

MORNING AND EVENING WEIGHTS OF NESTLING BIRDS

by

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INTRODUCTION AND ACKNOWLEDGEMENTS

This study was made at the University of Michigan Biological Station from June 28 to August 19, 1944. It was conducted to point out the variations in the morning and evening weights of nestling birds of different species and of the same species as well as the fluctuations and variations of weights of the individual bird.

Only birds of the order Passireformes were observed.

They are:

Tree Swallow

Irioprocene bicolor

E. Bluebird

Sialia sialis sialis.

A total of 96 hrs. were spent in the field, all weights included were taken between 5:00-7:00 A.M. and 9:30 and 7:30 P.M. The early morning hours were chosen to secure the minimum weight and the late evening hours to secure the maximum weight of the bird. 471 weights were taken during this period not more than 33 on a single bird. A set of portable Triple-Beam balances, sensitive to 1/10 gm., fitted into a convenient case were carried from one nest to the other. A small brown paper bag was weighed at each nest, the nestling placed in it, weighed and the weight of the bag subtracted from the total weight to find the weight of the

before first feeding?

bird. The bag was used because here the birds usually remained quiet and still. A small cover was placed over the scales to eliminate interference of wind.

The weight of the bird is just as important as its length. There are numerous biological problems on which weights of birds will throw light. Variation and fluctuations of these weights furnish criteria of much importance in the understanding of physiological and ecological reactions of birds as living organisms. The physiology of the bird, its behavior and the influence of the environment are all interacting factors no one of which can be understood without a knowledge of the other.

For the privilege of carrying out this study as well as for helpful guidance I am indebted to Dr. Olin Sewell Pettingill, Jr., Ornithology Professor, at University of Michigan Biological Station.

Due to my arrival at the Biological Station at the end of the nesting season and as the work was reduced to 8 weeks, this report is by no means complete but rather a small portion of an interesting and informative study.

HABITAT

The physical conditions of any region have some effect on the habitat and behavior of the birds living in that region. In the case of the species studied such activities

as choice of nesting sight, length of incubation period, length of nesting life as well as increase and decrease in weight are modified in some way by the environmental conditions. For the purpose of correlating such facts the chart on climatic conditions of the Douglas Lake region has been compiled from.

The birds nested in boxes along the shore of Douglas Lake. The map on the following page has been prepared to indicate the direct location of each nest. Birds seen in the area were chiefly Passerine birds. The small trees and bushes along the shore include the Aspen (*Populus tremeloides*), white pine (*Pinus strobius*), red oak (*Quercus borealis*), and various species of cherries (*Prunus* sp.). Often before entering the box the birds would perch in a near by tree or shrub. The trees served as a means of safety for the parents. Many insects were observed in the area, these serving as the chief source of food for the birds.

NESTING BOXES

All nests studied were located in nesting boxes on posts 5 - 6 ft. in height placed along the edge of the shore line from 81 - 187 ft. apart. The boxes were of the standard type dimensions approximately 9 x 5 in, 7 1/2 x 5 in. and the top which sloped slightly 7 3/4 in. square. The opening

was about 1 1/2 inches in diameter and located about 5 inches from the bottom of the box. The front of the box was removable, fitting tightly by means of a hook on each side. This made it convenient for study.

NESTING SUCCESS

The number of swallows and bluebirds nesting in the area seemed to be somewhat reduced this year, in spite of the ideal location of the boxes. Only 5 nests were in use during the study, 2 bluebirds and 3 tree swallows. The tree swallows were 100% successful, 13 eggs being laid among the 3 nests and 13 hatching and 13 young being fledged. The bluebirds were only 66 1/3 % successful, 6 eggs laid among the 2 nests, 6 hatching but only 4 being fledged.

YOUNG

All birds under observation hatched between June 28 and July 4, 1944. The young of tree swallows and blue birds are altricial at birth being born with eyes closed and only a tiny bit of down and unable to secure their own food. They are poikilothermic and must be brooded constantly by the parent for the first few days. The bluebirds differ from the tree swallows in that their feathers covered with a rather gray blue down while the tree swallows have a clear

white down.

When the nestlings were removed from the nest on mornings and evenings they would become quite cool for at least the first five days. The exposure to light and the cooling perhaps had some effect upon the weight and accounts for a portion of the variations shown in graphs

On the second night after the bluebirds hatched, 4 easter kingbirds whose parent had deserted were placed in the nest by a fellow student. This resulted in a slight drop in weight for that night. After the king birds were removed the nestling bluebirds continued to gain normally.

The sixth day in the nest, the eyes were half open and the young were well covered with down. By this time they had gained approximately 5 gms. and were increasing at the rate of two gms. per day and losing approximately 1 gm. per night.

The ninth day they began to notice their surroundings and the juvenal plumage had already made its appearance along the principal feather tracks.

The temperature of the region made a decidedly great drop from 70° to 54° min. night recording for July 12, 1944. This was either the 14th, 15th, or 16th day for each of the birds being studied. It was on this day that I observed a greater decrease in weight during the night than on any other night. The decrease can no doubt be accounted for by

the inability of the parent to secure food on this day as the drop in temperature was accompanied by increase in wind velocity and a heavy rain throughout the day.

The birds when removed from the nest deposited a bit of fecal material. This was particularly true at the removal from the nest during evening observations. As there was no record kept of fecal deposits, I cannot say definitely but I am quite sure it must have had some effect upon the variations in weights of the bird.

The nests of the tree swallows was not kept very clean. The last 5 days it contained many fecal deposits causing it to have a very pungent odor. The bluebirds kept a much cleaner nest although there was a small bit of fecal material in it.

On July 9, 1944 on my morning trip to the nests I found Bird I and IV to be heavily parasitized by fly larva (probably Protocalliphora--inidentified in the Station Laboratory). Three about 5/10 mm. long were attached to the hand portion of the wing of Bird I and 2 to the under surface of the left foot of Bird IV. These parasites were well gorged with blood and doubtless had been there for some time causing fluctuation in the weights. The other 2 birds in the nest were not parasitized at the time but 4 larva were picked from the nest. All of the nests became infested before the study was terminated, two or three parasites being picked from a single nestling at one time.

REACTIONS OF THE PARENTS

As the sexes of the tree swallows are very much alike it is quite difficult to distinguish between the male and the female. The female seemed to be less beautiful than her mate, a little browner. With the bluebirds the female is quite a bit paler than the male and it is not nearly so difficult to distinguish between them. With each species studied both parents took part in the incubation and care of the young, first one and then the other bringing food and both protecting the young.

On my approach to Nest III Tree Swallows on several occasions I was attacked by both parents who persisted in diving at me time after time in an effort to drive me away from the nest. The parents of the other two nests of the Tree Swallows were not so upset at the interference and often perched on an adjacent aspect and watched the procedure, while waiting to feed the young.

The bluebirds parent would always leave the nest when I was about 10 ft. away and fly to the pine tree nearby, there flying from limb to limb quietly until I was through. When the nestlings were about 13 days the parents seemed more upset from the interference than at any other time each diving at me several times.

The following graphs indicate the morning and evening weights of the birds from the first evening or morning after

hatching to the last evening or morning before the bird left the nest. Here I have indicated the tremendous amount of variation that exists in the weights of nestling birds. It should be noted that there is a gradual increase in the birds' weight from the time of hatching to the time of leaving the nest. The increase averages about 2 gms. and the decrease during the night about 1 gm. During the period of nestling life between 9 and 11 days there was a more rapid increase in the weight during the day and the amount of decrease at night remained approximately the same.

CONCLUSIONS

From the weights collected in this study I have come to the following conclusions:

I. The average weight of a tree swallow at the time of hatching is 1.82 gms. and the average weight at the time the bird leaves the nest is 21.50 gms. The bird gains an average of 19.69 gms. during the nesting life. These data were compiled from weights of 13 species distributed among 3 nests.

II. The average weight of a bluebird at the time of hatching is 2.19 gms. and the average weight at the time the bird leaves the nest is 26.62 gms. The bird gains an average of 24.47 gms. during the nesting life.

III. Bluebirds weigh .37 gms. or 16.8 % more than tree swallows at the time of hatching. Bluebirds weigh 5.16 or 19% more than tree swallows at the time they leave the nest. The increase in weight among tree swallows is 19% or 4.78 less than increase among bluebirds during the nesting stage.

IV. Out of 159 loss and gain records for night weights recorded of tree swallows I found 36 cases of night gain and 123 cases of night losses. The highest amount lost by a tree swallow was 3.23 gms. lost by Bird I in Nest III which contained 5 young. This loss took place on the 12th night of the bird in the nest. On this night the loss of all the tree swallows weighed was higher than any other night.

V. More tree swallows lost weight on the 16th night which was in 8 out of 13 cases represented the last or next to the last night the bird was in the nest.

VI. Few tree swallows lost weight on the 8th night of nesting life than any other night. The average loss on this night was 1.07 gms. This weight ranked 6th from the lowest amount of average losses and 10 below the highest amount of average losses.

VII. A comparison of nests of tree swallows with 4 young and nests with 5 young showed the average loss during the nesting period to be slightly lower for the nest containing 5 young than for the nests containing 4.

VIII. From the weights of bluebirds recorded I found them to lose more weight on their 10th night of nesting life than on any other night. The average loss on this night was 1.63 gms. Less weight was lost on the 4th night. The average weight loss for this night was .12 gms. In only one instance was there recorded a case of night gain among this species. This occurred on the 7th night after hatching when the average loss for the other two bluebirds in the same nest was .58 gms.

IX. Weights of birds included conformed to a general rule. There was a gradual increase from day to day from the date of hatching until 5 days old, then a more rapid increase followed by a fairly stationary weight and then a gradual decrease just before leaving the nest.

BIBLIOGRAPHY

- Weaver, Richard Lee
1942
Growth and Development of English Sparrows.
Wilson Bull., 54: 183-191.
- Kendeigh, Charles S.
1934
The Role of Environment in the Life of Birds.
Ecological Monographs, Vol. 4, No. 3.
- Low, Seth H.
1933
Further Notes on the Nesting of Tree Swallows.
Bird Banding, Vols. 3-4, 1932-33.
- Kuerzi, Richard Gottron.
1941
Life Histories of the Tree Swallow.
Proceedings of the Linnean Society of New York, Nos. 52-53, 1940-41.
- Krug, Howard H.
1941
Bluebird Banding at Chesley, Ontario.
Bird Banding, Vol. 11-12, 1940-41.
- Nice, Margaret M.
1938
The Biological Significance of Bird Weights.
Bird Banding, Vol. 9: 1-11, 1938.
- Baldwin, S. P. and S. C. Kendeigh--Variations in the Weights of Birds.
Auk, 55: 416-467.

Comparison of Night Losses
of Blue birds

Night.	B.I	B.II	B.III	Au. Loss
1	.51	.49	.38	.42
2	-----	-----	-----	-----
3	1.07	.78	.88	.91 ⁺
4	.23	.12	.03	.12 ⁺ *2
5	.50	.49	.80	.59 ⁺
6	1.45	.39	.60	.81 ⁺
7	.57		.59	.58
8	.77	.94	.82	.84 ⁺
9	-----	-----	-----	-----
10	2.62	1.66	.63	1.63 ⁺ *1
11	-----	-----	-----	-----
12	-----	-----	-----	-----
13	1.67	1.51	1.08	1.42
14	1.96	2.52	1.81	1.09 ⁺

Conclusion - From the weights of Bluebirds recorded I find them to lose more weight on their tenth night of nesting life than any other night. The average loss for this night was 1.63 gms. Less weight was lost on the fourth night. This ^{av.} weight was .12 gms. In only one instance was there recorded a case of night gain among this species. This occurred on the seventh night after hatching when the average weight for the other two bluebirds in the same nest was .58

Night Losses of Tree Swallows Compared

Night	B. I	B. II	B. III	B. IV	B. I	B. II	B. III	B. IV	B. V	B. I	B. II	B. III	B. IV
	N. I	N. I	N. I	N. I	N. III	N. IV	N. III	N. III	N. III	N. IV	N. IV	N. III	N. IV
1	.42	.84	.06					.30		-----	-----	-----	-----
2	.27	-----	.71			.10	1.86	.11		.55			
3	-----		.88	2.10	.05		.01	.11		-----	-----	-----	-----
4	2.36	.55	.03	-----						1.69	1.30	1.74	1.42
5				.33		.31		.54	-----	-----	-----	-----	-----
6	.06	.51		.31	-----	-----	-----	-----			.40	.89	.29
7			.58			.22	.43	.13	-----	1.85	2.34	-----	2.11
8		2.68	.11	.41	-----	-----	-----	-----	-----	-----	-----	-----	-----
9	3.31	-----	.43	.41	-----	-----	-----	-----	-----	-----	-----	-----	-----
10	-----	1.79	-----		2.57	3.19	2.35	2.27	.68	.77	1.35	1.43	1.13
11		-----			1.57	.86	1.44	2.11	-----	1.51	1.55	1.06	1.56
12	-----	-----	-----	-----	1.64	3.23	2.76	3.07	1.96	2.11	2.03	1.33	2.12
13	-----	1.75	-----	-----	-----	-----	-----	-----	.53	1.23	.85	1.63	1.43
14	2.52	.08	3.86	2.87	1.29	.62	.80	.58	-----	-----	-----	-----	-----
15	1.93	1.20	2.44	1.74	-----	-----	-----	-----	1.97	-----	-----	-----	-----
16	1.73	-----	2.59	2.49	.98	2.83	2.49	2.53	1.72	1.75	2.68	1.83	2.70
17	1.69	-----	-----	-----	1.72	.01	1.44	1.45	.18	-----	-----	-----	-----

B. = Bird

N. = Nest

----- No record of loss or gain

||||| = Gain during night

Plate II

Comparison of Bluebird and
Tree Swallow Av. Losses.

Night	Bluebird	Tree Swallow
1	.42gms.	.41gms.
2	-----	.60gms.
3	.91gms.	.63gms.
4	.12gms.	1.29gms.
5	.59gms.	.39gms.
6	.81gms.	.41gms.
7	.58gms.	1.09gms.
8	.84gms.	1.07gms.
9	-----	1.65gms.
10	1.63gms.	1.75gms.
11	-----	-----
12	-----	-----
13	1.42gms.	1.22gms.
14	1.09gms.	1.57gms.
Total	7.41gms.	12.08gms.
÷ N. of Wts	10	12
Au. Loss Species	.74gms.	1.00gms.

Conclusion :- Average losses of tree swallow ^{21%} higher than average losses of bluebirds.

Average Night Losses of Tree Swallows.

Night	Loss
First	.418ms
Second	.608ms.
Third	.638ms.
Fourth	1.298ms.
Fifth	.398ms. *4
Sixth	.418ms.
Seventh	1.098ms.
Eighth	1.078ms. *3
Ninth	1.658ms.
Tenth	1.758ms.
Eleventh	1.458ms.
Twelfth	2.258ms. *1
Thirteenth	1.228ms.
Fourteenth	1.578ms.
Fifteenth	1.858ms.
Sixteenth	2.198ms. *2
Seventeenth	.968ms.

*4 On the twelfth night of the birds nestling life the amount of weight lost was higher than any other night, and on the fifth night the amt of weight lost was lowest.

*1 More birds lost weight on the sixteenth night which was in 8 out of 13 cases represented the last or next to the last night the bird was in the nest. The ^{av.} amt. lost on this night was 2.198ms. just six gms. below the highest average loss.

*3 Fewer birds lost on the eighth night of nestling life than any other night. The average loss for this night was 1.078ms. This weight ranked sixth from the lowest amt. of average losses and ten below the highest ^{av.} loss.

Comparison of losses in Nest with Four Young
and Nest with Five Young
Tree Swallows

Night	Nest I 4 young	Nest II 5 young	Nest III 4 young
1	.42g	.30g	-----
2	.50g	.69g	.55g
3	1.49g	.05g	-----
4	.98g	-----	1.31g
5	.33g	.43g	-----
6	.88g	-----	.52g
7	.58g	.28g	2.10g
8	1.60g	-----	-----
9	2.08g	2.18g	1.71g
10	1.79g	2.21g	1.17g
11	1.75g	1.49g	1.42g
12	-----	2.55g	1.92g
13	-----	.53g	1.28g
14	2.23g	.82g	-----
15	1.82g	1.97g	-----
16	2.27g	2.11g	2.28g
17	1.69g	.96g	-----
Total	20.41g	16.37g	14.26g
No. Nts.	15	14	10
Av. Loss	1.46g	1.16g	1.42g

Conclusion :- The av. loss during the nesting period was lower in the nest containing five young than was the loss in the nests containing four young.

Comparison of First and Last
Tree Swallow Weights
in Nest

Nest	Bird	First Wt.	Last Wt.
I	I	1.98 gms.	24.43 gms.
I	II	1.95 gms.	24.39 gms.
I	III	2.23 gms.	24.49 gms.
I	IV	1.46 gms.	18.83 gms.
II	I	2.12 gms.	21.91 gms.
II	II	1.91 gms.	21.37 gms.
II	III	1.71 gms.	20.87 gms.
II	IV	2.14 gms.	20.08 gms.
II	V	1.79 gms.	18.31 gms.
III	I	1.78 gms.	22.96 gms.
III	II	1.57 gms.	22.73 gms.
III	III	1.45 gms.	22.51 gms.
III	IV	1.51 gms.	20.72 gms.
III	XIII	23.60 gms.	279.60 gms.
		$\frac{1.815 \text{ gms.}}{13 \overline{)23.60}}$	$\frac{21.50 \text{ gms.}}{13 \overline{)279.60}}$
III	XIII	1.82 gms.	21.50 gms.

Conclusion - The average wt. of a tree swallow at the time of hatching is 1.82 gms. and the average wt. at the time the bird leaves the nest is 21.50 gms. The bird gains an average of 19.69 gms. during the nesting life. This data was gathered from 13 species distributed among 3 nests.

Comparison of First and Last
Bluebird Weights

Nest	Bird	First wt.	Last wt.
I	I	2.16gms	27.87gms.
I	II	2.23gms.	26.49gms.
I	III	2.14gms.	26.12gms
I	III	2.19gms.	26.66gms average

Conclusion - The average weight of a Bluebird at the time of hatching is 2.19 gms. and the average weight of the time the bird leaves the nest is 26.66 gms. The birds gain an average of 24.47gms. during nesting life.

Temperature of Douglas Lake Region Summer 1944

Date	Day		Night	
	Max	Min.	Max.	Min.
June 29	60	58	80	56
" 30	76	50	60	47
July 1	80	56	76	53
" 2	80	58	80	55
" 3	82	56	80	56
" 4	82	59	86	60
" 5	84	61	73	61
" 6	88	66	83	65
" 7	82	67	88	63
" 8	86	64	81	64
" 9	80	60	85	60
" 10	78	62	75	62
" 11	79	63	76	63
" 12	70	62	80	63
" 13	73	54	70	54
" 14	79	51	71	51
" 15	81	65	79	65
" 16	79	54	70	54
" 17	79	53	77	51
" 18	79	57	74	56
" 19	78	61	79	60
" 20	61	55	69	56
" 21	77	53	61	52
" 22	81	56	73	56
" 23	85	57	79	57
" 24	84	64	87	60
" 25	83	53	69	58
" 26	77	58	80	58
" 27	69	58	69	58
" 28	71	58	71	57
" 29	70	58	61	58
" 30	74	57	67	58
" 31	84	57	73	56

Average Weights of
Blue birds

Age	Bird I	Bird II	Bird III	Average
1 day	2.50	2.36	2.00	2.28
2 days	3.55	3.44	3.47	3.48
3 days	7.82	7.41	6.94	7.39
4 days	9.36	9.15	8.98	9.16
5 days	12.82	12.61	12.50	12.64
6 days	16.75	14.79	14.76	15.43
7 days	18.16	17.46	17.30	17.64
8 days	20.36	18.87	18.68	19.31
9 days	22.63	21.99	20.41	21.67
10 days	24.38	23.06	21.89	23.11
11 days	23.75	23.56	21.55	22.95
12 days	-----	-----	-----	-----
13 days	25.02	24.57	23.94	24.51
14 days	26.11	25.47	24.76	25.44
15 days	27.37	26.49	26.12	26.66

Average Weights of Some Passerine Birds

Age	Traa Swallow	Bluebird	English * Sparrow
1 day	2.3	2.3	2.8
2 days	3.3	3.5	4.8
3 days	5.2	7.4	6.9
4 days	6.9	9.2	10.2
5 days	9.9	12.6	11.7
6 days	13.2	15.4	13.8
7 days	14.0	17.6	16.4
8 days	17.4	19.3	18.0
9 days	18.5	21.7	20.3
10 days	20.3	23.1	20.4
11 days	22.1	22.9	22.7
12 days	21.7	---	22.7
13 days	22.1	24.5	25.6
14 days	22.7	25.4	25.2
15 days	22.3	26.7	23.9
16 days	21.9	---	26.0
17 days	21.5	---	22.5

* Note - These weights taken from growth study of English Sparrow by Richard Lee Weaver.

Average Weights of Nestling Tree Swallows.

Plate XI

Age	Nest I Bird I	Nest I Bird II	Nest I Bird III	Nest II Bird IV	Nest III Bird I	Nest III Bird II	Nest III Bird III	Nest III Bird IV	Nest III Bird V	Nest IV Bird I	Nest IV Bird II	Nest IV Bird III	Nest IV Bird IV	Average wt.
1 day	1.98	2.36	2.23	1.46	3.14	3.00	2.62	3.58	2.47	1.78	1.57	1.45	1.51	2.34
2 days	1.84	3.68	2.55	1.88	4.98	4.91	4.60	4.97	4.42	3.62	2.93	2.75	2.15	3.30
3 days	4.84	5.06	2.84	3.62	7.07	6.68	6.01	6.63	6.69	5.28	4.50	4.42	4.20	5.23
4 days	8.71	7.64	3.07	2.96	9.57	8.99	7.98	8.85	8.99	8.76	7.92	7.85	7.40	6.97
5 days	10.53	9.51	6.01	6.17	11.94	11.83	10.30	11.81	11.72	---	---	---	---	9.99
6 days	13.85	12.35	7.98	7.92	15.14	13.88	13.33	13.47	14.12	12.69	12.52	12.21	11.51	13.15
7 days	16.98	14.18	10.12	9.60	17.68	16.13	15.06	16.02	16.61	16.41	14.36	12.42	12.39	14.04
8 days	19.48	17.73	13.28	12.61	20.81	18.24	17.86	17.99	---	19.84	17.32	17.26	16.94	17.44
9 days	21.34	---	16.14	15.58	---	---	---	---	19.61	20.70	20.40	17.68	17.26	18.52
10 days	---	22.98	18.30	15.85	23.94	21.89	19.89	20.19	18.57	21.30	20.67	20.49	20.12	20.34
11 days	23.98	23.63	---	---	24.30	20.87	19.84	20.79	19.77	23.54	23.38	21.95	21.22	22.11
12 days	24.19	---	20.18	20.11	24.07	21.67	20.64	21.06	20.75	22.82	22.08	21.25	20.09	21.67
13 days	---	24.48	20.37	18.73	25.92	23.00	22.05	21.47	20.70	23.97	22.11	21.43	20.48	22.06
14 days	25.86	23.49	---	---	26.37	22.31	21.25	22.03	20.00	23.23	22.09	21.93	20.84	22.66
15 days	25.58	24.16	21.15	19.90	24.41	23.80	20.76	21.93	20.79	23.37	22.19	21.40	20.15	22.27
16 days	25.40	---	21.31	18.97	24.38	24.00	22.15	22.38	19.05	23.30	22.62	21.37	18.18	21.90
17 days	---	24.39	22.52	19.69	21.68	19.51	19.48	19.36	18.98	22.96	22.73	22.51	20.72	21.50
18 days	24.43	---	---	---	20.26	20.25	20.16	19.85	18.31	---	---	---	---	22.21