

STUDIES OF FOOD AND GROWTH OF THE PRAIRIE FALCON

WITH SEVEN ILLUSTRATIONS

By F. H. FOWLER

In the spring of 1928 the bird lover who has the regular annual job of "loving" the Prairie Falcons in one of the cañons of the San Joaquin side of the Mount Hamilton range was either seriously sick, or in foreign parts, or forcibly confined by the police—therefore unable to perform his regular duties. The details do not greatly matter; the main thing is that two pairs of falcons hatched their eggs. The unique opportunity thus afforded to observe the young at progressive stages of their development was obviously not to be neglected.

Nest number 1 was in the upper foothills, at an altitude of about 1700 feet. The eggs were laid on the loose rock chips and sand of a small shelf overhung by the upper part of a sandstone cliff. The distance from the top down to the shelf was about ten feet, and from the shelf to the base of the cliff about forty-five feet more. From the bottom of the rock a steep slope of earth pitched off into a gully. The nesting site faced to the south.

Nest number 2 was in the lower foothills, at an altitude of about 800 feet. This nesting bluff also faced south, and was composed of conglomerate overlying soft sandstone. The eggs were laid in a slight depression in the sandstone, several feet back in a horizontal cleft formed by weathering along the plane of contact between the conglomerate and the sandstone base. The height from the base of the cliff to the nest level was about ten feet, but by working along from the end of the ledge, flat on one's face under the overhanging conglomerate, the nest could be reached without a ladder.

Higher on the bluff, and to the left, was a cavity occupied in 1928 by a pair of Horned Owls, apparently using an old raven's nest; in 1930 this nest had again changed tenants, being occupied by another pair of falcons that were photographed from a blind suspended on cables. This nest of 1930 is designated nest number 3, in the note on page 201 of this article.

On April 1, 1928, inspection through glasses from the opposite hill showed at least four and probably five eggs in nest number 1. On the same day a full set of five eggs was counted in nest number 2. On April 15, both sets were found to be still intact, and on going over the cliff to take photographs it was definitely ascertained that nest 1 contained five eggs.

A business trip delayed the next examination of nest number 1 until April 29, when it was found to contain five young falcons, about nine days old, according to subsequent weight comparisons.

Nest number 2, which could not be visited until May 6, then contained four very young birds, believed, after much subsequent study and figuring, to average about three days old. They were weak, had a marked tendency to capsize, and when they did roll over immediately curled up as if still in the shell. Only the most advanced had their eyes part way open, and the others showed very marked and extensive granulation around the unopened eyelids. No remnants of the fifth egg, nor of any chick hatched from it, could be found.

The young in nest number 1 were systematically weighed and photographed in the nest, until the family took to wing some time between May 23 and the next visit on May 30. Those in nest number 2 were weighed, and a selected bird photographed to scale, until they appeared ready to leave the nest when last visited June 6.

The labor and expenditure of time involved were considerable. Several members of my long-suffering family, and a young friend of a scientific turn, were at various times pressed into service as assistants and as rope tenders at nest number 1. When I slid over the cliff there on each trip my pack looked like that of an itinerant peddler starting on a summer's campaign. Doubts were even expressed in some quarters as to the sanity of one who having reached years of discretion and a weight of two hundred, slides over a cliff periodically, draped indiscriminately with two cameras, a tripod, a large focusing cloth, and a set of scales. Doubt ripened into certainty in the latter part of the season, when a butterfly net was added to the outfit, to bring in the wanderers from remote corners of the ledge.

An excellent series of still photographs of this family was taken, principally to show its nest-life. This was supplemented by two short strips of movie film

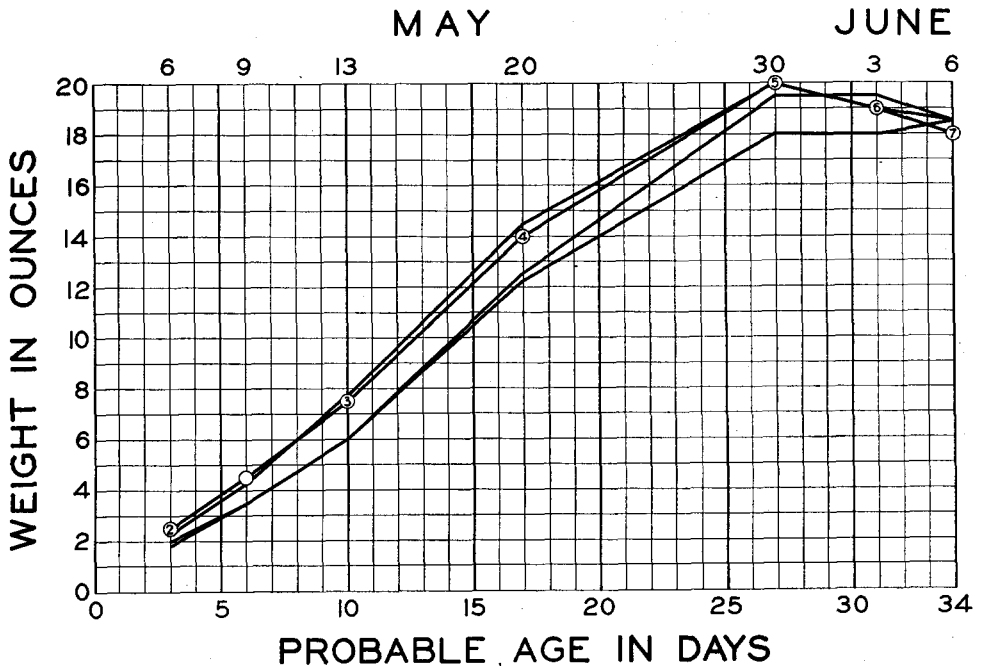


Fig. 41. DIAGRAM SHOWING RELATION OF AGE AND WEIGHT OF FOUR YOUNG PRAIRIE FALCONS IN NEST NO. 2. KEY NUMBERS IN CIRCLE REFER IN SEQUENCE TO FIGS. 42 TO 47 ACCOMPANYING THIS ARTICLE.

of young and parents, taken by a camera concealed in a concrete "rock" set on the end of the shelf and operated by pulling a fish line. All of these pictures form part of another story.

Weights taken at nest number 1, when adjusted to compensate for age, and for full or empty crop, correspond closely with the longer and more complete record taken at nest number 2, and are therefore not here included.

Such information on the food supply of nest number 1 as could be collected is included in table 1. The extent of this information is, I believe, about what can ordinarily be obtained from periodic examinations of a nesting site. It in no way compares in completeness or in interest with the observations at nest number 2.

The old birds at nest number 2 were extremely interesting. The female was very large and a strong flier, the male was very small, and the swiftest falcon I have ever seen. In their gyrations during my periodic visits, in the perpetual war on the horned owls, and in a fight with an invading male from a neighboring pair, he actually flew circles around the heavier female, despite her marked strength and speed.

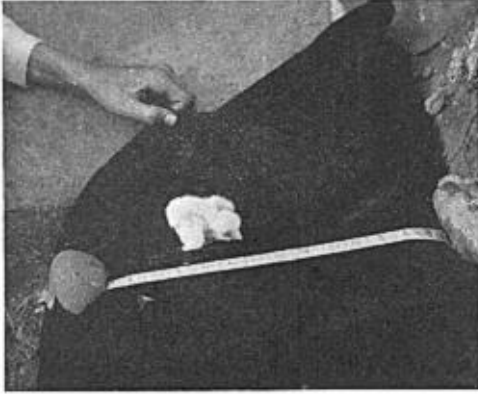


Fig. 42. TYPICAL YOUNG FALCON, PROBABLY THREE DAYS OLD AND WEIGHING $2\frac{1}{2}$ OUNCES. MAY 6, 1928. PHOTOGRAPH IS TO VERY SLIGHTLY SMALLER SCALE THAN FIGS. 43-47.

probably cleans off and eats the scraps of meat from the skin and bones, and leaves them where they are never found for record. The larger birds are ordinarily partially plucked before being brought to the nest, and the fag ends are probably carried away at the end of the feast. Smaller birds disappear on the spot as if by magic.



Fig. 43. TYPICAL YOUNG FALCON TEN DAYS OLD, AND WEIGHING $7\frac{1}{2}$ OUNCES. MAY 13, 1928. SCALE IN FIGS. 43-47 IS IN INCHES.

None of the material collected from the shelf at the base of the cliff can possibly be attributed to the owl family; the latter had left both the nest and the vicinity about two weeks before food remnants were gathered from any other

This pair were mighty hunters, remarkable for the variety of their quarry. They also had the habit of bringing in their game intact to the nest, or to a small shelf near the base of the cliff, and there plucking the birds and leaving the remains, after satisfying the ravenous family and their own appetites.

This habit is rare, I believe. Usually the mammals are torn into and partly eaten before being brought to the nest to feed to the young. When the feeding is about completed, the parent lifts the remains in its beak, makes a running start, and on the instant of taking wing shifts the remains to its talons. On some rocky point in the vicinity it then

probably cleans off and eats the scraps of meat from the skin and bones, and leaves them where they are never found for record. The larger birds are ordinarily partially plucked before being brought to the nest, and the fag ends are probably carried away at the end of the feast. Smaller birds disappear on the spot as if by magic. This habit of carrying remains away was observed from the blind in 1930.

The unusual opportunity for collecting food data afforded by the individual peculiarities of this pair of birds at nest number 2 was not discovered at first, due to the round-about path followed in removing the young from the nest to a small flat on the opposite side of the gully for photographing and weighing. We thus missed, during our first visits, the small ledge at the base of the cliff, where many of the bird and animal remains were left by the parents. Later in the nest life more and more material was found here and in the nest crevice proper.

location than the falcon's nesting crevice. The combined collection from both ledges gave a large and varied assortment during the latter part of the nest life. At each visit care was taken to clear everything away, thus avoiding duplication in listing.

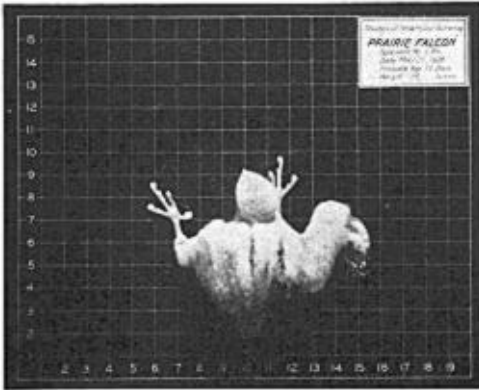


Fig. 44. TYPICAL YOUNG FALCON SEVENTEEN DAYS OLD, AND WEIGHING 14 OUNCES. MAY 20, 1928.

It is difficult or impossible to estimate definitely the number of animals represented by a given number of pellets from a nest. All the young may receive a full crop of fur from a single large ground squirrel. In a family of five, such as that at nest number 1, this meal might result in five pellets available for analysis from the death of one animal. On the other hand, five pellets found at the roosting place of a mature bird would almost certainly have meant at least five animals killed.

To this list prepared by Miss Bowen for nests numbers 1 and 2, I have added my own lists of materials collected but not sent to her; the combined results are shown in detail and summary, in table 1. The list of nest number 3 (shown only in the summary) includes the material brought in by the pair of birds I was photographing from the blind in the spring of 1930; no special effort was made to make this list absolutely complete by searching out every bone or feather.

After the photograph and movie campaign of 1930 had been completed, four pellets were found on the edge of the mesa, just behind the old bird's lookout rock across the cañon; none was found at the base of the rock. These pellets disgorged by the old birds measured 2.00 x 0.80 in.; 2.12 x 0.88 in.; 1.82 x 0.90 in.; and 2.10 x 0.90 in.; they are notably more compact and symmetrical than those of the young.

Observation of falcons in captivity coupled with the fact that these wild birds deserted their lookout point for the firmer footing of the flat mesa shows that the process of casting up a pellet is a serious and sea-sick business. When the symptoms of "casting" first attack a falcon it draws its feathers down flat, stands up full height, sticks its head and neck outward and upward, and for a few moments looks bereft of its senses. It then starts to duck its head in a series of quick jerks, at the same time contorting its neck violently from side to side. This muscular action appears to force the relatively large pellet from the bird's interior upward into the

A field list, with as full identification as possible, was made of all material when collected and most of it was then forwarded to the Department of Zoology, Stanford University. There, through the kind cooperation of Professor J. O. Snyder, a detailed analysis (particularly of mammal remains in the pellets) was made by Miss Lydia A. Bowen, then a graduate student in the Department. Thanks are due Miss Bowen for her very careful work. Extreme care was used to prevent duplication in both bird and mammal counts; this conservatism probably leads to an under- rather than an over-estimate of the number of mammals represented by the contents of the pellets.

crop. The sidewise contortions then cease, and the pellet is cast by a series of up and down pumpings of the head and neck. The bird then stands for a few moments seemingly with the sad question in its mind—"Would a good dose of Mothersills have obviated all of this?" It then shakes itself, resumes its interest in life, and begins to wonder where the next supply of fur and feathers is available.

The diversity of quarry dragged home to nest number 2 and particularly the recurring raids on neighboring Burrowing Owl families are of particular interest.

About twenty-seven days, as shown by the curves and photographs, bring the young falcons to their maximum nest weight of 18 to 20 ounces, with tail and

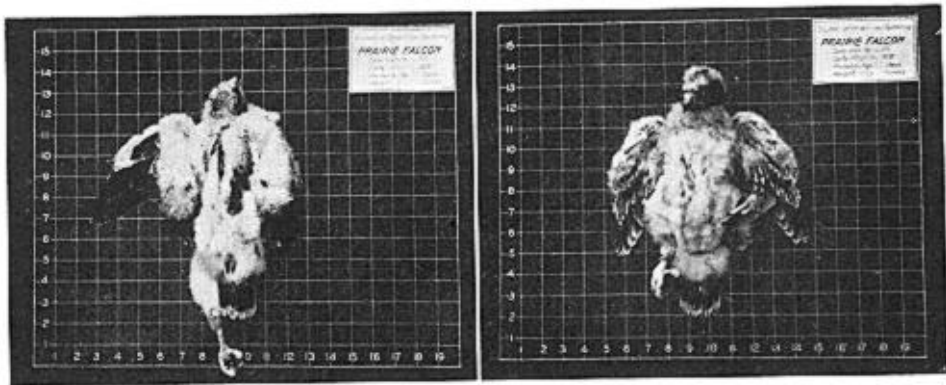


Fig. 45. TYPICAL YOUNG FALCON TWENTY-SEVEN DAYS OLD, AND WEIGHING 20 OUNCES. MAY 30, 1928.

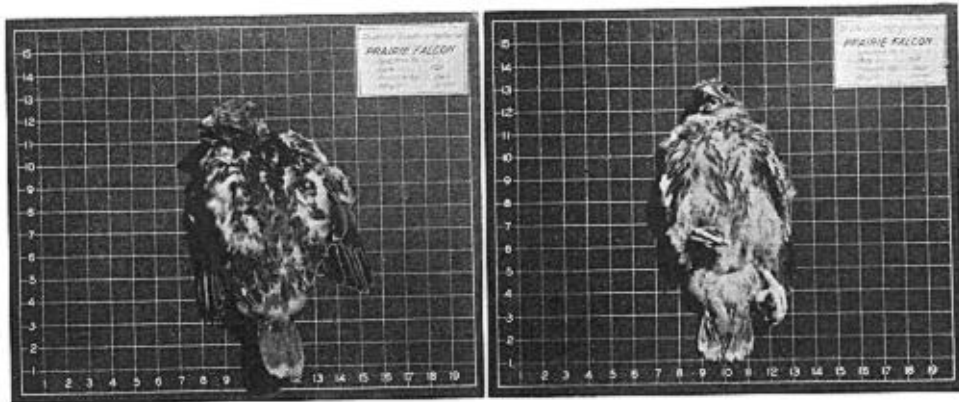


Fig. 46. TYPICAL YOUNG FALCON THIRTY-ONE DAYS OLD, AND WEIGHING 19 OUNCES. JUNE 3, 1928.

main wing feathers and a few tracts on the body well started. Seven days more of ravening feeding brings out the full feathering, but with a loss of weight. Final development of the wings and tail, and shedding of the down (by this time well hidden by the feathers), is completed after the young are on the wing, but still fed and guarded for an uncertain period by the parents.

Probably a definite weight of meat (with comparatively little variation one way or the other) is required to develop a young falcon from the egg to the day

of flight. Whether this food supply consists of tender birds or tougher rodents probably makes little difference in the total weight consumed. However, toward the end of the nest life the demands of the family are so tremendous that an endless stream of mammals and fair sized birds seems to be the only recourse of the hard-working parents. Small birds could hardly be caught fast enough.

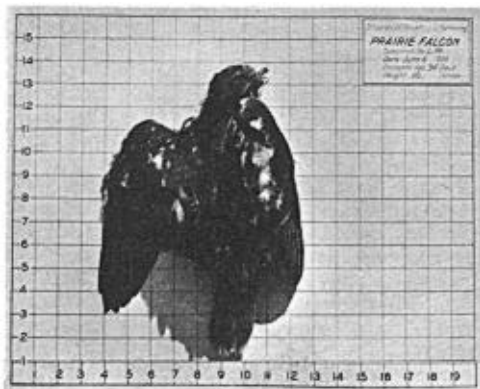


Fig. 47. TYPICAL YOUNG FALCON THIRTY-FOUR DAYS OLD, AND WEIGHING 18 OUNCES. JUNE 6, 1928.

The food actually secured probably depends to a large extent on the locality, the season, and the individual hunting ability of the parents. In the general locality of these studies ground squirrels and meadowlarks (being the most readily available source) probably form a large part of the normal supply of the average falcon family. Here, and elsewhere, it is probably more difficult for the parents to raise a brood hatched a month late than one hatched at the normal time. The hunting ability of the parents is a prime factor in at least the variety of the food supply.

Only by observing a large number of families can a true estimate of the falcon's economic status be established.

The wonderful development that takes place in the young is clearly shown by the curves of figure 41 studied in conjunction with the series of photographs, figures 42 to 47. In these figures is condensed much of the information secured by the expenditure of some fourteen days in the field and fifteen hundred miles of auto travel. They constitute a rather complete summary of the growth of the Prairie Falcon.

In the table occupying the following three pages (199-201) is given the detailed record of my findings in regard to the food of the Prairie Falcon, by the methods described on pages 195-196 of this article.

TABLE 1. DATA ON FOOD COLLECTED AT THREE NESTS
Nest No. 1, Located in the Upper Foothills, Elevation 1700 Feet

Date 1928	Material observed or collected	Count of birds or mammals
April 29	<i>Birds</i> Western Meadowlark, a few feathers.	1 Western Meadowlark
	<i>Mammals</i> Seven or eight pellets, one of which contained bones of two spermophile feet; one, the bones of one larger foot; others a few small bones and claws. Fragments of skin and tail.	2 California Ground Squirrels (probably more)
May 2	<i>Birds</i> No bird remains.	
	<i>Mammals</i> Nine or ten pellets with a few bone fragments. A few bits of spermophile skin and bone.	2 California Ground Squirrels (probably more)
May 6	<i>Birds</i> Western Meadowlark, a few feathers.	1 Western Meadowlark
	<i>Mammals</i> Eight or nine pellets. A few skeletal parts.	2 California Ground Squirrels (probably more)
May 9	<i>Birds</i> Western Meadowlark, one rather small foot, one wing and feathers. California Horned Lark, one feather.	1 Western Meadowlark, immature 1 California Horned Lark
	<i>Mammals</i> Six pellets, one containing the bones of two fore feet, another the complete hind foot of full-grown Ground Squirrel. One spermophile leg, and rib section.	2 California Ground Squirrels (probably more)
May 13	<i>Birds</i> Western Meadowlark, one newly killed bird, and many older feathers.	2 Western Meadowlarks
	<i>Mammals</i> No remnants found.	
May 16	<i>Birds</i> Western Meadowlark, three wings (a pair, and one smaller), one head and one foot.	2 Western Meadowlarks, probably both immature
	<i>Mammals</i> California Ground Squirrel, one hind leg and pieces of skin. No pellets.	1 California Ground Squirrel
May 20	<i>Birds</i> Western Meadowlark, one leg and some feathers.	1 Western Meadowlark
	<i>Mammals</i> No remnants found.	

Nest No. 2, Located in the Lower Foothills, Elevation 800 Feet

Date 1928	Material observed or collected	Count of birds or mammals
May 6	<i>Mammals</i> Nelson Spermophile: One seen in bird's talons.	1 Nelson Spermophile
May 9	<i>Birds</i> Western Meadowlark, one wing of very young and feathers of older bird. California Horned Lark, a few breast feathers.	2 Western Meadowlarks 1 California Horned Lark
	<i>Mammals</i> California Pocket Gopher, one skull, one pellet of gopher hair, and a few bones.	1 California Pocket Gopher
May 13	<i>Birds</i> Mourning Dove, numerous feathers. Other feathers, not identified.	1 Mourning Dove 1 Miscellaneous
May 30	<i>Birds</i> Burrowing Owl, two wings, probably a pair, from adult. California Horned Lark, one wing and a few feathers. Mourning Dove, four tail and wing feathers. Rock Wren, right wing. Brewer Blackbird, two feathers. Western Meadowlark, six wings, probably two pairs, and two left wings; one young and others apparently adult.	1 Burrowing Owl 1 California Horned Lark 1 Mourning Dove 1 Rock Wren 1 Brewer Blackbird 4 Western Meadowlarks
	<i>Mammals</i> No mammal remains.	
June 3	<i>Birds</i> Burrowing Owl, eight legs, apparently three pairs and two others (one long and one short); also four wings apparently one pair and two left wings. Western Meadowlark, four legs (one pair and two odd); eight wings (two pairs and four other rights); two upper and one lower mandible; three tails and miscellaneous remnants. California Jay, three legs (probably one pair and one odd); two pairs of wings; one tail and one head. One bird smaller than the other, but both mature. Brewer Blackbird, one leg; two left wings; feathers. California Shrike, one small wing.	5 Burrowing Owls, one immature 6 Western Meadowlarks, one immature 2 California Jays 2 Brewer Blackbirds, adult females 1 California Shrike, young
	<i>Mammals</i> California Ground Squirrel, remains of five counted on ledge.	5 California Ground Squirrels
June 6	<i>Birds</i> Burrowing Owl, three legs and one wing. Western Meadowlark, five legs (two pairs and one extra); three wings (one pair and one small extra); one small tail.	2 Burrowing Owls, one adult and one nearly grown 3 Western Meadowlarks

Date 1928	Material observed or collected	Count of birds or mammals
June 6	<i>Birds (continued)</i>	
	Poultry, one small white wing about the size and shape of a meadowlark's; probably a Leghorn chick from a neighboring ranch.	1 Chicken (?)
	California Jay, twelve legs (five pairs and two extra rights); five right wings, and six left wings; four tails and three heads.	7 California Jays
	California Shrike, some small tail feathers.	1 California Shrike
	California Horned Lark, one left wing.	1 California Horned Lark
	Four pellets, of which three were chiefly composed of a few bits of bone and a mass of Jay and Meadowlark feathers; the fourth contained also Shrike and Horned Lark feathers.	
	<i>Mammals</i>	
	California Ground Squirrel, remains of two.	2 California Ground Squirrels

Note: Miss Bowen reported that in determining the hair (in the pellets) the microscope was used, and that it was easy to distinguish gopher hair. It was not possible however to distinguish California Ground Squirrel from Nelson Spermophile hair. A few Nelson Spermophiles may have been captured, but California Ground Squirrels certainly predominated. The data for nest no. 3, which was observed only in 1930, are not given above but are included in the summary below.

SUMMARY FOR THREE NESTS

Species	Nest no. 1	Nest no. 2	Nest no. 3	Total
<i>Birds</i>				
Mourning Dove	..	2	..	2
Burrowing Owl	..	8	..	8
California Horned Lark	1	3	..	4
California Jay	..	9	..	9
Western Meadowlark	8	15	1	24
Brewer Blackbird	..	3	..	3
California Shrike	..	2	..	2
Rock Wren	..	1	..	1
Poultry	..	1	..	1
Miscellaneous (unidentified)	..	1	6 ^a	7
	9	45	7	61
<i>Mammals</i>				
California Pocket Gopher	..	1	..	1
California Ground Squirrel	9 ^b	7 ^b	8	24
Nelson Spermophile	..	1	..	1
	9	9	8	26

(a) Probably all California Horned Larks or young Meadowlarks.

(b) Since some of these determinations are from pellets, the numbers listed are a minimum; probably many more are represented by the remains. Also, some here listed as California Ground Squirrel may have been Nelson Spermophile.

Palo Alto, California, May 14, 1931.