MOURNING DOVE PRODUCTION
IN SOUTHWESTERN IOWA[1]

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DURING 1938 and 1939, observations were made of the nesting of
Mourning Doves, *Zenaidura macroura,* in the vicinity of Lewis, Iowa,
to determine dove production in this area. Production is here con-
strued to mean the number of young reared to flying age and leav-
ing the nests. Lewis, Cass County, Iowa, was chosen as the focal
point of the observations. Within a radius of five miles of it, fourteen
farmyards and five other nesting sites, such as gullies and woods, were
selected for convenience of approach. Since the observer had no
idea of the abundance or distribution of breeding places of doves
in this region, all observation areas were chosen on the basis of
variety of cover and ease of approach during bad weather.

The region around Lewis is mainly rolling farmland cut by many
gullies, part of which are wooded or brushy. To the west of the
town lies the East Nishnabotna River which has been ditched and
straightened, but parts of its original bottom lands are still wooded.
Wooded hills are usually bur oak-shagbark hickory (*Quercus macro-
carpa-Hicoria ovata*) association fragments, while the bottomlands are
covered with elm-walnut (*Ulmus-Juglans nigra*), elm-soft maple
(*Ulmus-Acer saccharinum*) and elm-box elder (*Ulmus-Acer negundo*)
types. Roadsides and gullies are in many places covered with box
elder and plum (*Prunus*) thickets or dense growths of hemp (*Can-
nabis sativa*). Farmyards are usually protected by Scotch pine (*Pinus
sylvestris*), red pine (*Pinus resinosa*), and Norway spruce (*Picea abies*)
planted a generation ago, and a few fruit trees.

The town of Lewis is 160 acres in area with about 150 homes and
1600 trees. Only 4.4 per cent of the trees are evergreens and of the
remaining deciduous trees, elms make up 33 per cent, box elders 15.6
per cent, apples 10 per cent and soft maples 7 per cent. Altogether
there are 35 species of trees represented.

METHODS

On Monday, Wednesday and Friday of each week all of the trees
and other possible nesting sites in Lewis were examined. On Tues-
day, Thursday, and Saturday the trees of fourteen farmyards cover-

ing forty acres were examined; and a twenty-acre cemetery planted with large evergreens, four gullies, and Cold Spring State Park were worked over for nests. The park is wooded and covers sixty acres so no attempt was made to examine every tree at each visit. No systematic search for nests on the ground in plowed and cultivated fields was made, but rather those nests reported by farmers were observed and recorded.

For each nest discovered the height above the ground, the distance from the tree trunk—if in a tree—and the size of the tree were recorded. Bi-daily records were kept concerning the life of each nest, its occupants, and its accidents; and when feasible without endangering the nest, the eggs were measured with calipers and young banded when between five and eight days old.

The work on this project was done under the supervision of Dr. Geo. O. Hendrickson, Assistant Professor in Wildlife Management, Iowa State College, and T. G. Scott, U. S. Fish and Wildlife Service.

DEFINITIONS

In the following discussion the following terms are used. *Nest* indicates each separate and distinct nest that the birds build. *Nesting* indicates each time that the birds lay eggs in a nest whether old or new, or each attempt at starting or raising a brood. *Renesting* refers to another nesting or brooding attempt in a dove's nest previously used in the same breeding season. Additional dove nests built in a tree already containing a nest or having had a nest in it during that season are spoken of as *secondary nests*. An *active nest* is any nest containing eggs, young, or one which is in any way being used by a pair of doves. A *successful nesting* is one in which the young have reached flying age, that is, ten to thirteen days old, and have left the nest.

PRODUCTION OF NESTS

On the 220 acres under observation, 1108 nests were built in 1938 and 1443 in 1939. In these nests 1464 nestings were attempted in 1938 and 1975 in 1939. Hence these records concern 2551 nests and 3439 nestings. Approximately 250 breeding pairs of birds were active in the area in 1938 and 330 in 1939. The greatest number of nests existing in one day during the summer was taken as indicating approximately the number of nesting pairs for the area. There was an increase of 80 nesting pairs in 1939, but whether this increase was general over the southwestern part of the State was not determined. Each breeding pair averaged 5.85 nesting attempts in 1938

and, even though the pairs increased in 1939, they made 5.98 nest-ing attempts.

The start of the nesting season was on April 16 in 1938 and on March 23 in 1939. Although both years had warm weather during the last of March, it was quickly broken in 1938 by a heavy snow-storm on April 6, and interrupted in 1939 by a snowstorm on April 17. By this time many nests had already become established. The date that the last young left the last nest was October 15 in 1938 and October 11 in 1939. Gonadal development as shown by sexual activity of captive birds indicated that breeding activity could con-tinue from about March 20 to about October 15 unless altered by weather (Cole, 1933).

No new nests were built after September 17, 1938, and after Septem-ber 24, 1939. Although a storm of August 30 served only to trun-cate the September peak, a three-day cold rain and wind from September 13 through September 17 brought a halt to nest build-ing in 1938. Hot winds from September 4 to 15, 1939, stopped nest building except for three unsuccessful attempts made after September 15. Continued warm and calm weather after these dis-ruptive spells failed in both years to stimulate the birds to more nesting, although some were seen courting. Captive birds showed a cessation of activity at this time, too.

The nesting season in 1938 extended over 183 days, while in 1939 it covered 203 days. The nest-building season was, of course, shorter, covering 155 days in 1938 and 186 days in 1939. Nesting activity lasted 11 per cent longer in 1939 than in 1938.

The peaks of daily nesting activity in 1938 show four broods of young: one in June, one in July, a small one during the August nesting slump, and one during September. Fewer pairs were active in August and this produced the slump in active nests which was evident in both years. During June of both years the peak of nest production was on June 5. For 1939 this was the peak day of the year, while in 1938 highest nest production was on July 14. Considering the fact that the number of active nests during the last of June was increasing, it is probable that a high peak would have been reached in July of 1939 had not a severe storm destroyed one third of the nests.

STORMS

Wind and heavy storms are the greatest decimating factors of nests, eggs, and young. Nice (1922) reported similar findings in Oklahoma. During 1938 there were but few severe storms, while in 1939 the

season was a series of blasts. On June 7 a hailstorm occurred during which hailstones weighing as much as one-half pound fell. Nests were not only knocked out by wind and rain, but parents and young were killed on the nests by direct blows. Many species of birds were observed to have suffered from this storm. June 18 brought another severe storm, which halted the nest building that followed the storm of June 7. Losses of nests from storms and other causes were quickly regained. Late in June the number of nests was increasing daily and it is believed that there would have been a high peak in July of 1939 as there was in 1938, but on July 4 a near-tornado destroyed 33 per cent of the existing nests. Following this, nest production was gaining when subjected to another severe storm on July 16. Then a rainy spell during the first two weeks of August was climaxed by a cloudburst during the afternoon of August 10, when three inches of rain fell in two hours. As already indicated, the final slump of 1939 was brought about by ten days of hot, dry winds, which prematurely dried crops and blew nest after nest apart. While watching one high nest blow apart the observer almost caught the two young as they came crashing down to the hard pavement. During the two years of observation the majority of severe storms occurred at night.

Phases of Nest Building

Nest building of the Mourning Doves was divided into three phases. Graphic interpretation of the average difference between weekly losses and gains in the number of active nests during two seasons revealed these phases. During the first part of the season, from March 31 to June 9, there were more nests gained than lost each week so that there was a constantly greater number of active nests. This is termed the *acceleration phase* of nesting. From June 9 to September 1 occurred the *fluctuation* phase of nesting and it was during this time that the total active nests fluctuated with the vagaries of the weather, but each loss was regained. During the last of the season, from September 1 to the close of nesting in October, there were more nests lost each week than gained. This is the *deceleration phase* of nesting.

Production of Young

During 1938, 1502 young left nests in the observation area and during 1939, 1583 were successful. Storms and other agencies killed 220 young before they could leave their nests in 1938 and 275 in 1939. Therefore, in the two years 3085 young were raised and 495

were lost; or 3580 young hatched, but 13.7 per cent were killed. The per cent of loss in 1938 was 12.7 and in 1939 was 14.8.

The average number of young raised per nest built was 1.355 in 1938 and 1.097 in 1939. In 1938 the nesting attempts averaged 1.02 young and in 1939, 0.8. The young raised in successful nestings proved remarkably consistent, for in 1938 the average was 1.85 and in 1939 it was 1.8. Nice (1922; 1926) found a ratio of 1.7 young to the successful nesting.

Since nests are built constantly during the season, broods therefore overlap and are not evident. From the peaks shown by a graph there appear to be seven broods, but since breeding pairs average only six nesting attempts and lose half of these, this is not possible. The existence of broods is best indicated by observing all of the nesting attempts of single pairs. Some pairs succeed in bringing four sets of young from single nests. By determining the number of days between the earliest and latest nests to bring off four families, it is possible to indicate the presence of four broods. Since it takes but thirty days from egg laying until young leave the nests, theoretically, in a 180-day season six broods could appear.

In 1938, the earliest nest in which four broods were eventually produced was no. 38 built on April 30, and the latest was no. 529 built on May 25. In 1939 the earliest nest to produce four broods was no. 74 built on April 23, and the latest was no. 870 built on May 26. Six nests in 1938 and four in 1939 raised four broods. The time when the bulk of young from each brood left their nests was as follows:

TABLE 1

PERIODS OF SUMMER IN WHICH BROODS OF YOUNG MOURNING DOVES APPEAR

1938	Days
Brood 1—May 30 to June 20	21
Brood 2—July 5 to July 25	20
Brood 3—Aug. 5 to Aug. 25	20
Brood 4—Sept. 8 to Oct. 1	23

1939	Days
Brood 1—June 3 to July 4	30
Brood 2—July 4 to Aug. 3	30
Brood 3—Aug. 12 to Sept. 2	21
Brood 4—Sept. 13 to Oct. 3	21

Average	Days
Brood 1—June 1 to June 27	26
Brood 2—July 4 to July 29	25
Brood 3—Aug. 8 to Aug. 29	20
Brood 4—Sept. 10 to Oct. 2	22

The first brood begins to appear during the acceleration phase of nesting and the fourth brood falls entirely within the deceleration phase of nesting. The bulk of young appear during the fluctuation phase of nesting, since two broods are raised then.

Nesting Success

As a result of bad weather and the increased number of storms the nesting success of 1939 was less than that of 1938. Success in 1938 was 55.3 per cent while in 1939 it was 44.4 per cent, or 810 and 877 nestings, respectively. This is somewhat above the 40 per cent noted by Nice (1922) for Oklahoma. Destruction of nests containing eggs was more severe than the destruction of those containing young. During the two seasons the eggs hatched in 1,959 nestings, and only 272 of these nestings or 13 per cent were lost. Of the more than 6,300 eggs that were laid in two years only 48 per cent produced young that left the nest. Four times as many eggs as young were lost. Part of this greater success of young resulted from increased diligence on the part of the parents in protecting the nest. They did not defend the eggs with near the resistance demonstrated against danger to the young. Feet of the young are large and strong and they cling to the nest material tenaciously. Further, daily gain in weight as the young grow older also adds to the stability of the nest. All of these factors make the resistance of nests containing young 400 per cent greater than of nests containing eggs.

TABLE 2

THE NUMBER OF NESTINGS IN A NEST

Number of nestings	1938	1939	Total
1	845	1124	1978
2	183	233	416
3	57	70	127
4	12	14	26
5	2	2	4

TABLE 3

SUCCESS OF NESTINGS

Number of successful nestings per nest	1938	1939	Total	Per cent of success 1938	1939	Average per cent
1	502	542	1044	58	48	53
2	110	120	230	60	51	55
3	21	27	48	36	40	37
4	6	4	10	50	28	38
5	0	0	0	0	0	0

During two years the largest number of nesting attempts in a given nest was five. Two nests each year were used five times, but none of the pairs of birds succeeded in raising five broods from the same nest. Tables 2 and 3 give the number of nestings in each nest and their success.

The two-year average percentage of success for nestings was 49 while 52 per cent of the nests built had successful nestings in them.

TABLE 4

Success of Nestings in Nests Used more than Once

Times nest used	Number of successful nestings	1938	1939	Percentage
2	0	37	76	23
2	1	88	114	42
2	2	83	84	34
3	0	5	8	11
3	1	14	21	28
3	2	23	23	36
3	3	16	18	27
4	0	0	1	7
4	1	2	1	15
4	2	1	8	30
4	3	5	1	23
4	4	4	3	23
5	0	0	0	0
5	1	0	0	0
5	2	0	0	0
5	3	0	2	50
5	4	2	0	50
5	5	0	0	0

From Table 4 it is apparent that the majority of nests used twice had one successful nesting in them. Of those used three times over a third raised successful families; of those used four times nearly a third raised two broods; and of those used five times half raised three and half raised four families.

ESTIMATED PRODUCTION IN CASS COUNTY

Since Cass County is homogeneous topographically it is assumed that the area under observation was representative of the whole county. There are 2,380 farms and nine towns in the county which has an approximate area of 368,640 acres. Towns cover about 20,480 acres and, as the farmyards and lots under observation averaged 2.5 acres, it is assumed that there are 5,950 acres devoted to farm lots.

These two types of habitat produce the bulk of the doves, therefore all the rest of the area, including fields of crops, woods, stream bottoms, gullies, etc., are lumped together to give 342,210 acres. In this region of Iowa 61 per cent of the doves were produced in towns, 25 per cent were produced in farmyards, and only 14 per cent were produced away from farmyards and towns.

TABLE 5

Two Years of Mourning Dove Production in Cass County, Iowa

	1938		1939	
	Average per acre	*Total*	*Average per acre*	*Total*
5,950 Acres farm lots	9.5 nests	56,525	8.8 nests	52,360
	12.4 nesting	74,480	12.0 nesting	71,400
	11.3 young	76,235	7.6 young	45,230
20,480 Acres towns	4.3 nests	88,064	6.7 nests	137,216
	5.8 nesting	118,784	9.4 nesting	192,512
	6.4 young	131,072	7.9 young	161,792
342,210 Acres remaining	0.1 nest	34,221	0.1 nest	34,221
	0.1 nesting	34,221	0.11 nesting	37,643
	0.08 young	28,517	0.11 young	37,643
Total	Nests	178,810		223,797
	Nestings	227,485		301,555
	Young	226,824		244,665

The average production for two years was 201,303 nests, 264,520 nestings, and 235,744 young, with a possible plus or minus error of ten per cent. Because of the thoroughness with which the observation area was examined each season, it seems hardly possible for the error to be greater than ten per cent. Even a ten per cent error would mean that 255 nests were missed and this seems improbable. Nesting away from farmyards and towns was estimated to be about one nest to ten acres for both seasons.

Since the breeding stock apparently brings off enough young to treble itself each season, then the average breeding stock for two years was 78,581 birds, or a theoretical total of 314,325 young and parents could be expected to be in the county at the end of each season. This is one dove to each 1.2 acres. The actual number is not as great as this since both young and parents suffer losses during the season, and more or fewer birds may return each spring.

POPULATION CHANGES

That any slight change in environmental resistance produces a corresponding change in the total population is brought out by the 1939 production. There were 1.32 as many breeding birds in 1939 as in 1938 and these birds made 1.32 as many nesting attempts. Each individual pair made an average of 5.85 nestings in 1938 and 5.98 in 1939, so that a difference of only 2 per cent existed between the efforts of the birds each year. But the 1.32 birds raised only 1.07 as many young in 1939 as in 1938 which is a difference of 0.25 birds or 24 per cent. That is, the 1939 number of breeding pairs failed to produce the number of young that could be expected of such a breeding population under 1938 conditions. Hence, the environmental resistance of 1939 breeding season must have been 24 per cent more severe than in the season of 1938. This is borne out by the fact that there were several more destructive storms in 1939. In the area under observation breeding stock in the spring of 1939 was eighty pairs greater than in 1938, or 32 per cent more birds began this season. If we assume that such an increase was widespread over the county, then it is apparent that the winter of 1938–39 was 32 per cent less severe on the birds than that of 1937–38. If the environmental resistance was 32 per cent less during the winter and 24 per cent greater during the summer, the resistance for the entire year was 8 per cent less in 1939 than in 1938, and a corresponding increase in young would be expected. The actual increase in young was 7.86 per cent.

CENSUSING BY NESTS

Not only was the total nesting activity greater in 1939 than in 1938, but, except for September, the average daily number of active nests for each month was higher. This held true for nesting in town, but in the country the reverse was true. In 1939, country nesting was consistently less by monthly average (see Table 6).

The two-year average number of nesting attempts was 1720. In order to find how many nestings for the season a given number on any day of the month would indicate it is necessary to determine the ratio of daily activity to the season's yield (Table 7).

The months of June, July and August are those when the average daily nesting is of most consistent ratio to the season's yield and it is during these months that censusing by nests should be undertaken. The success of nesting for the two years was: town, 51.4 per cent; country, 45.3 per cent; or an average of 50 per cent. The

TABLE 6

AVERAGE NUMBER OF ACTIVE NESTS PER DAY PER MONTH IN THE
OBSERVATION AREA

Month	Total			Town			Country		
	1938	1939	Aver.	1938	1939	Aver.	1938	1939	Aver.
March.........		2	1		2	1			
April..........	15	31	23	9	24	15	7	7	7
May..........	125	193	159	71	147	109	53	44	48
June..........	224	297	260	132	232	182	91	65	78
July...........	219	250	234	140	200	170	82	55	69
August........	183	218	200	130	174	152	52	43	47
September.....	145	90	118	105	69	87	40	21	31
October........	21	4	12	18	3	10	4	1	2

TABLE 7

RATIO OF DAILY ACTIVE NESTS BY MONTH TO SEASON'S YIELD

Month	Average	Town	Country
April......................	75.0	81.0	71.0
May......................	10.8	11.2	10.3
June......................	6.6	6.7	6.3
July......................	7.3	7.2	7.2
August....................	8.6	8.1	10.6
September.................	14.5	14.1	16.0
Average.................	10.4	10.2	10.8

average number of young produced in a successful nesting was 1.82,
for town 1.86 and for country 1.73.

The average maximum number of breeding pairs for two years
was 290, with the maximum 210 in town and 93 in the country.
Dates of maximum activity in town and country did not coincide,
hence the discrepancy in the above figures. In order to determine
the number of active pairs in an area it is necessary to know what
part of them are actively nesting each month (see Table 8).

TABLE 8

RATIO OF PAIRS OF BIRDS SEEN NESTING EACH MONTH TO TOTAL
BREEDING STOCK

Month	Average	Town	Country
April......................	12.0	14.0	13.0
May......................	1.2	2.0	2.0
June......................	1.1	1.1	1.2
July......................	1.2	1.2	1.3
August....................	1.5	1.3	2.0
September.................	2.4	2.4	3.0

In censusing a given area by use of nests make the following observations:

1. Do the censusing during the fluctuation phase of nest building, i. e., June, July, August, preferably June and July.

2. Do not census immediately after a storm or bad weather, but make observations after a week of mild weather, if possible.

3. Pick out sample habitats of the entire area. The size of these sample habitats will depend upon the observer's method, but preferably should be from five to ten acres in extent. That is, in towns examine nesting sites of several blocks and in the country examine several different farmyards. Miscellaneous sample plots should each cover several acres.

4. Examine every tree, bush, shrub and likely place in the sample areas for nests.

5. Add up the total number of active nests seen and the total acreage covered. Do not count inactive nests.

6. Multiply the total nests by the ratio figure for the month of census in order to determine the total nests that will be attempted in the area.

7. Multiply this figure by the per cent of success, i. e., 50 per cent.

8. Multiply the successful nestings by the number of young raised per nest, i. e., 1.82. This gives the number of young that may be expected to be raised in the sample area.

9. Multiply the number of active nests in the area by the month's ratio of nesting birds to the breeding stock and this gives the number of breeding birds in the area.

10. Add the total breeding stock to total young raised for the total of birds in the area at the end of the season. Success of this census depends upon the thoroughness of the observer in finding nests. During mild weather in the fluctuation phase of nest building, the daily difference in number of active nests is seldom more than ten per cent of the average activity, hence a plus or minus ten per cent correction will make the final figure more nearly accurate. Losses of young and parents during the season from cats, automobiles, diseases, accidents, etc., are variable, but data at hand indicate that they are between three and ten per cent, but may be much higher. Correcting the total production computed by this figure will give the expected, theoretical, fall population. Per-acre production can be determined by dividing the final figure by acres of census area.

Censusing by this method like censusing by the *coos* of the bird (McClure, 1939) is subject to many variables and at best can only be a somewhat closer estimate than a guess. If the area under observa-

tion at Lewis should be an exceptional one, then all of these figures would be too high, but it is believed that the ratios as given are consistent and will be consistent for the bird regardless of the area under observation. Meteorologically the two seasons of observations differed greatly but the reactions of the birds were very consistent.

SUMMARY

From March to October of 1938 and 1939 nesting of the Mourning Dove was observed in a 220-acre area in southwestern Iowa at Lewis. One hundred and sixty acres of this were in Lewis and the remainder scattered among farmyards, gullies, and woods.

During the two years, 250 breeding pairs in 1938 and 330 pairs in 1939 made a total of 3439 nesting attempts. Each pair built about six nests and one-half of the nesting attempts were successful in rearing young.

Nest building during the breeding season was divided into three phases: an acceleration phase in spring, a fluctuation phase during summer, and a deceleration phase in fall.

In the two years, 3085 young were reared. Of the young that hatched, 87 per cent were successful in leaving their nests, but only 48 per cent of the eggs that were laid produced successful young.

Although there were 32 per cent more breeding doves in 1939 than in 1938, decimating factors reduced production of young to but 7.86 per cent more for 1939.

A method of censusing the dove population by counting active nests in sample areas is given. Nests are counted and then multiplied by standard figures to give the total young that may be produced by the end of the season.

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