill and dragging it about the eyrie; such an act, which is quite incongruous with any end to be attained is often seen in the young, when it may be interpreted as 'play,' using this term in a rather broad sense. After spending eighteen and a half minutes at the nest the mother bird suddenly moved

up to the front, dropped off and, with the momentum gained by the descent of a few feet, gracefully rose and made for a tall tree-perch in the woods.

Upon entering the grove on the morning of June 14, 1922, we recorded what proved to be an unusual event, a visit of an old bird to its eyrie "empty-footed," a circumstance referred to in section IV; at that early hour both birds were perched close together on one of their favorite stands, but facing in opposite directions. When we had advanced to within two hundred feet of them they went off in succession and in the following order, the male to the north and the female to the south; but the latter soon wheeled and landed on the eyrie, apparently for its inspection, and there she remained several minutes as we were coming up. The same thing apparently happened as we were approaching the woods on the morning of June 16, when one of the Eagles entered the nest from the south side and remained eighteen minutes. This was without doubt the female also, and we thought that in this instance she might have gone to the eyrie to feed; but, however that may have been, we soon disturbed her mate on the perch where, as we were convinced, but a short time before she had been resting beside him. When we entered the tent the young were standing together bolt upright, facing the breeze, and showed from their quiescent behavior that the larder had not been recently replenished. Although two other visits were recorded in which nothing was observed in the talons of the parent we were not positive that some food, actually delivered, might not have eluded us.

Shortly after eleven o'clock on the morning of June 14 the female Eagle was seen coming at full speed direct from the lake, and bearing in her talons what proved to be a large blue pike. Landing on the right side she dropped the fish and came to attention as usual; and while the young were crouched and squealing she grabbed the prey in one talon and dragged it to the center of the nest; then with both feet implanted in the fish she began feeding with great voracity while the Eaglets stood by in suspense; after a time she began to tear off chunks of the white flesh and to pass them up, one at a time, to the nearest bird, which received three pieces in quick succession, from bill to bill; then the Eaglet on her left came in for five helpings, served directly, as before;

after this she finished her own repast, ever and anon darting a swift glance around or turning an eye to the sky overhead. Finally the monarch bird stood erect and for full five minutes calmly surveyed her nest and young and the scene spread out on all sides to her view. Suddenly she jumped off, spreading her white fan of a tail, and an instant later drawing up and folding her talons; in another moment she was preening on the tall east perch.

An Eagle, assuredly the female, came to the eyrie at about six o'clock on the morning of June 16, holding in her talons neither fish nor fowl but fresh twigs of the pin oak and, dropping them as she landed, promptly took to the stub-perch. Meantime the young Eagles pecked curiously at the green leaves and for many hours thereafter were seen to occasionally approach them and toss them about as in play; and there they remained only to finally wither and be trampled under foot. The possible meaning of so curious an act will be considered a little later. After resting twenty minutes the Eagle left the nest-perch and went direct to the lake, flying low and going far from shore. In six minutes she was back with another blue pike and in a minute after landing it she jumped up to the stub; twenty minutes were then passed in preening, guarding and quiet repose; returning to the nest, she seized the fish on which one of the Eaglets was working, tore it apart and ate of it with gusto, now and again handing up pieces to her young. Ten minutes were consumed in the feeding processes, when she went to the stub for the third time and in five minutes joined her mate on the tall east perch. Twenty minutes later (7:45 A. M.) this same bird was off again for the lake, flying low as before; again she returned in exactly six minutes, and this time with a small catfish; tarrying but six minutes at the eyrie, she dropped off and flew to the east. After the lapse of a quarter of an hour the spirit moved the male, who first reconnoitered the nest, wheeled about and flying low down trailed eastward in the wake of his mate. On another occasion, if our identification of the sex was correct, the female Eagle, five minutes after the delivery of a fish, flew directly from the nest-perch to the lake and in three minutes was back with another, thus making record time.

Much to our surprise, from June 14, 1922, until the close of nest-life on July 4 of that year, all direct feeding of the Eaglets

ceased. With one exception the time spent at the nest was reduced to a few minutes or seconds, the birds coming at great speed, dropping their quarry and making off at once for a favorite tree, no nest-perch being available at that time. Equally surprising also was the fact that in 1923 bill-to-bill feeding went on up to the last day of eyrie-life, or for weeks after the young Eagles could help themselves and when they had attained a size scarcely inferior to that of their parents.

This direct feeding of the young of a precocious bird, especially when at an advanced stage of growth, would be more remarkable did we not know from experience what variation in food habits may occur not only between closely related individuals, but even in the same individual at different times and under diverse conditions. What the regular aquiline practice may be during the period of down, I cannot now say, but at this late phase the common habit of the old birds, when hungry and unafraid, was to tear open the prey and first satisfy their own desires; then, by way of introducing it to their young, help them directly to a few tastes. As already noticed, there was seldom any contest or rivalry among the Eaglets, seldom any eager crowding around the parent, but each commonly awaited its turn, and often at a respectful distance. However, exceptions to this and certain other rules the reader will notice as the narrative proceeds. The pieces of food were held up to the bill of the Eaglet (See Pl. XXIII.), never placed in an open mouth, much as at a very early stage I have seen food-morsels passed to the bill of a nestling Gull; quite as often as not the bills of both birds were depressed to such an extent that a clear view and photograph of the act were difficult to secure. Such a proffering of food, it would seem, represents an instinct which, as in so many other cases, long outlasts its need and primary use. The direct feeding observed was mainly by the female, and only rarely did the male possess sufficient confidence to partake of food at the nest and serve his young.

Macpherson's observations of the feeding-habits of the Golden Eagle began when the young were about 18 days old, when they received morsels of flesh and often titbits, such as pieces of liver, directly, as in the American Eagle, but at that stage they were not allowed to devour the intestines, a delicacy which the old birds claimed as their own. The male was never seen to feed at the

nest, probably as a result of his greater wariness or timidity, and seldom did he venture to offer food to the young. Leverets were brought whole to the eyrie, but the hind quarters only of fully grown rabbits and hares, and at first plucked but not skinned. The older animals presumably had been divided and their fore-quarters devoured at some convenient spot near the eyrie. At the age of twenty-three days the Eaglet was encouraged to feed on his own account, and was presented with a grouse which had been previously plucked, disembowelled and torn into fragments by one of the parent birds. When six weeks old he was fairly well able to help himself, though he seemed unable or disinclined to stand on the prey and use his bill-hook with much effect. At this time less care was shown on the part of the old birds in plucking and serving rabbits, and the Eaglet, on attaining his eighth week, was seen to devour a whole rabbit "at one sitting," head and bones included.

The writer just quoted said nothing about established habits of approaching the nest which was placed high on a ledge of rock. The circumference of the Vermilion nest is divided by four upright branches into four well marked sectors, that on the southwesterly side, towards our observatory, being the largest and embracing nearly one hundred and eighty degrees. During the first season we kept a record of the sectors which the Eagles used for entrance and exit at each visit, fully expecting that a definite habit of entering and leaving the eyrie would be formed by individual birds, at least when their behavior was reasonably free: but nothing of the sort occurred, and only once in the course of 60 consecutive visits were their entrances and exits similar on two successive occasions. When coming from the east and flying at excessive speed, they might as often as not enter the eyrie on the west; rarely, when flying high, would they approach from either front or rear, pause for an instant over the nest and drop like a plummet to its center. Quite often during our first season they would come direct from the lake, drop low over the intervening fields and then rising suddenly as they reached the nest slip over the far side with such speed that it was often difficult to see what was brought. Such behavior, dictated no doubt by fear or suspicion, bid fair at times to become a regular habit, but the choice of sectors was seldom the same.

The following incidents which occurred in 1923, and for the first time gave us the whole Eagle family "at dinner," we owed to the adoption of the nest-perch: June 19, 10:49 A. M.: the male reconnoitered the nest, passing on the north side and was soon soaring and circling over the farm-lands to the northeast. A minute later the female landed a large fish on the eyrie and promptly took the stub, but after a brief rest was on the nest again; looking about cautiously and taking one step at a time, she advanced towards a feeding Eaglet and when he had given place began to rip up the fish and satisfy her own hunger; pausing from time to time she would hand out pieces to the young who had gathered about her; with heads well down and almost in contact with the nest they received them directly from her bill. Suddenly at 10:53 A. M., with a shrill scream, as if to announce his arrival, the male plumped down with a fish; for a moment he stood beside his feeding mate and the four Eagles together made a very striking and unusual picture; his stay, however, was brief, and upon his departure the female returned again to the nest-perch and settled down. About half an hour later, when she was still on the stub, the male again came screaming to the eyrie and with another fish, this time entering on the west; but something had evidently displeased him, for walking across the nest he gave out a number of emphatic yelps, and after a minute went off from the easterly sector. On this occasion the female held to the nest-perch for an hour, finally leaving it shortly before noon. (Compare Pl. XXI.)

When they were coming direct from the lake-shore we would often see the Eagles rise to clear the wires by the railroad, then drop to within fifty feet of the ground to rise perhaps fifty feet higher as the nest was approached, and putting on the brakes at the moment of alighting enter at a rather high rate of speed. More than once we have been warned of their presence by the wiry, squealing cries of the Eaglets who rarely failed to sense the oncoming parent from afar; or, when our attention was directed away for the moment, and the sated young failed to give the usual signal, it would be recalled by a loud thud which was sometimes made by the impact of the bird's body with the nest itself. The position of the Eagle's head when alighting, whether erect or depressed, and of the wings, whether raised over the back or directed forward, seemed to depend on the speed of the bird at

the moment of slowing down. Only once did we see the Eagle, upon leaving the eyrie, move to its edge and, expanding its wings to their full extent, rise almost directly without the usual preliminary step of dropping down several feet before ascending to the perch. We have a photograph of a bird in this unusual pose, on the nest, but unfortunately made with a long-focus lens which failed to stop the motion completely.

Whether the frequent act of devouring some of the food at the nest on the part of the old birds was invariably dictated by hunger, or more commonly incidental to an instinct, stronger doubtless at an earlier stage, to tear open the prey and prepare it for easier mastery by the young, we cannot say; we are inclined, however, to regard the eyrie as not only a rendezvous but as a sort of common dining table for the whole family. The fish and fowl were often partly disembowelled and an Eagle was once seen to carefully remove the gills of a fish before beginning to strip off the flesh.

Although we constantly watched the young Eagles, day in and day out for many weeks at their eyrie, and the old ones when both on it and their perches, we never saw them in the act of regurgitating the indigestible residue of their food from the stomach and we found but few castings of the adult Eagles intact; one of these had been freshly disgorged from a perch on the observatory tree, which the old birds had the habit of using when re-fitting their nest in March, 1924. It was a sodden cream-colored mass of the remains of feathers of the domestic fowl and measured an inch to an inch and a quarter in diameter; another, about which some doubt might be expressed, was found neither under any of the habitual perches nor on the nest but on the platform of our observatory, beneath the rail, to which the Eagles had been seen to resort after the novelty of the structure had worn away. This was a brown, flattened mass of hair, leaves and other organic substances, and measured about one and one-half inches in diameter; it might pass equally well, perhaps, for a pellet of an Owl but for one or two tell-tale objects,—the elytra of a beetle and an entire grain of corn, which inevitably suggest the digestive stomach or proventriculus of the fowl.

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(To be concluded)