

A Study of Variations In the Development
of Nestling Cedar Waxwings.

By

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A Study of Variations In the Development of Nestling
Cedar Waxwings.

The purpose of this study was to determine whether any variation exists in the rate of growth of nestlings of a species, where different numbers of young are being raised. Weights and measurements of nestlings were taken daily from time of hatching until nest leaving. In one case where the nest was located after the eggs had hatched (Cedar Waxwing, Nest #4) the age of the nestlings was estimated. The growth data obtained for each nest was tabulated and compared with data of the same sort for the species that had been collected in the region by others. Graphs were drawn to illustrate daily averages of the weights and more significant measurements for young of each nest, and the growth and development curves for each nest, were compared. Lastly a review was made of the principal literature on the subject of bird weights, with particular stress on that relating to the species studied, in attempt to obtain a basis for the interpretation of the data at hand.

The field work for this study was done on four nests of the Cedar Waxwing (*Bombycilla Cedrorum*) Time spent in field work totaled about thirty-five hours. It is obvious that no conclusions could be based on such meager records, particularly since only two broods of the Cedar Waxwing studied survived nestling life. To obtain data for comparison use was made of weights and measurements of nestling Cedar Waxwings taken by students at the Biological Station, as part of life history studies. The comparative presentation of this scattered data in one report may be useful.

I wish to express my thanks to all those whose work supplied this additional data. I am greatly indebted to Dr. O.S. Pettingill, Jr. for originally suggesting this study and for guidance given during the work.

METHODS.

Weights were taken on a triple beam balance fitted into a portable field case. Making allowance for disturbance of the scales by wind, they are accurate to one-tenth of a gram. All weights were taken in the evening from four to seven o'clock. Weights were taken as near to the nest site as was possible so as to disturb nestlings as little as possible. Where tower blinds were erected (waxwing nests #3 and 4) weights and measurements were taken within the blinds.

Six measurements were taken. They were total body length, wing extent, length of wing from bend to tip of longest primary, length of bill, length of tail, and length of tarsal toe. Standard procedure of measurement was followed. (See Baldwin, Oberholser and Worley's Measurements of Birds). A pair of dividers and a millimeter rule were used in measuring.

Marking nestlings so individual records can be kept is always a problem in a study of this sort. Two attempts at marking by tying threads on the legs of nestlings (Waxwing nests #1 and 2) proved this method to be completely unsatisfactory. The threads were invariably removed by the parent birds. After this, nestlings were marked on the feet with red fingernail polish. When renewed every two days, this provides easily recognized markings which apparently do not disturb the adult birds. In one instance a young goldfinch two days out of the nest was found. The markings on its feet were four days old, but were still distinct enough to be recognized.

SOURCES OF ERROR.

The chief source of error in weights was defecation by the young birds before weighing. Several attempts were made to check the possible amount of loss in this fashion. Feces of young waxwings naturally varied greatly in weight with age of the nestling. Loss of weight by defecation was found to amount to from .2 to .4 gram in nestling waxwings over eight days of age. The amount of loss in younger waxwings was not determined. No attempt was made to correct weights for such loss. In any large series of weights of any species loss in this manner would be insignificant.

In measuring, the bothersome source of error was in taking wing extent, and total body length measurements. I quickly found that it was possible to stretch nestlings so much that the measurements decided on was more or less arbitrary. The only correction for this is to try to use a uniform amount of stretch. Nevertheless the error is probably considerable. That is the reason why I have relied more on weights than on measurements in making growth comparisons.

Development of Nestling Cedar Waxwings.

Data is presented on the growth rates of nestlings in six nests of the Cedar Waxwing. I collected data on weights and measurements from four nests. These are numbered consecutively according to the time when the first egg hatched. The other figures on growth are from nests studied by Jeanette Dickson in 1939 and by Robert Lea in 1940.

RECORD OF WAXWING NESTS.

Nest #1 (1944)

This nest contained four eggs. One nestling hatched July 10 and was weighed for eight days. The other three eggs didn't hatch.

Growth data from this nest is of little use in a study of average growth rates because the nestling was disturbed so much that its growth could not have been normal. Unknown to me, the nestling was disturbed ~~to me, the nestling was~~ ~~disturbed~~ morning and evening by a student studying morning and night weights besides my daily weighing and measuring. The other eggs were chilled, and on the fifth day the nest was deserted. The young bird was left in the nest to see how long it would survive without food. A careful check was kept to see that the nest really was deserted. Three visits were made besides the nightly visits for weighing. At no time were any waxwings seen or heard in the vicinity of the nest after the fifth day, while until the fifth day a brooding bird had been flushed from the nest at every visit. On the sixth and seventh days, the nestling showed progressive emaciation and loss of weight. On the eighth day the nestling was dead. Death had evidently occurred only a few hours before, since no activity by maggots was found. The weight loss was 5.4 grams from 19.6 gram on the fifth day to 14.2 grams on the eighth day. This is a loss of 27% of body weight before death which shows remarkable resistance for a nestling barely out of the cold-blooded stage.

Line graphs of the daily weight, wing extent, wing length, and total body length of this nestling are figured in Waxwing Graph Series A page I. Its weight increase for the first five days is shown on Waxwing Graph G, page IV.

Nest #2. (1944)

This nest contained five eggs. The first nestling was hatching about noon on July 13; and all five were hatched by the evening of July 14, when the first weights were taken. This the first day average show 5 grams, is slightly high as some of the nestlings were nearly one and a half days old. Weights and measurements of these nestlings were taken for seven days until July 21. At the evening of the seventh day it was cold and raining, and the young birds apparently were chilled when taken from the nest. Three of them were dead on the evening of July 22, and the remaining two by evening July 23. The data from this nest is of use, since nestling development for the first seven days was normal. Average daily development of these nestlings is figured in Waxwing Graph Series B page I, and the weight increase for the first five days as compared to other waxwing nests is shown on Waxwing Graph G page ~~IV~~ ^{III}.

This waxwing nest failure was plainly because of exposure of nestlings due to my interference, and is not a case of nest desertion. On the eighth day, July 22, a brooding bird was flushed from the nest, which contained three dead nestlings, and two very nearly dead at the time. The three dead nestlings were removed, and the parent bird returned to the nest in about five minutes. On July 23 the remaining nestlings were dead, but both adult birds were still in the nest vicinity.

Nest #3 (1944).

This nest contained five eggs. Hatching had begun on the evening of July 14, By the evening of July 15, when the first weights and measurements were taken four young had hatched. The one nestling exactly 24 hours old weighed 3.9 grams. First day figures here are slightly low since some nestlings were less than one day old. The fifth nestling was hatching on the evening of July 16, and was first weighed on July 17. The uneven hatching in this nest tends to flatten the average growth curves. Average daily development of these nestlings is shown in Waxwing Graph Series C. page II. The average weight increase for the first five days is shown on Graph G, page IV, and the weight increase from the fifth to twelfth days is shown on Graph H, page IV.

These nestlings left the nest on the fourteenth day, July 29. On the fifteenth day the five nestlings were out on the branches around the nest, and could not be caught for weighing and measuring. On subsequent visits I could find no waxwings in the vicinity.

Nest #4 (1944).

This nest contained two young when found on July 31. Neither nestlings' eyes were completely open, and the primary feather sheaths were 2-3 millimeters out of the skin. On this evidence I estimated the nestlings to be five days old, and recorded them as of this age. The condition of eyes and wing

feather sheaths agrees with that in waxwing Nests #1, 2 and 3 at known ages of four to five days. Lea, who studied Cedar Waxwings in this area in 1940 states "The eye slits of waxwing nestlings at four days were apparently ready to break open." I believe that the time of opening eye slits is constant enough among waxwings to permit the above estimate.

These nestlings were weighed and measured until they left the nest at the age of thirteen days. The nest was poorly constructed, and fell to pieces completely on August 5, so that these nestlings spent their last two days of nestling life perched on one of the branches that had supported the nest. Their average development is shown in Waxwing Graph Series D page III and their weight increase from the fifth to the twelfth day is shown on Graph H, page IV.

Nest #5 From the data of Robert Lea, 1940.

This nest contained three young. Growth data is shown in Waxwing Graph Series E, page III, and weight increases from hatching to fifth day, and from fifth to twelfth days are shown on Graphs G and H, page IV.

These nestlings did not leave the nest until the eighteenth day, which suggests that all of the waxwings that I studied left prematurely. The growth curve of Lea's waxwings agrees fairly well with those of the nests I studied, except that after the drop in weight from the tenth to twelfth days, his waxwings showed a rapid increase until leaving the nest on the eighteenth day. I was not able to locate any of the nestlings from Nests #3 -4 after they left the nest, so I cannot say whether they would have shown a similar increase.

Nest #6 From the data of Jeanette Dickson 1939.

Records of weights and wing extent and length measurements were kept for two nestlings from a nest of three from hatching until nest leaving on the twelfth day. I averaged these figures for two nestlings, but it is not a true average for the nest since no data was given for the third nestling. Growth data of these nestlings is figured in Waxwing Graph Series F, and weight increases are shown on Graphs G and H. *page IV.* *Fig I*

Dickson's waxwings show higher first day weights and more rapid increases during the first week than any others that I studied, or saw data for.

Miscellaneous Data on Waxwing Weights.

These are scattered single mentions of Cedar Waxwing weights for both nestlings and adult birds, and comprise all of the Cedar Waxwing weights I could find in the available ornithological literature. These may be of some aid in interpreting the weights I have recorded, and also will illustrate how very little is known about the weight variations of even so common a bird as the waxwing.

1. In T.S. Roberts Birds of Minnesota, the only one of the widely circulated bird books to include bird weights, the weight of the adult Cedar Waxwing is given as from 1.06 to 1.5 ounces or from 29.7 to 42 grams.

2. Robert Lea (1940) records an adult male Cedar Waxwing trapped for banding while feeding young, as weighing 27.9 grams.

3. F.H. Herrick (Wild Birds at Home, 1935) shows photos of a young Cedar Waxwing that weighed 5 grams shortly after hatching, and 39.6 grams at the age of ten days.

4. S.P. Baldwin and S.C. Kendeigh (Variations In The Weight of Birds, 1938) made a detailed study of weight variations of many species trapped for banding over a period of nine years. The record only one Cedar Waxwing weight, an immature trapped in August that weighed 25.9 grams.

5. Mrs. Kenneth B. Wetherbee (Some Weights and Measurements of Live Birds, 1934,) shows four Cedar Waxwing weights of birds trapped in July. Two adults each weighed 31.1 grams. Two immature birds weighed 26 grams and 27.1 grams.

6. Paul Stewart (A Preliminary List of Bird Weights, 1937) lists weights of nineteen adult Cedar Waxwings which averaged 36.84 grams with extremes of 40.25 grams and 32 grams.

SUMMARY OF DEVELOPMENT OF CEDAR WAXWING .

1. Weight.- The weight curve shown in the graphs of average daily weights followed the same general pattern for all nests. There was a rapid and generally constant rise until a peak was reached on the tenth to twelfth days. This was followed by decrease in weight during the period from the eleventh to the thirteenth day of nestling life. For the four nests on which data at this stage is available, the loss during this time averaged about one gram. This was the stage at which young waxwings left the nest in the nests I studied. Lea's weights of waxwings, which remained in the nest until the eighteenth day show a constant rise from the twelfth to the eighteenth day, with a gain of seven grams during this time.

WEIGHT CHART

Nest No.:	No. of Nestlings :	Highest Average weight reached before first decrease, :	Age at This time.
#3-1944 :	5 :	26.5 Grams	: 11 days
#4-1944 :	2 :	31.9 "	: 12 days
#5(Lea Nest) :	3 :	26.9 "	: 10 days
#6(Dick-son Nest)(2 weighed) :	3 :	30.8 "	: 11 days

Chart 1 Peak Weights Reached.

2. Wing Extent. Wing extent shows a far more rapid increase than any other measurement taken, as might be expected. The wing extent curve shows a slow rise until the fourth day with a rapid rise thereafter. The rise of the curve for nests I worked on begins to slow about the time of nest leaving (thirteenth to fourteenth day.) Lea's waxwings showed a much slower increase in wing extent from the twelfth to the eighteenth days. This slowing of growth had begun to be noticeable in nestlings I studied by the twelfth day. Comparative wing extents

on first day and twelfth day are shown in Chart 2.

3. Total Body Length. The total length curve shows a more gradual but constant rise, beginning to flatten out after the tenth to twelfth day, usually. For Nest #4 the rise was constant until time of nest leaving. Total body length at first and twelfth days is shown on chart #2. The choice of the twelfth day was again arbitrary since this was the time of earliest nest leaving.

Nest	No of Nestlings	Ave. Wing Extent 1st day	Ave. Wing Extent 12th day	Ave. Body Length 1st day	Ave. Body Length 12th day.
#1	1	41.5 m.m.	X	45 m.m.	X
#2	5	36 m.m.	X	46 m.m.	X
#3	5	53 m.m.	168 m.m.	42 m.m.	122 m.m.
#4	2	X	205 m.m.	X	133 m.m.
Lea Nest #5	3	X	200 m.m.	X	120 m.m.
Dickson Nest #6	3 (2 weighed)	56 m.m.	140 m.m.	58 m.m.	122 m.m.

Chart 2. Comparative Wing Extent, and Body Lengths X=No data available

5. Wing Length. Insufficient material is at hand to justify a description of the growth curve. The one complete record for Nest #3 shows a number of abrupt rises and plateaus.

CONCLUSIONS

As has been shown by graphs and development charts, the growth rate of the two nestlings in Nest #4 was conspicuously more rapid than the growth rate of five nestlings in Nest #3. The highest average daily weight for Nest #4 was 31.9 grams, when nestlings were twelve days old. In contrast the highest average daily weight in Nest #3 was 27 grams when the nestlings were thirteen days old. The highest daily average for Nest #4 was 1.9 gram higher than the maximum weight recorded for the heaviest nestling in Nest #3. The highest daily averages from nests studied by Lea and Dickson, each containing three nestlings, fall between these extremes.

From this very scanty data, it would seem that in the Cedar Waxwing, at least, there is a direct connection between the growth rate of the nestlings, and the

number of young in the nest. It might eventually prove that the rate of growth is in inverse proportion to the number of nestlings. There are far too many unknowns for the nests for which figures are present to draw any such conclusions. Possible variation in amount of food available or in weather conditions might account for some of the differences shown. I did not have sufficient time to observe feeding frequency at each nest to see if this varied. Any variation of this sort could obviously affect the growth rate of the nestlings. Only by a thorough study of a large number of nests could one be certain that no other variant existed, which could account for differences in growth rate. For the nests discussed here the only known point of variation was in the number of nestlings. If you consider that no other variant was present, then the rate of development of nestling Cedar Waxwings is controlled by the number of young in the nest.

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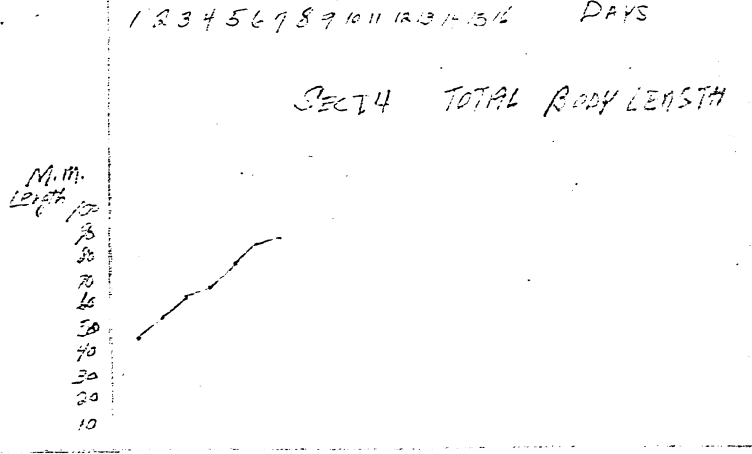
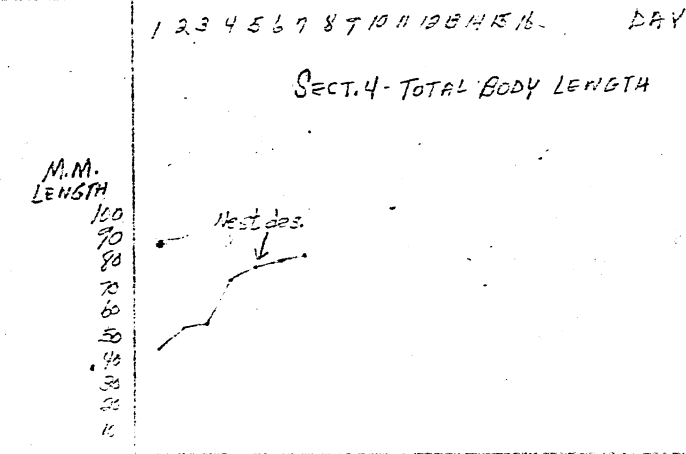
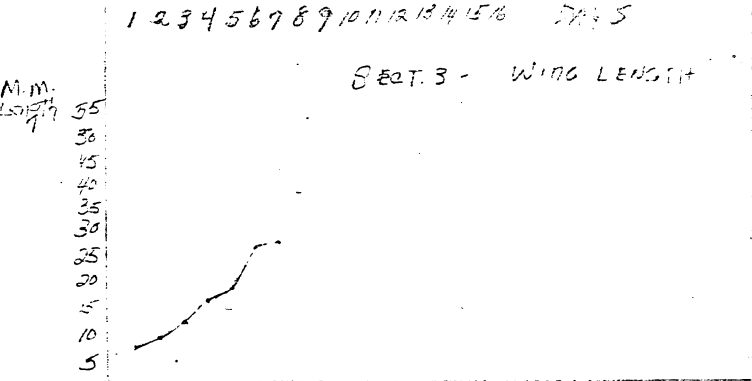
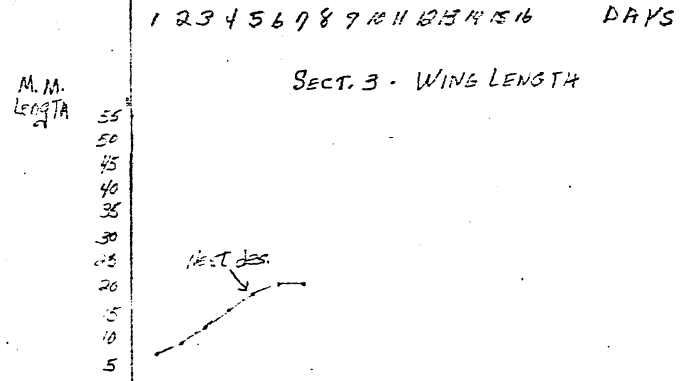
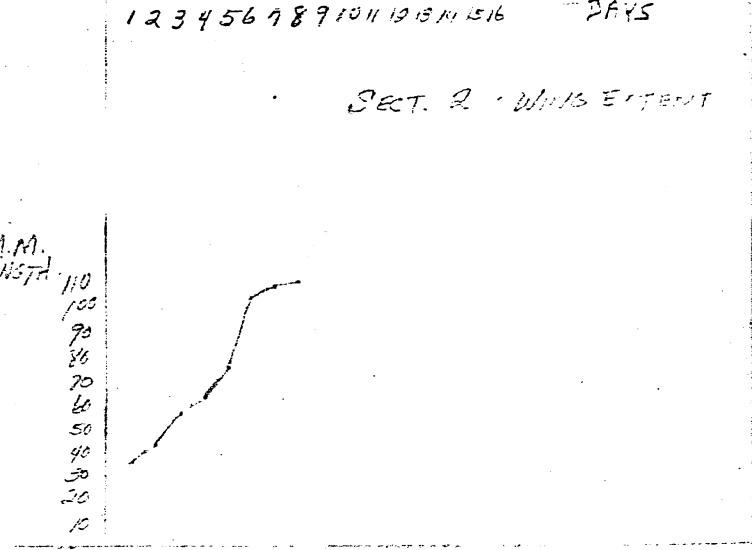
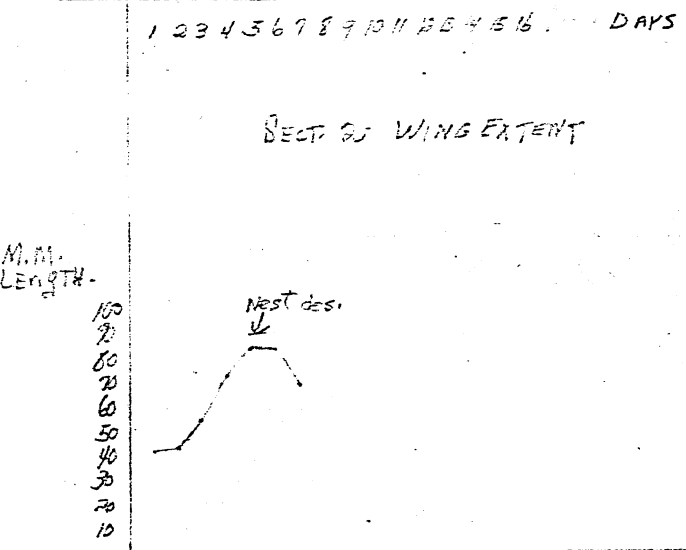
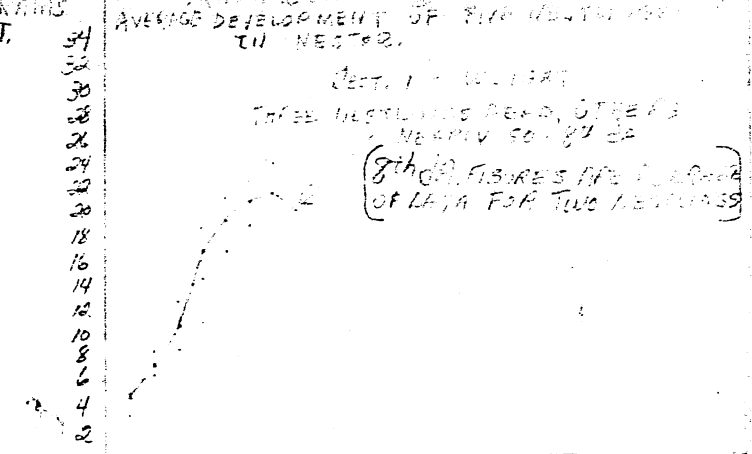
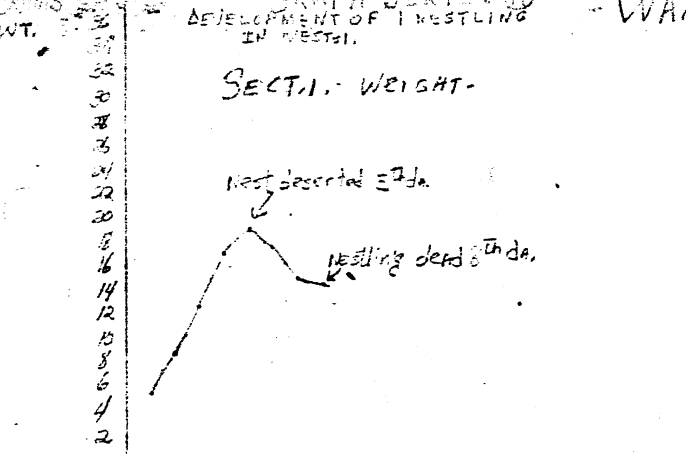
EXPLANATION OF GRAPHS.

Daily averages of weights, wing extent, wing length, and total body length for nestlings of each nest were graphed. The same scale was used for weights and measurements of each group so the growth curves would be comparable. For Graph Series E (Data of Lea) and Graph Series F (Data of Dickson) no wing length measurements were available.

Graphs G and H show average total increase of weight for each group of nestlings during the two main periods of nestling life. Graph G shows amount of increase from hatching to the fifth day. This covers the time during which the nestling is unable to maintain its body temperature, and before its eyes are open. Graph H shows amount of increase from the fifth to the twelfth day. The selection of the twelfth day was an arbitrary one. It was used because it was the earliest time of nest leaving among the nests studied. It is presumed that young Cedar Waxwings are capable of leaving the nest at any time after the twelfth day, and that the actual time of nest leaving is governed by outside factors, such as weather or interference with nest.

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Page IV top	Graph G	Weight Increase up to fifth day		
bottom	Graph H	Weight Increase fifth to twelfth days.		



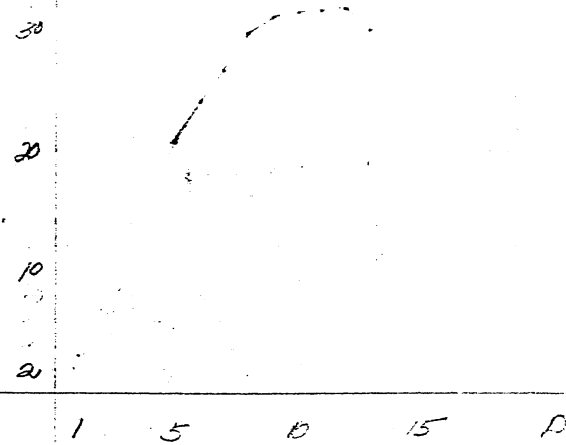
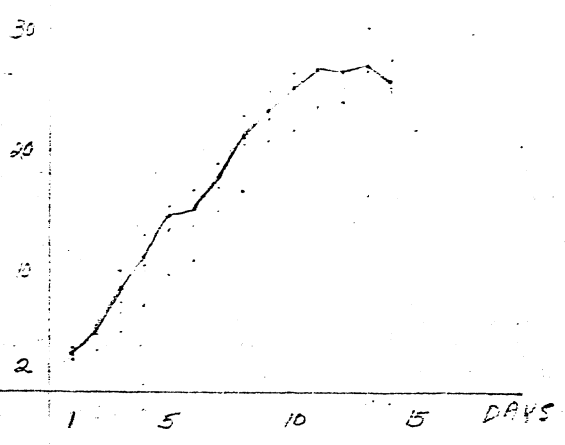
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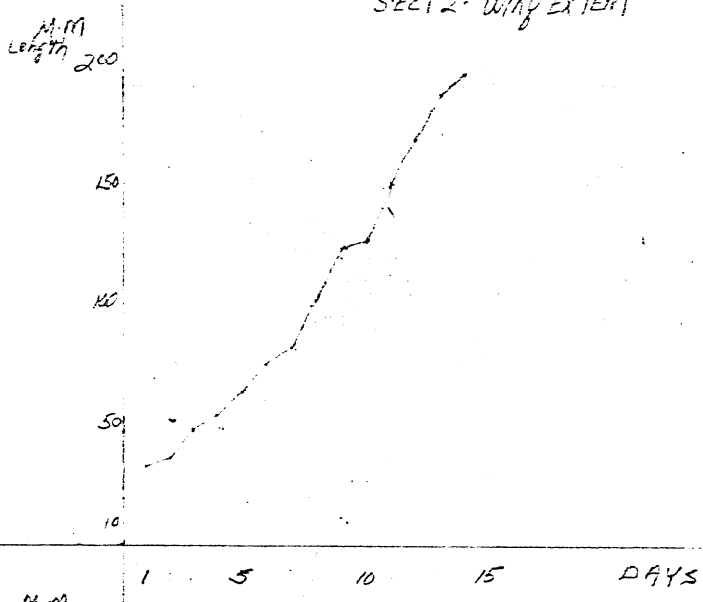
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 IN NEST 3. SECT. 1 WEIGHT

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 SECT. 1 WEIGHT

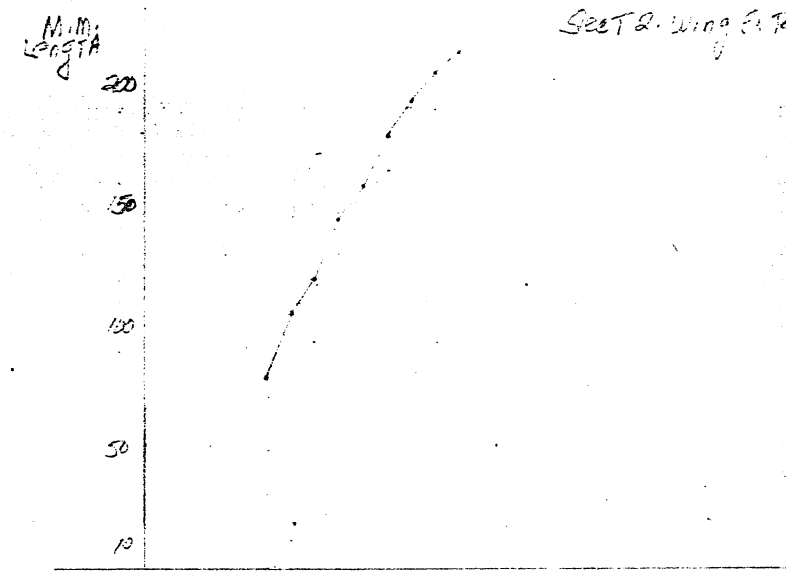
AVERAGE DEVELOPMENT OF TWO
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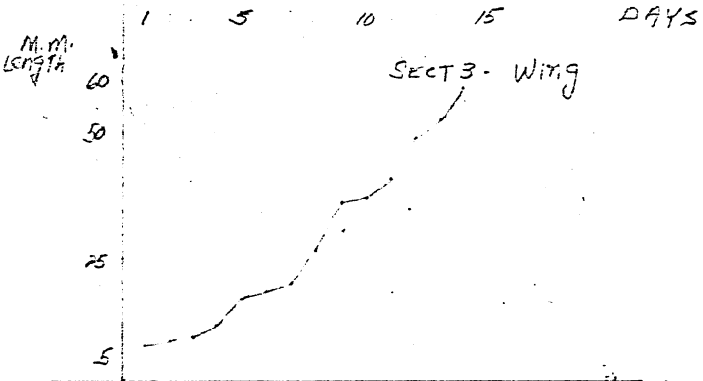
SECT 2 - WING EXTENT



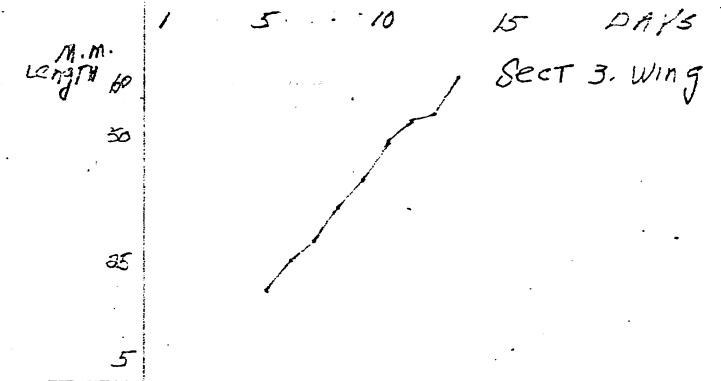
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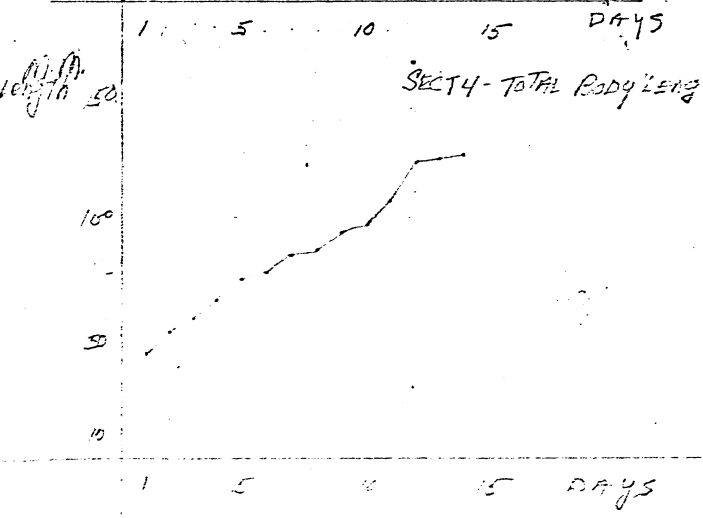
SECT 3 - WING



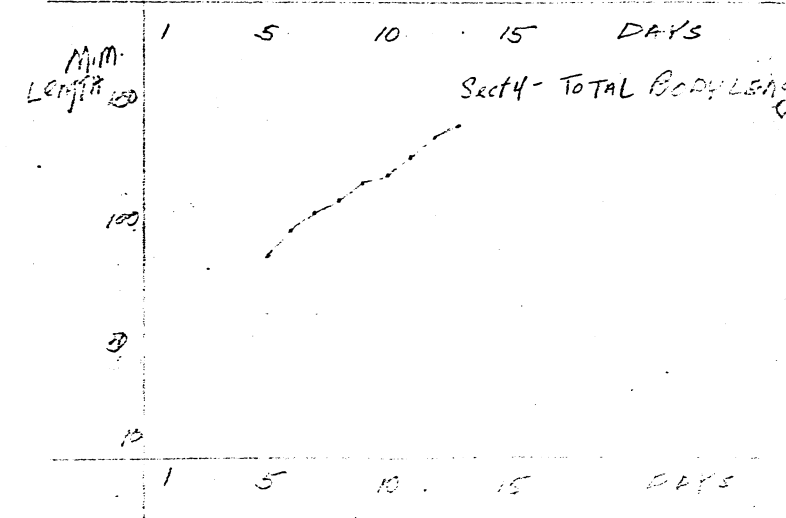
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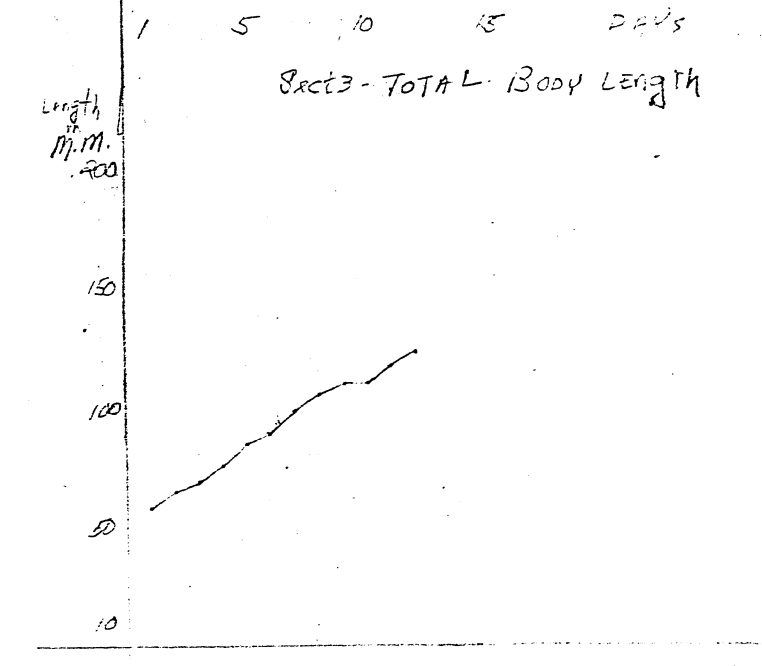
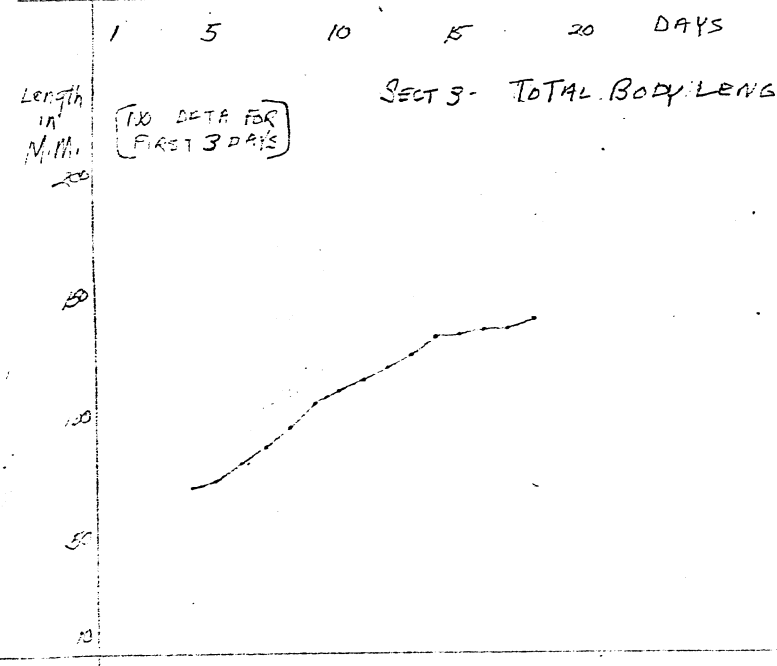
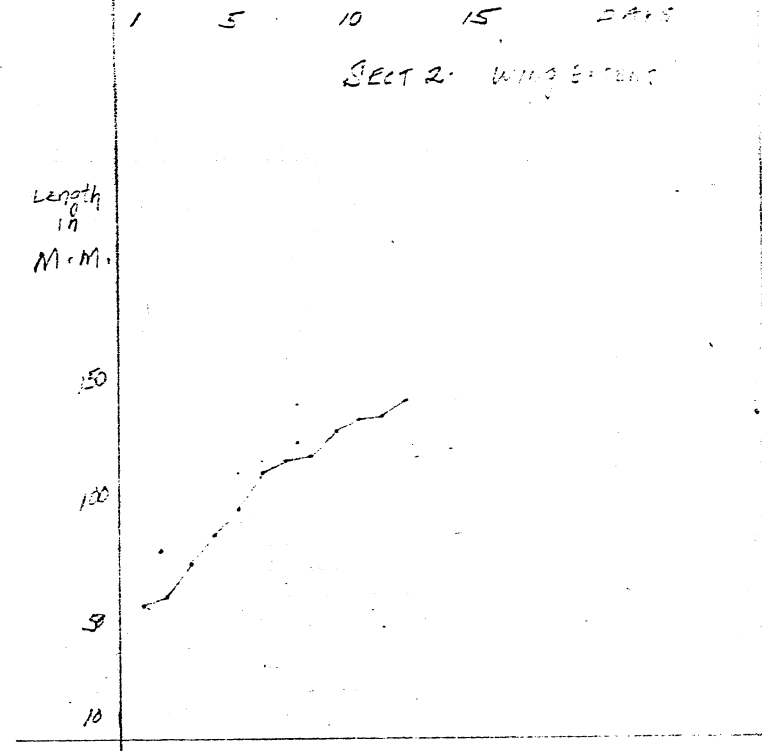
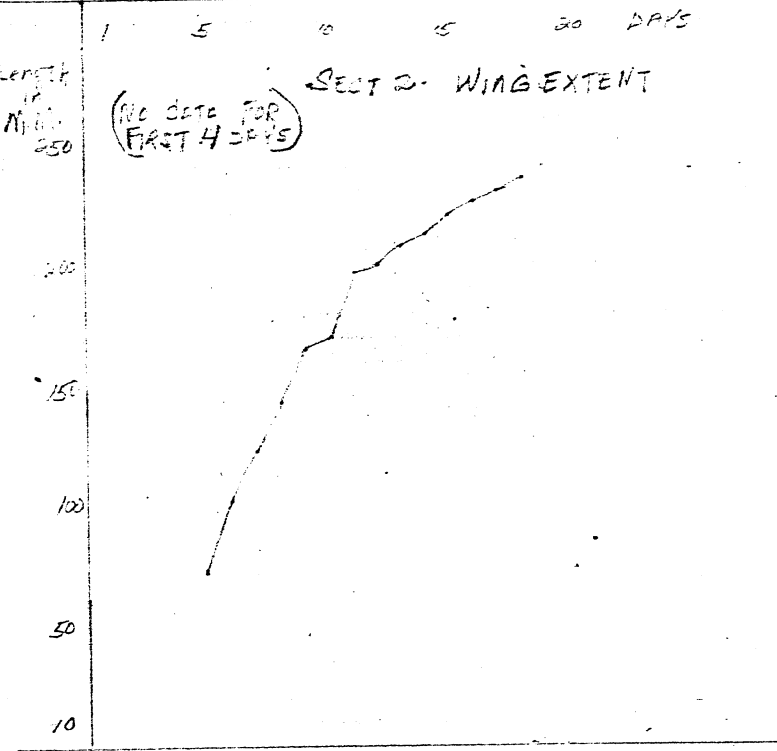
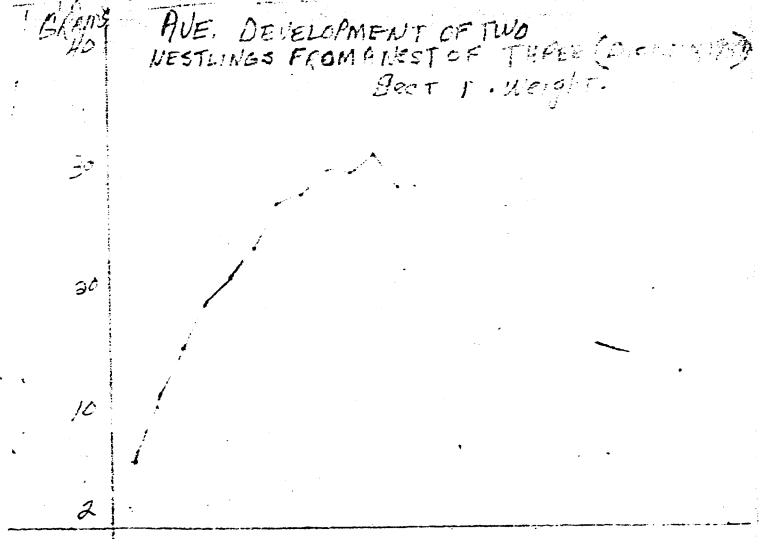
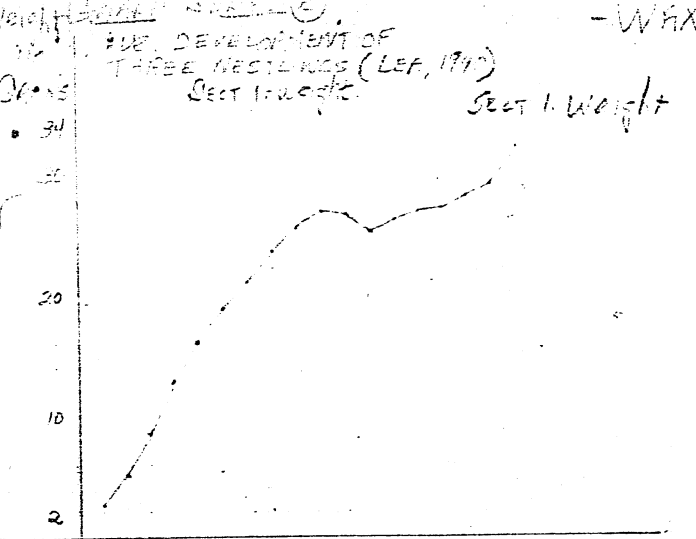


SECT 4 - TOTAL BODY LENGTH



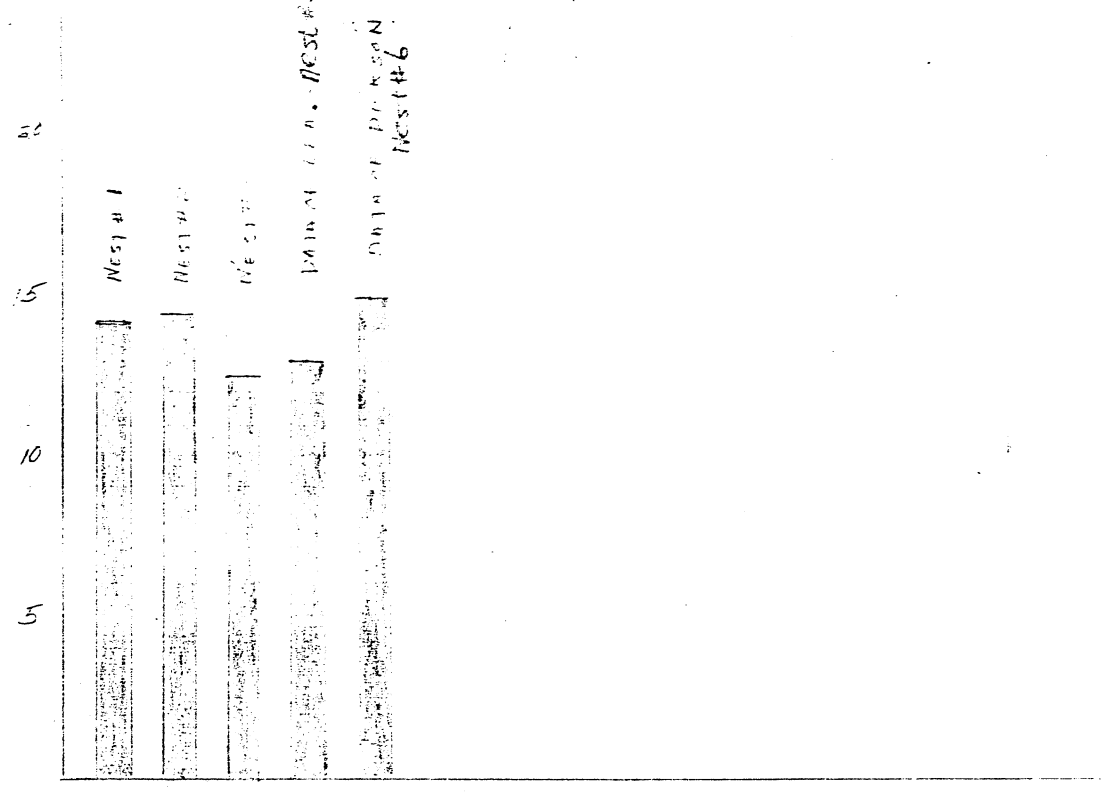
SECT 4 - TOTAL BODY LENGTH





GRAPH (G) - AVERAGE TOTAL INCREASE IN WEIGHT FOR FIRST FIVE DAYS.

NO. OF NESTS



GRAPH (H) - AVERAGE TOTAL INCREASE IN WEIGHT FROM FIFTH TO TWELFTH DAY.

Weight in Grams

