SOME ASPECTS OF MOURNING DOVE
BEHAVIOR RELATED TO REPRODUCTION

A Thesis
Presented in Partial Fulfillment of the Requirements for the
Degree Master of Science

By

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II INTRODUCTION

A. Development of Problem

With the diminution in numbers of certain species of game birds; increasing emphasis has been placed on the mourning dove as a game species. The mourning dove now ranks fourth among the game bird species of the southern United States. As a result, there has been an emphasis placed on dove research in the past few years. This research is not confined to the southern states, but is also being conducted in certain northern states where the dove is not on the game bird list. Research on the status of the mourning dove must be carried on throughout its breeding range before scientific management principles can be applied in any portion of this range.

In cooperation with this widespread research program, this study was begun in 1952. It was planned to derive estimates of populations and production during 1952. The observation of nesting behavior was also an objective. In 1953 the nationwide trend had swung to an examination of methods for censusing the mourning dove. Thus, in 1953 emphasis was placed on observing the cooing behavior of individual marked males.

B. Objectives

The principle objectives of this study were:

(1) By use of marked individuals, to observe nesting behavior of the mourning dove, with emphasis placed on re-nesting and permanency of mating; and

(2) To investigate cooing activity and to determine the effect of
certain factors on it.

C. Description of Study Area

This study was conducted on the campus of The Ohio State University, Columbus, Ohio. The campus has an area of approximately 185 acres. Its western limit is located less than one-half mile from the Olentangy River.

Some portions of the study area are characterized by a dense concentration of large buildings. In other locations there are botanical and horticultural gardens, small groves of conifers, and one pond. A large number of the shrubs and trees are exotics.
III TRAPPING METHODS

A. Nest Trapping

A program of nest-trapping was a very important tool in this investigation. Individual doves had to be identified with nests and mates, and marked so as to be recognizable during succeeding nestings. A rather delicate technique is required as more than a minimum of disturbance to the nesting pair may result in their abandoning the nest and nestlings; and, what is worse, they may desert the study area, thus passing entirely from observation.

1. General Technique

Certain techniques are applicable to the utilization of all the nest traps tested.

The optimum nesting stage for nest-trapping is the interval when the nestlings are from about three to eight days of age. At this time the adult is more attentive to its young, less flighty, and less likely to abandon its nest than during any previous nesting stage. Also indicative of this is the more rigorous manner in which the "broken wing" ruse is performed when a dove is flushed early in the brooding period. During this same period a dove seems to be more tolerant of human disturbance than it does when incubating. It follows that, since a dove is most attached to its nest early in the brooding period, it will enter a trap more readily at this time. Trapping is not advised when nestlings are one or two days old. At this stage they are more susceptible to injuries sustained as a result of the struggling adult. It is preferable, however, to trap
when nestlings are at the lower rather than the upper limit of the three to eight-day old age interval. By the time nestlings are eight days old they are not being brooded nearly so much as when they are younger. An adult does not seem to enter a trap baited with eight-day old nestlings as quickly as it will in one containing younger birds. Also an eight-day old nestling may itself present a problem to the trapper by fluttering from the nest as the trap is being situated. Other observers have reported that nestlings more than eight days of age are susceptible to being coaxed from the trap by the adults.

Best results were obtained when traps were located at least one day in advance of the day that the actual trapping was to begin. When locating the trap, an attempt was made to place it so that the opening faced in the same direction in which the bird normally approached the nest. On the day of trapping an effort was made to capture the first adult about two hours after sunrise. This would ordinarily be the female, who had been brooding all night and had not yet been relieved by the male. At this time the male would usually be in the near vicinity and might be expected to enter the trap within an hour or two after the release of the female. The amount of time elapsing before doves entered the traps was quite variable. Some did not enter for several hours, whereas others re-entered within an hour after they had been captured and released. No trapping preference between sexes was noted during this study. If for some reason trapping is done in the afternoon, caution should be taken to insure the return to brooding before
nightfall of one of the adults. It is generally believed that a dove will not return to the nest after dark, and the nestlings would thus suffer from exposure throughout the entire night. For this reason trapping operations should always be suspended at least two hours before sunset.

In general, nests should not be trapped during a rainfall or other severe weather. This is a precaution against a possible loss of the nestlings by overexposure. It should be considered, however, that doves spend more time brooding their young under conditions of inclement weather and seem to enter a set trap more quickly at such times. On very hot, dry days, on the contrary, they may wait four or more hours before entering the trap. Before deciding whether or not to trap on a day of bad weather three factors should be considered; the age of the nestlings, the degree of severity of the weather, and the "temperament" of the individual bird. Doves that nest the closest to human habitation may be either inherently less excitable or have become conditioned due to frequent association with humans. In any event, they may be more closely approached by humans before flushing from the nest and will generally enter a trap soon after it is set.

One such bird had its nest about five feet from the ground in an arbor vitae tree that was located adjacent to the main entrance of one of the buildings on Campus. It had become acclimated to a practically continuous procession of students which passed within four feet of its nest. Attempts to flush this dove were greeted by hissing and threatening wing movements. The observer was tempted to pick up this bird in his hand and thus circumvent the trapping operations but was re-
warded with only a handful of tail feathers. This pair of doves was easily trapped, however; both birds were captured in an automatic trap in a single afternoon.

2. An Automatic Nest Trap

The first nest trap employed was an automatic one constructed by Paul A. Stewart (Stewart, 1954). An automatic trap makes use of a trigger which is released by the bird upon entering the trap, and is opposed to a manual trap where the operator must release the trigger by pulling an attached string or some other device after the bird is within the trap. Since the mourning dove broods its young continuously, an automatic release mechanism is not a necessity. It was first used in this study merely to omit the inconvenient release string which is associated with the manual trap. This string must extend down the trunk of the tree in which the trap is located and away from the tree far enough for the operator to approach it without flushing the bird. In addition to being difficult to locate, the string sometimes serves as a temptation to interference by passersby.

In general, the automatic trap consists of three main parts; the trap body, a removable end which includes a swinging door and the "trigger", and a removable door which covers the other end of the trap, (see Figure 1). In practice a nest is placed in the trap body the day before the actual trapping is to take place. Both ends of the trap are left open in order to make it readily accessible to the doves. On the following day, after the birds have become accustomed to the trap, the trapping takes place. At about 9:00 A.M. the brooding dove, usually the male, is flushed from the nest. The two trap
Figure 1. Stewart's Automatic Nest Trap, Disassembled.

Figure 2. Stewart's Automatic Nest Trap, Set, and Baited with a Mourning Dove Nestling.
ends are then installed and the trigger set. Ideally one of the adults might be expected to enter and spring the trap about one to two hours later. It would be marked and released, the trap reset, and after a like interval the other adult might be caught. The trap can then be removed and the nest replaced on its normal substrate.

Stewart used this technique successfully in 1951, but it did not prove satisfactory when used in this study on the same area in 1952. The chief cause of failure seemed to be the reluctance of the birds to enter the set trap. This reluctance seemed to be due to the facts that only one end of the trap is open when it is set and that this automatic trap has a board floor. Figure 2 shows a set trap containing a dove nest and a nestling that was about six days old. A bird that enters the trap must step onto this board to approach its nest, the latter having been moved there from its natural position. The manual trap, on the other hand, has a net bottom which is fastened under the branch supporting the nest. Thus the nest need not be moved and the dove can approach it along the branch which supports it.

An example of the reluctance of the birds to enter the automatic trap occurred on April 17, 1952. At 10:30 A.M. a dove was flushed from its nest, which had been placed in the trap body on the previous day. The trigger end was then affixed to the trap and the trigger set. The other end of the trap was closed. At 10:50 A.M. the trap was revisited and found to be un-sprung, although a dove was perched in a tree less than thirty feet away. At the next observation, 11:25 A.M., the trap still had not been released, but there were now two doves perched in a nearby tree. One and then the other of these
birds flew by the trap, each hovering momentarily over it as they passed. At 1:45 P.M. one of the doves was still in the tree while the second was observed walking along the top of the trap. It also walked back and forth beside the trap and around the closed end, then flew back to the tree where the other adult bird was still perched. At 2:30 P.M. the trap was found to be sprung, but no bird had been caught and two adult doves were still in the near vicinity. The trigger was re-set and was subsequently found to be still set at 3:15 P.M. In order to encourage the return of one of the adults to the nest before dark, the ends of the trap were then removed. The adults apparently abandoned the nest, however, as one of the nestlings was found dead in the nest on the following day. In retrospect it should be pointed out that even if one of the adults had been caught at 2:30 P.M. when the trap was found to be sprung, the other bird probably would not have been caught during the remainder of the day. In fact it often happened that one of a pair could be caught but that the time required in doing so was so great that trapping would then have to be abandoned, before the capture of the second bird, due to the increased age of the nestlings.

On two occasions doves were recovered from the automatic trap that had injured themselves to the extent that blood was drawn from the leading edges of their wings. One of these birds disappeared, along with its mate, immediately after its release. Three months later it was re-trapped on a second nest which was located more than one-quarter of a mile from the first site.
The second dove that injured itself was found struggling inside the trap, while a robin was perched on top and seemed to be packing down through the wire mesh at the captured dove. This nesting situation was one of four found during this study where active robin and dove nests were located within one yard of each other. These birds seemed ordinarily to get along peacefully; although on a few occasions a dove was observed to chase a robin or vice versa. After the release of this dove it was noticed that the nestlings appeared rather stunned. In spite of their rather advanced age of seven days, they died later the same day apparently of injuries incurred from the struggles of the captured adult.

On one occasion a dove was observed to enter and release an automatic trap but appear not to notice that it was caught. Instead it proceeded to feed the nestlings. For obvious reasons, however, whenever an automatic nest trap is used it should be visited as frequently as possible in order to recover a trapped bird as soon as possible after it is captured.

While the results of this study favor the use of a manual nest trap, there are two situations in which Stewart's automatic nest trap might prove useful. One is the rare situation where, for reasons previously discussed, the release line of the manual trap is not feasible. The other situation involves the setting out of trap bodies for use as nesting substrata. Five of approximately one dozen trap bodies that were set out in 1952 were utilized by doves for nesting substrata in 1953. These birds had a long period of time in which to become accustomed to the traps and showed relatively little hesitancy in entering them after they were set.
3. **A Manual Nest Trap**

Toward the end of the 1952 nesting season use of the automatic trap was discontinued. Subsequently a manual nest trap described by Swank (1952) was tested. This trap has two sliding doors which are supported, when the trap is set, by two pins, each of which is attached to the release line. A pull on the line jerks the pins simultaneously out from under the doors causing them to slide down in their tracks. These tracks are constructed of folded sheet metal and are soldered to the trap body. A three foot by three foot piece of cord netting is used for the bottom of the trap. It is permanently fastened to only one side of the trap. Thus when the trap is being placed over a nest the net can be brought up under a tree branch and fastened to the other three sides of the trap by safety pins.

The trap was placed over the nest one day previous to the initiation of trapping. The release line extended down the trunk of the tree and was concealed as well as possible from passersby. How far from the nest to leave the end of the line was a question that could be answered only after considering the following: the possibilities for a concealed approach by the trapper to the line, the height of the nest above the ground, and the flushing distance of the individual bird. About two hours after sunrise on the following morning the string was pulled, and the first adult caught. This is an advantage over the operation of the automatic trap; where at this step the brooding bird would have to be flushed and the trap set. Thus with the automatic trap, instead of being half done, you would have just begun.
After a dove escaped under one of the falling doors, rubber bands were attached to them to increase their rate of descent. This adjustment was used at all times but was found to be particularly helpful when the trap had to be located at an angle to the horizontal. In such a position the increased friction between each door and its track greatly retarded its fall.

With the use of this technique Swank's trap proved satisfactory. Both birds of a pair were usually caught in a single morning. One day, however, the trap was accidentally dropped from a tree, thus becoming sprung out of shape. An effort was made to realign the door tracks but when the trap was next used one of the doors stuck halfway down and the dove escaped. Another time while pushing this trap up through the dense branches of a small hawthorne tree it was again sprung out of shape. Subsequently a door stuck again after being released and another dove escaped. These aggravations prompted the construction of a more durable manual nest trap.

4. A Manual Nest Trap Devised for This Study

Late in the nesting season of 1953 a nest trap was constructed which makes use of swinging doors. It is pictured in Figures 3 and 4. The frame of the trap is of 5/32" iron rod which is soldered into the shape of a box, 8" x 8" x 12". The two doors are hinged to the top edge of the frame by bending the door rodding loosely around the frame rod. These doors are made to extend five inches above the trap in order to engage the trigger. Coil springs taken from snap type rat traps are mounted on the rods which hinge the doors to the frame. Two of these springs on each door cause the doors to close very
Figure 3. A Manual Nest Trap Devised for This Study.

Figure 4. A Close-up of the Manual Nest Trap Devised for This Study.
rapidly when the trap is sprung. A spring-type cupboard door catch was installed at the bottom of each door in order to hold it shut.

The trigger is a flat piece of iron four inches long and has a hole bored in its center to enable it to rotate on a swivel bolt. This bolt is fastened to a cross bar which extends between the top centers of each side of the frame. Two nuts, one above and one below the cross bar, fasten the swivel bolt to the cross bar and are adjusted to permit easy turning of the trigger. One end of the trigger is pierced to hold the release line. A slight pull on this line rotates the trigger and releases both doors simultaneously.

All of the trap but the bottom is covered with one-inch mesh chicken wire. A 2 1/2' x 3' piece of a badminton net encloses the bottom after the trap is in place. The net is fastened with safety pins and has the same advantages which were discussed previously in connection with Swank's trap.

As is generally advised, the entire trap was painted black. It is not definitely known, however, that black traps are more effective in trapping doves than are traps of any other color.

While this trap when set occupies sixteen inches more along the longitudinal axis than does Swank's trap, it saves three inches in height. This difference in size does not seem to be an important factor in determining the relative merits of the two traps.

It is felt that this trap is at least as effective as Swank's and, at the same time considerably more durable. Unfortunately it has only been used on two nests; so this belief has not yet been substantiated. It did, however, work quite satisfactorily on those two instances.
B. Bait Trapping

A program of bait-trapping was initiated with the objective in mind of obtaining information about population movements of mourning doves. Doves that were caught were to be permanently marked with plastic tags; a differently colored tag being used for each month in which the birds were trapped. Thus when a tagged dove was observed later, the color of its tag would reveal the month in which it was first identified on the area. Of particular interest was the question of the status of those mourning doves which winter on the Study Area. It was hoped to discover whether these birds are also summer residents or whether they are migrants from farther north.

All of the juvenile doves that might be captured were to be checked in order to determine the progress of the molt of their primary wing feathers. Any of these that were recaptured would again be checked. The lapse of time between two stages in the post-juvenile molt of each recaptured dove could then be calculated. Finally, if enough birds could be trapped and retrapped, the resulting data might add to the refinement, for use with Ohio doves, of the system of ascertaining the stage of feather molt as an aging technique.

The bait-trapping program was begun with some misgivings due to the reported experiences of other workers in this and other areas. Some reported an almost total lack of success while all described the mourning dove as "trap wary".

1. General Technique

The only bait used during this study was a mixture of about equal parts of cracked corn and whole wheat. Webb (1949) in the examination of the crop contents of seventy-four Ohio doves collected
at all seasons of the year, found, by a volumetric test, that corn
and wheat were the primary and secondary foods, respectively. As
doves were often seen feeding on limestone grit, some rock salt was
added to the bait. This was later discontinued, however, as the pre-
sence of rock salt in the bait did not seem to be related to the de-
gree of trapping success.

Before an area was trapped it was always pre-baited for at
least one week before the traps were set out. When the traps were first
placed out, considerable bait was scattered outside of them. As the
doves cleaned this up, it was not replaced, but more bait was scat-
tered within the traps.

Mass-type traps, such as were used during this study, leave a
trapped bird highly vulnerable to predation. Such traps should be
checked frequently in order to release any trapped birds as soon as
possible after their capture. During this study a minimum number of
checks included one fairly early in the morning, two more during the
day, and a fourth just before nightfall. This last check is a safe-
guard against any bird remaining in a trap overnight, where it would
fall almost certain prey to nocturnal predators.

Frequently it was not convenient to check the traps the neces-
sary number of times during a day. On such days about one-half of the
top of each trap was folded back and left open. This is considered
preferable to either moving the traps off the bait or blocking the
trap entrances as the birds can continue to enter and feed within the
traps, thus becoming increasingly accustomed to them. In fact some
workers prefer to trap by this method at all times, leaving the tops
of their traps open during the week and trapping only on weekends.
By trapping in such a manner it is reported that one might trap as many doves in a single weekend as he would otherwise catch in one week of continuous trapping.

2. **Traps Used**

The first type of trap used was a two-cell modification of the three-leaved clover trap (Keeler and Winston, 1951). It was constructed of one-half inch mesh hardware cloth and was about 2' x 2' x 5' in length.

The second type of trap used was rectangular in shape, being about 4' x 4' x 1' in height. A 4' x 4' frame of 1/2" x 1" board supported the top of the trap. The sides were of one-half inch mesh hardware cloth which overlapped at the corners to give added rigidity. A portion of a badminton net was used for the top of the trap. This was considered necessary with such a low trap to prevent the birds from injuring themselves by flying against the top. A 4" x 4" square opening was cut in each side of the trap. Each opening was one foot from a corner but all were staggered so that no two openings were directly opposite each other. A tunnel was constructed of the hardware cloth to exactly fit each opening and to extend six inches into the trap. Birds were removed from the trap by being driven through a door, which was cut in one corner, into a small handling cage.

The third type of trap used has been called an Ohio quail trap. It is constructed of one-inch mesh chicken wire and is approximately 2 1/2' x 2 1/2' x 1' in height. One side of the trap is the large open end of a huge funnel which tapers down to a 4" x 4" opening at about the trap center. An important feature of this trap is that it can
be folded flat; and in this position a large number of them can be easily transported. When these traps are in use they must be pegged to the ground; as they are so light in weight as to be readily turned over by a large animal, captured dove, or the wind. A length of number nine wire with one end bent in the shape of a crook was used as a peg during this study.

3. Results

On August 28, 1952, one week after the area had been pre-baited, two of the modified clover leaf traps were set out on The Ohio State University Farm. One of the traps was placed near a small pond, at which doves were frequently seen watering in the late afternoon. The second trap was placed under a power line by a corn field. Flocks of fifty or more doves could commonly be found perched on the wires over this spot during July, August, and less commonly in September. On September 5, 1952, twelve doves were perched on these wires and fifteen more doves were feeding around the trap below. Upon approaching, it was discovered that only one of these doves was within the trap. This individual was aged according to the scale arrived at by Swank in his studies of the feather molt of Texas doves and was found to be only thirty-seven days old.

No more doves were caught until October 7, 1952, when the remains of a dove were found in one of the traps, along with two live Cooper's hawks. The two hawks, an adult and a full-grown juvenile, were banded and released at a spot some two miles distant from the point of capture. No success was experienced throughout the remainder of October, when trapping attempts were abandoned. Throughout the entire trapping period doves were commonly seen feeding around the outside of
the traps, but never within them. Bait quickly disappeared from around the traps, but that on the inside remained apparently untouched.

On January 12, 1953, one of the modified clover leaf traps was placed in a grove of conifers on the Campus. On January 26, a large rectangular trap (previously described) was placed in a second grove of conifers on the Campus. Flocks of wintering doves were known to roost in each of these groves.

A disadvantage in the use of the rectangular trap was soon discovered. One or more gray squirrels were almost always found feeding in it. When the trapper approached, some of these squirrels would calmly head for an exit, while others seemed to panic and would begin to chew frantically on the net top. Large holes began to appear in the net. In addition to this annoyance it was suspected that the squirrels were keeping doves from alighting at the trap site. A box trap baited with English walnuts resulted in the capture of five squirrels. They were transported to a rural woodlot and released. An occasional squirrel was still seen at the dove trap but no further serious interference was experienced from this source.

Between January 28, and March 4, twenty-one doves were captured. Nineteen of these were caught in the rectangular trap, whereas only two were caught in the clover leaf trap. All twenty-one birds were banded, tagged, and released. During the same period eight slate-colored juncos were also caught in the traps and banded.

On August 27, 1953, six of the Ohio quail traps were placed in close proximity to each other at the same site, under the electric wires, where trapping was attempted in 1952. These traps were left out
throughout the month of September but no success resulted. The small number of doves present on the University Farm during this period may have been a factor in this failure. While the usual large flocks of doves were present on the area during late July and early August, there seemed to be fewer doves present during the period in which trapping was attempted than during the same period in 1952.

It must be concluded that during the autumn the mourning dove is very difficult to trap. Perhaps this is because the dove, a ground-feeding seed-eater, finds its food most abundant at this time of year. Even though larger, more easily found flocks of doves exist in the autumn, perhaps late winter, spring, and even early summer trapping would yield better results. Indeed, such was the experience of a bird bander at St. Charles, Missouri (Graff, 1953). Table 1 is a record of the mourning doves that he banded from "May 29, 1949 to December 1, 1953". The onset of Graff's successful trapping, in May, might be related to the formation of the year's first flocks of juveniles. Trapping might be most successful, then, during early summer when the dove population is swelled by flocks of early juveniles but the food supply is not yet so abundant as later in the autumn.
Table 1  Doves Banded from May 29, 1949, to December 1, 1953, by George S. Graff, St. Charles, Missouri

<table>
<thead>
<tr>
<th>Year</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug.</th>
<th>Sept.</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1949</td>
<td>1</td>
<td>12</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>1950</td>
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<td>12</td>
<td>12</td>
<td>4</td>
<td>8</td>
<td>43</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>1951</td>
<td>19</td>
<td></td>
<td></td>
<td>12</td>
<td>6</td>
<td>37</td>
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<td>8</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>46</td>
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<tr>
<td>1953</td>
<td>31</td>
<td>29</td>
<td>25</td>
<td>8</td>
<td>6</td>
<td>99</td>
<td></td>
<td></td>
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<tr>
<td>Totals</td>
<td>1</td>
<td>3</td>
<td>68</td>
<td>80</td>
<td>58</td>
<td>24</td>
<td>8</td>
<td>242</td>
</tr>
</tbody>
</table>
IV BANDING AND MARKING

A. Banding

Preparatory to trapping, a federal bird-banding permit was obtained. Subsequently all of the doves that were caught during this study were banded with official U. S. Fish and Wildlife Service numbered aluminum leg bands.

These leg bands are as permanent an identification device as is known for birds. As such they serve as a check against the loss of any more conspicuous marker that has been used on a bird. Of course, this scheme of organised, cooperative bird-banding on a federal level is the only practical means known of obtaining certain information about migratory birds. In this category are questions on longevity, and on dates, speeds, and destinations of migrations.

1. Banding Data

The dates and some of the circumstances surrounding the trapping of the 102 doves banded during this study are shown in Table 2. Table 3 contains a list of all banded birds that were recaptured (recoveries). All of these recoveries but the last two, bands numbered 513-82611, and 513-82612, were originally banded and recovered in nest traps. These two were originally captured and recovered in baited traps. The two doves that were originally trapped in June, 1951, were banded on this date by Paul A. Stewart of Columbus, Ohio. A report of the banding and recovery of this pair of doves appeared in Bird Banding (Stewart and Mackey, 1953). These two birds were mated in both years that they were caught, as were the two doves numbered 513-82604 and 513-82605.
### Table 2  Doves Banded

<table>
<thead>
<tr>
<th>Year</th>
<th>1952</th>
<th>1953</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nestlings</td>
<td>12</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Adults Banded at Nest</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Adults Banded at Baited Trap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>17</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Band Number</td>
<td>Sex</td>
<td>Date Banded</td>
<td>Date Recovered</td>
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<td>-------------</td>
<td>------</td>
<td>---------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>48-3690k8</td>
<td>Fem.</td>
<td>June 23, 1951</td>
<td>April 4, 1952</td>
</tr>
<tr>
<td>48-3690g9</td>
<td>Male</td>
<td>June 25, 1951</td>
<td>April 4, 1952</td>
</tr>
<tr>
<td>48-335632</td>
<td>Fem.</td>
<td>April 19, 1952</td>
<td>May 23, 1953</td>
</tr>
<tr>
<td>48-335641</td>
<td>Male</td>
<td>May 7, 1952</td>
<td>Sept. 9, 1952</td>
</tr>
<tr>
<td>48-335651</td>
<td>Male</td>
<td>June 24, 1952</td>
<td>May 21, 1953</td>
</tr>
<tr>
<td>513-8260k4</td>
<td>Fem.</td>
<td>Sept. 12, 1952</td>
<td>April 15, 1953</td>
</tr>
<tr>
<td>513-82605</td>
<td>Male</td>
<td>Sept. 12, 1952</td>
<td>April 15, 1953</td>
</tr>
<tr>
<td>513-82611</td>
<td>Male</td>
<td>Feb. 3, 1953</td>
<td>Feb. 18, 1953</td>
</tr>
<tr>
<td>513-82612</td>
<td>Male</td>
<td>Feb. 5, 1953</td>
<td>Feb. 8, 1954</td>
</tr>
</tbody>
</table>
With but one exception, all of the bandings and recoveries that are reported herein, took place on the campus of The Ohio State University at Columbus, Ohio. One dove, number 513-82612, was recovered by Elmer Davidson at his home about 1/4 mile north of the Campus in Columbus, Ohio. That more of these birds were not recovered elsewhere is not surprising since of 33,247 doves banded from 1920 to June 30, 1948 there have been only 1,242 recoveries, or 3.74% (Peters, 1949).

B. Marking

The objectives of this study required that doves be marked so as to be individually recognizable. Such a marker should, to be clearly distinguishable at a maximum possible distance, persist for a maximum period of time, not inconvenience or endanger the life of the bird, and be easily and cheaply constructed.

Colored leg bands have been used successfully with several species of birds, but these were not thought to be feasible for use with the mourning dove. The dove’s normal posture, even when on the ground, is characterized by the body being held so low that the breast feathers almost cover the feet. In this position leg bands are not readily discernible.

1. Airplane Dope

Some doves were marked with Testors’ model airplane dope. This paint is limited in its application as it can be successfully applied only to the wing primaries. Lesser feathers, when painted, will mat and are soon preened out. Painted marks will also persist longer on the primaries because they are the last feathers to be molted.

When a dove is in flight the wing moves so rapidly that any mark which has been placed on it cannot be clearly seen. Because of this, all
marks were applied so as to be visible when the bird was at rest and the wings folded. Unfortunately the area of exposed primaries that is present by a folded wing is so small that no combination of marking designs can be used on it. Instead the entire area was painted one solid color. This was accomplished by holding the extended wing with the primaries separated, and painting the entire lengths of the outer five primaries. When, after a minute or two, the paint had dried, a second coat was applied. The feathers were held apart until the final coat had dried and there was no danger of their sticking together.

One color was thus used for each pair of doves, the paint being applied to only the right wing of the male and the left wing of the female. Only two pairs of birds were marked in this fashion, one pair being marked with red paint and the other with orange. No difficulty was experienced in distinguishing between these colors and both were visible at a considerable distance. One pair was marked in mid-April and the second in early May. The markings on all four birds were still visible in early September of the same year when these doves were last seen on the area. It is believed that at least two other colors could be found that might be used in combination with red and orange, thus permitting the marking of four pairs of birds by this method.

In addition to the wings, paint was also applied to both surfaces of the tip of the tail and to the upper mandible. This was done to help distinguish between marked and unmarked birds on the nest, no matter what portion of the bird was exposed. Especially helpful was the paint on the underside of the tail since the long tail of the mourning dove invariably projects over the edge of the nest. These additional
markings proved so helpful that they were also used in conjunction with the other marking devices that were tested during this study.

2. A Plastic Marker

A plastic-type marker for use on birds was perhaps first used on the pheasant (Taber, 1949). Such a marker has also been successfully used on the bobwhite quail (Wint, 1951). Advantages of this type of marker are that it persists independent of feather molts, is visible at a maximum distance, and allows the individual marking of a large number of birds. It was hoped that a plastic marker could be constructed that would be usable with the mourning dove.

After considerable experimentation, a marker was developed of the type photographed in Figure 5. The four tags in this photograph serve to illustrate the types of simple designs used on the markers. Such designs can be recognized almost as far as the tags can be seen. These identifying marks are cut out of a plastic "cloth" which is thinner than that used for the tag proper. The marks are superimposed on the tags and then fused in place by the heat of an iron. Four color series of tags were constructed. On one series of tags red symbols were affixed to a white background; other combinations used were: white on red, red on yellow, and yellow on red. Those tags having yellow on them were used on male birds, whereas those using white were placed on females.

The dimensions of the tag were 2 1/4" long by 3/4" wide. This is believed to be the smallest effective size, with regard to the distance at which the markings can be recognized, that is feasible for use with the mourning dove. A slightly longer tag is apt to be stepped
on by the dove. When the bird is walking or at rest, the tag hangs
down one side or in front of the bird (see Figure 6). A tag that hangs
in front of a bird on the nest is more often visible from below than one
that lies on the bird's back.

When a dove is in flight, the tag hangs in the most favorable
position as it trails straight back along the bird's back (see Figure 7).
This freedom of motion of the tag is also advantageous in that it causes
the marker to offer a minimum of resistance to vegetation. In addition,
the bird, when picking the tag with its beak, cannot move it far en-
ough to cause the safety pin to pull against the skin through which the
pin is inserted.

This mobility of the tag is allowed by the method of coupling the
tag to the safety pin. First the small ring of a Pflueger fishing tackle
snap (Number 1235, size 3) is fitted into a split brass ring. The ring
is then soldered to a small (about one inch long) safety pin, as shown
in Figure 5. The other end of the snap engages an eye which has been
punched into the tag. The safety pins were silver-coated.

At first the tags were pinned at a point on the back just poster-
ior to the pectoral girdle. It was soon discovered, however, that the
skin in this region is too tight to be easily raised. When a wild dove
that had been tagged in this manner lost its tag after three months, it
was decided to pin the tags farther forward. Henceforth all birds were
tagged by inserting the safety pin through the skin at the base of the
neck, above and just anterior to the pectoral girdle. In this region the
skin can be easily gathered and raised for pinning. The mourning dove
is notorious among taxidermists for its thin and easily torn skin.
Figure 6. A Tagged Dove with the Tag Hanging in Front.

Figure 7. A Tagged Dove with the Tag Hanging in Back.
Unless enough skin is taken to fill the pin, the tag will probably tear loose in a few months time.

Before tagging a dove, it was first placed in a sock in order to bind its wings and feet. The bander then had both hands free for pinning the tag to the bird. After piercing the skin, care was taken to close the pin without tearing the skin. This was done by holding the point of the pin firmly against the bird's body with a pair of needle-nose pliers. The pin was then closed by bringing the clasp down onto the point while holding the point stationary.

The plastic marker proved to be as conspicuous as was anticipated. White or yellow tags could be seen at a distance of fifty yards or more when the birds were flying or perched. In addition, tagged doves were so conspicuous that they often attracted the attention of disinterested people. Several reports of tagged birds were obtained from this source. Since no tagged dove was known to have fallen victim to predators, the effect of these markers on the rate of predation is unknown.

No departure from the normal nesting behavior was noted in either males or females that were tagged. Also there were no known instances of any portion of the marker becoming disengaged from the remainder of the assembly or failing in any other way. In fact the only serious difficulty encountered was that of the marker being lost due to tearing of the skin. Of approximately forty wild doves tagged, five were known to have lost their markers. All but one of these had carried their markers throughout the 1952 nesting season but had lost them before returning to nest in 1953. The fifth dove carried its marker for only three months during the 1952 nesting season. All of these doves were
tagged on the back and not at the base of the neck, and this may have been responsible for the loss of the tags. Fourteen of the forty tagged wild doves carried their tags for from two to six months before passing from observation. A dove that was tagged and released on February 5, 1953, was recovered, still tagged, by Elmer Davidson of Columbus, Ohio on February 8, 1954. Of six doves kept captive in a large cage, only one lost its tag. Two of the others carried their tags for one year, at which time the birds were released.

In the spring of 1953 all bird-banders were notified that henceforth no migratory birds could be marked in any other manner than with official leg bands unless specific permission was obtained from the U. S. Fish and Wildlife Service. Subsequently this agency refused permission for doves to be tagged with plastic markers. One reason that was given for this refusal was that the weight of a marker as compared to the weight of a dove would be similar to a 150 pound human carrying a five pound weight on his back. While the validity of any comparisons of this type is certainly questionable (and experimentation revealed no abnormal behavior on the part of tagged doves), the second objection raised against the use of plastic tags admittedly has a legitimate basis. This objection was a consideration "...of the potential poor public relations, not only for the bird banding program but all migratory bird research which might result from the discovery by certain persons of birds treated in this way". In fact, during this study a Columbus, Ohio resident voiced a complaint against this marker after seeing one of the tagged birds.

One episode occurred, however, in which a tagged bird resulted in good public relations for the U. S. Fish and Wildlife Service and
brought considerable publicity to the bird banding program. This involved the recovery of a tagged dove on February 3, 1954, by Elmer Davidson, of Columbus, Ohio. Davidson reported the incident to Don Mack, who is outdoor editor of a Columbus newspaper—The Ohio State Journal. Subsequently Mack reported the incident in the February 12, 1954 issue of this newspaper. The following quotation contains excerpts from this article.

"Elmer Davidson... is retired and both he and his wife take a great interest in birds and in feeding them through the cold winter months.

"Along with the birds they've been feeding at their back yard stations this winter, seven or eight turtle doves have been regular patrons for the hand-outs. Elmer noticed that one of the doves not only wore an aluminum leg-band but also had some sort of red colored gadget on its back, between the base of the wings. The more he noticed this bird the more inquisitive he became, so he decided to try to trap it....

"A red tag, quite small was attached to a wire snap, which, according to Davidson, reminded him of the type snap used by fisherman, as a rule affixed to a swivel. The snap end had been gently severed through the skin of the bird, and then brought out and snapped together. I questioned him as to how the healing results of the process looked, and he said that the bird showed no effects from it in any manner and that it was not only beautifully healed all around the two tiny openings but the feathers had grown completely around the wound, if you'd care to call it that.

"The leg-band, a common practice amongst bird students and others, contained the following inscription, 'write U. S. Fish and Wildlife Service, Washington, D. C., 513-82612'.

"Davidson noted the inscription on paper and promptly released the dove. He has written the U. S. Fish and Wildlife Service the information and requested that they inform him the particulars. It will be interesting as to where the banding, as well as the "tagging" operations took place.

"Much helpful and interesting information has been disclosed by bird banding operations, both as to migrations of birds and their life cycles and habitat preferences."
At last reports Mack was seeking to recapture the tagged dove for presentation on his television show.

3. Dyeing Mourning Doves

After the use of the plastic tag had to be discontinued, permission was obtained from the U. S. Fish and Wildlife Service to dye portions of mourning doves, not exceeding 25% of the entire plumage. Dye, unlike paint, does not matt feathers, therefore it can be applied to all of the feathers of a bird's body. It was believed that by dyeing various portions of the dove's anatomy, such as the breast, back, wings, and tail, in varying combinations and with varied colors, enough doves could be individually marked to carry on an intensive-type study such as this. Of course additional birds could be marked with model airplane dope as previously described.

A scarlet dye was tested and found to be very conspicuous. It also persists until the feathers are molted and does not seem to injure the bird. The dye was mixed according to a formula supplied by Harold S. Peters of the U. S. Fish and Wildlife Service. Dye mixed by this formula had been used on doves in the Southeastern States (Ninston, 1952). DuPont's scarlet powdered aniline dye is added to a solution of six parts water, one part glacial acetic acid, one part 95% ethyl alcohol, and a pinch of an emulsifying agent which is also manufactured by the DuPont Company.

In the process of dyeing, this dye solution is poured into a shallow pan. The dove's feathers are spread and held in the solution for from one to two minutes. The bird can then be removed and held with its feathers spread for five to ten minutes, or until they are dry enough to sustain it in flight. It will be noted that this dye does not dry so
rapidly as does the model airplane dope.
V POPULATION FLUCTUATIONS

An attempt has been made to portray graphically the fluctuations of dove populations on the Study Area throughout the year (Figure 8). All figures represent the number of doves that one might expect to find on the Area on an average day in a given month, and do not represent the total number of doves which might pass through the Area in that month. Estimates of the total population are based on actual observations made throughout 1952 and 1953. By the use of considerable speculation the total population is broken down into nesting adults, juveniles that were produced on the Area, and migrants. The results, it is hoped, are within the realm of possibility, and are at least thought provoking.

The term migrants, for the purposes of this graph, refers to all doves which neither nested nor were produced on the Area. This includes those doves which might otherwise be classified as wintering.

Thirty nesting adults are indicated for February although they would not actually begin nesting until March. The peak population of nesting pairs was found to be approximately twenty in both 1952 and 1953.

Doves are termed "juveniles" after they are fifteen to twenty days of age, at which time they are independent of the nest. Thus while the graph shows the biggest increase in resident juveniles (thirty) to be in June, it should be noted that these birds were produced in May.

The greatest amount of speculation which had to be done in the compilation of the graph concerns the migration dates of the juveniles that were produced on the Area. A study should be made of this problem, in which juveniles could be dyed or otherwise marked at the nest and then followed to determine the date at which they left the nesting area.
Figure 8. An Approximation of Population Fluctuations of Mourning Doves on the Study Area.

- total population
- migrants
- nesting adults
- juveniles produced on the area
It was assumed that, as a general rule, all summer residents
winter elsewhere and that all winter residents are not produced in the
Area. This has been found to be the pattern for most migratory species;
and, also, none of the marked breeding birds was ever observed after the
first of October. Since most northern observers have agreed that the
largest southward population movements of doves occur in late July and
August, it was further speculated that the first large flock of native
juveniles would leave the Area in late July. These birds would then be
replaced at about the same time by migrants from farther north. It is
interesting to note that while a single flock of fifty or more doves was
often seen in late July and early August, two smaller flocks were regular-
ly seen later in August and September.

During 1952 sixty active dove nests were discovered. Considering
that several nests probably escaped discovery, the estimated twenty pairs
of breeding doves established three and a fraction nests per pair. The
nesting success was calculated at 64.7%. Austin (1951) in his analysis
of the banding of 2,690 doves in Cape Cod from 1930 to 1950, estimated
that each breeding pair established three nests and that the nesting
success was 77%. These figures show a close enough relationship between
dove production on Cape Cod and on this Study Area that Austin's computed
production ratio for his large population sample might be used to estimate
the average annual production on this Area. Austin indicated that the
annual production of a breeding pair was 4.6 young. Adjusting this figure
to twenty breeding pairs we arrive at an annual production figure of 92
birds.

This figure of 92 was rounded off to 100 for illustrative purposes
(see graph, Figure 8). The curve representing the numbers of juveniles
produced on the Area portrays the new appearance of 10 juveniles in April, 20 in May, 30 in June, 20 in July, 10 in August, and 10 in September. The curve is modified by the departure of 60 juveniles in August, 20 in September, 10 in October, and 10 in November.
VI NESTING

A. Courtship and Mating

Some doves seem to be already paired when they appear on the breeding grounds in the spring. Whether these birds were mated the previous year and remained paired throughout the winter, or had mated on the wintering grounds, is not known. It appears, however, that some doves acquire mates after their arrival on the breeding grounds.

Three male doves had established cooing perches on the roofs of three different buildings by February 1, 1953. One of these birds was regularly seen feeding within his territory with a female and was judged to be paired. No such evidence of pairing was seen on the part of the second male, however, until about three weeks later. By this time the third male had disappeared. Thus for three weeks an unmated male dove and a mated male dove were observed in an attempt to discover any differences in the behavior of the two.

No differences were noted in the behavior of the two birds. Both were regularly found cooing on their perches early in the morning and late in the afternoon. They also cooed considerably, but less regularly, during the remainder of the day. In the case of each dove, its cooing probably served to proclaim a territory against the invasion of other males. The cooing of the unmated male might have functioned to attract a female, while that of the paired male might have been a sexual stimulus to its mate. On a few occasions each male dove was observed to execute a type of flight maneuver that has been described as having significance in courtship.
Barrow (1912) described this flight in the following manner:

"An individual leaves its perch on a tree, and with vigorous and sometimes noisy flapping, rises obliquely to a height of a hundred feet or more and then, on widely extended and motionless wings, glides earthward in one or more sweeping curves. Usually the wings, during this gliding flight, are carried somewhat below the plane of the body, in the manner of a soaring yellowlegs or sandpiper, and sometimes the bird makes a complete circle or spiral before again flapping its wings, which it does just before alighting. This peculiar evolution is commonly repeated several times at intervals of two to three minutes and appears to be a display of flight for the benefit of its mate, the assumption being that only male doves soar."

Male doves were observed executing this flight in the presence of females; just as frequently, however, it appeared that there were no other doves in the vicinity. Throughout the breeding season males that were on their cooing perches were observed to frequently take flight, glide in one or two spirals over their territories, and return to their perches. This flight was often interrupted if the soaring dove sighted another dove within his territory—after which he usually gave chase. The great variability in the length and vigor of this performance, as well as in the season and setting in which it occurs, leads one to attach a varied significance to the act, or perhaps no significance at all.

After two doves have become paired they spend considerable time engaged in courtship behavior. The longest period of continuous courtship display that was observed occurred on June 7, 1953. At 7:15 A.M. the male dove, perched on a branch of a silver maple tree, was rapidly uttering a series of soft three-syllable coos. Craig (1911) has termed this
call the "nest coo". It is quite distinct from the louder, five-syllable "perch coo". The female responded by uttering a single high note twice. She then flew from a nearby tree and alighted on the same branch on which the male was perched. She walked down the branch to him and began preening his tail, back, and wings. He reciprocated by preening her back. Subsequently, they began to simultaneously caress each other about the head with their bills. Throughout the performance both birds continually fluttered their partially extended wings. These activities finally culminated in copulation at 7:45 A.M. Subsequently, when either one of the pair started to walk away, the other would flutter its wings with increased vigor. This behavior resulted in the return of the departing dove. Courting would then begin anew. Finally, at 8:45 A.M., the pair left the scene. During the elapsed hour and a half copulation occurred at least twice.

Courtship usually does not culminate in copulation. Frequently the female is not receptive to the advances of the male. On such occasions he will hop after her while assuming the same menacing posture that typifies one male's attack of another. The neck feathers are puffed out, the head held forward, and the wings held stiffly at the sides. He may halt at intervals to emit the long "perch coo". Meanwhile the female evades his rushes as unconcernedly as possible while continuing to feed.

Even when copulation does occur it is not always preceded by an extended period of courting. On March 20, 1952, two doves were sitting about one foot apart on the peak of a building. One bird maintained a squatting posture and fluttered its wings repeatedly at about three-second intervals. In less than a minute the other dove mounted the first, after which they both flew.
The only time that a marked pair was observed to copulate was on June 25, 1953. At this time these birds had a nest containing two ten-day old nestlings.

As a general rule a male dove follows his mate. When a pair is feeding together, the female usually leads the way. On one occasion a marked pair of doves was feeding on a street adjacent to the curb. They were moving slowly in single file with the female in the lead. When she stopped to feed, he casually brushed on by and continued to move ahead. Immediately she rushed ahead and forced herself between him and the curb, thereby assuming the lead once again. The male dove appeared not to notice as he continued his steady pace along the curb. This act was repeated three times before the birds took flight.

1. Permanency of Mating

A survey of the literature indicates a lack of information pertaining to the mating habit of the mourning dove. The majority of the available evidence points toward some degree of monogamy in the mating behavior of this species. Several workers have observed marked pairs of doves that remained mated during successive nesting attempts in a given season. During this study four pairs of marked doves were known to have remained mated throughout an entire nesting season (see Table 4). The dates of successive nestings given in the table refer to the date that the first egg was laid and the date that the nestlings left the nest. In no instance during this study was a dove known to change mates.

Evidence was uncovered that mourning doves may remain paired for two or more years. On June 23, 1951, the female of a pair of doves was
Table 4  Record of Nesting Activities of Marked Pairs of Doves

1953

<table>
<thead>
<tr>
<th>Marked Pair Letter</th>
<th>Dates of Successive Nestings</th>
<th>Number of Young Produced</th>
<th>Change in Location of New Nest</th>
<th>Number of Trees Utilized</th>
<th>Number of Nests Utilized</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>April 8 - May 10</td>
<td>2</td>
<td>new tree, new nest</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>May 26 - June 24</td>
<td>2</td>
<td>same</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>June 25 - July 21</td>
<td>1</td>
<td>new nest, same tree</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>July 28 - Aug. 27</td>
<td>2</td>
<td>same</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sept. 1 - Sept. 28</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>March 1 - March 30</td>
<td>2</td>
<td>same</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>April 12 - May 14</td>
<td>1</td>
<td>same</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>May 18 - May 24</td>
<td>0</td>
<td>same</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aug. 3 - Sept. 2</td>
<td>2</td>
<td>new nest, same tree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>March 21 - April 19</td>
<td>2</td>
<td>new nest, new tree</td>
<td>2</td>
<td>3</td>
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<td></td>
<td>April 30 - May 29</td>
<td>2</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>June 10 - July 1</td>
<td>0</td>
<td>same</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aug. 26 - Sept. 25</td>
<td>2</td>
<td>new nest, old tree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>April 23 - May 24</td>
<td>2</td>
<td>new nest, new tree</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>June 2 - June 30</td>
<td>2</td>
<td>same</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>July 22 - Aug. 25</td>
<td>1</td>
<td>same</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
caught in a nest trap on the Campus. This bird was banded with band number 48-369048, and released. Two days later the male was caught in the same trap and given band number 48-369049. The nest and nesting platform were left in the tree, and during the second week of March, 1952, a pair of doves was using the same nest. On April 4, 1952, both adults were trapped, identified, and released. They were found to be the same birds which used this nest during 1951. This incident was reported in *Bird Banding* (Stewart and Mackey, 1953).

A second pair of doves, numbers 513-82604 and 513-82605, were banded on September 12, 1952, and re-trapped on the same nest on April 15, 1953. In this case the nest was blown down during the intervening winter, but the doves built a second nest on the identical crotch of the same tree in 1953.

These two incidents may or may not represent normal behavior for the mourning dove. It would be enlightening to know whether the mates of each pair were continuously together through the intervening winter, or whether each bird returned to its former nesting territory independently. Re-mating and re-use of the previous year's nesting site might have occurred somewhat by chance.

There is evidence of a circumstantial nature for the theory that a pair of doves may remain mated during the interval between breeding seasons. The writer has noted that wintering flocks on the Campus contained several units of two birds. On several unseasonably warm evenings in early January more doves were observed returning to a roost in a pine grove by twos and singles than in groups of any other number.

Webb (1949) made the following observations, "...during several hunting seasons in the southern states. Often when a dove was shot from
a flock passing over the shooting grounds, another dove would leave the flock and fly back at low levels directly over the spot where the shot dove had fallen. Likewise, a wounded dove which could not maintain the speed or altitude of the flock, was often followed closely by another dove until both alighted on the ground or in a tree. Such observations are not conclusive, but suggest the possibility that some doves, either migrants or resident doves, are mated during the winter season."

Taylor (1941) in describing a feeding, wintering flock of doves in North Carolina stated, "The flock when alarmed seldom moved off as a unit; instead the birds usually flushed a few at a time, and commonly the tendency to fly away in pairs was noticed." In describing flocks of doves that roosted on the ground in the middle of grassy fields, Taylor observed, "On several occasions where flocks were visited at night, the roosting birds commonly flushed in singles and pairs."

The following statement by Nice (1922) seems opposed to the theory of a monogamous mating habit for mourning doves: "I think we are on safe ground in assuming that when four eggs are found in one nest they are the product of two females. Whether such cases always or usually mean polygamy we have no means of knowing at present.... We have observed considerable lapses of fidelity of male doves to their mates." It should be noted that four eggs can only rarely be found in one nest. None of the approximately 125 nests observed during this study contained more than two eggs.

Another statement which cautions the acceptance of the theory of monogamy for mourning doves is that by Leopold (1943): "...in addition to increasing gregariousness among the doves as fall progresses, there
seems to be a partial segregation of adult males into small, closely united flocks." This statement was based on hunting observations in Missouri, and the difficulty of positively identifying sexes of the mourning dove in the field should be kept in mind. Also one would expect to see large numbers of single birds of such a heavily hunted species in the autumn and winter in the southern states. Young of the year probably do not mate until the following spring, therefore they probably winter singly or in flocks.

B. Territorial Behavior

From the beginning of historical times members of the pigeon family have been held as symbols of gentleness and peace. Individuals of the species Zena i d u r a m a e r o u r a have been named "mourning" doves as a result of the interpretation of sorrow which human ears have given to this bird's song. The same song may hold a variety of quite different messages for another dove.

The mourning dove can be a very pugnacious bird. There are reports of doves dominating winter feeding stations. One such dove was reported to rout a blue jay and even a gray squirrel.

In the Columbus, Ohio area the first territories are established about the middle of February. By the first of April the number of territories has reached the maximum. These territories are extremely variable in size. On the Study Area the average-sized territory had a diameter of approximately 100 feet. Where the nesting population was very dense, however, as in a grove of conifers, the territory might consist only of a single tree. In fact, incidents have been reported where two active dove nests were located in the same tree. Such nesting concentrations probably should be ascribed to the presence of better nesting sites, however,
and not to an innate tendency toward colonial nesting.

On a territory of average size the male dove usually establishes two singing perches, one on the opposite side of the territory from the other. The male's frequent cooing from these perches probably serves to proclaim his territory to other doves. He also actively defends this area by driving trespassing doves from it. On one occasion, at about 2:30 P.M., while a male dove was engaged in incubating duties a second dove alighted on the branch which supported the nest. The intruder alighted about 15 feet from the nest. The incubating dove immediately arose from the nest and began walking deliberately toward the interloper. The latter took flight, after which the other dove returned to its nest.

Both male and female doves have been observed defending their territories from other doves. The male, however, usually is more persistent in defense of the nest than is the female. Most females on the nest do not allow a human to approach very close before flushing. On the contrary, several males have remained on the nest and beat the writer's hands with their wings before flushing. As a rule the male of a pair always entered a nest trap more readily than did the female. On one occasion a male dove was captured in a nest trap twice on one day and once the following day. The female of this pair was not captured once during this period. Nearly always when a feeding pair was approached, the female flushed before the male.

Mourning doves will also chase other species of birds from their territories, but they seem to be more tolerant of these than they are of other doves. Robins are a good example. Active robin and dove nests were often located in the same tree in close proximity; yet the two species were usually quite tolerant of each other. Only on a few
occasions were doves observed chasing robins, or vice versa. Webb (1949) reported an incident in which relationships were not so harmonious: "In one instance, after the author had flushed a dove..., a robin nesting nearby was flushed. The robin lit in the dove nest tree about one foot from the dove nest. Since the robin was watching the observer, it apparently was unaware of the dove which now occupied a position in a dead tree about 15 feet above its own nest. The dove suddenly and very quietly dropped off its perch, struck the robin with such force as to knock it to the ground, and gently lit on its own nest and settled over the young. The robin recovered soon after striking the ground, left the scene of the incident and did not return within one hour."
One case of prolonged territorial strife between two pairs of doves was observed on a segment of The Ohio State University Campus. A sketch of the area involved will be referred to in order to clarify the description of this episode (see Figure 9.) The sketch is drawn to scale in order to elucidate sizes of the nesting territories and the distances between the cooing perches and the nests. It should be noted that these territories were the largest that were known to have existed during this study. Considerable detail has been omitted in the sketch; only the locations of the more important trees are included. The northern-most building is the Botany and Zoology Building. As can be seen from the sketch, there is a large area just south of this building that is clear of buildings. This area is dissected by several cement walks. The first dove to establish a territory, male 1, included this entire cleared area in his territory. The four buildings shown bordering this park-like area provided rather natural limits to the size of the nesting territory.

The territory of male 1, then, was over 100 yards in diameter. The size of nesting territories of other doves also seemed to be limited by natural boundaries such as street intersections and buildings. However, since such existing boundaries were usually relatively close together, these territories rarely exceeded 100 feet in diameter. It may be concluded that the mourning dove does not have an inate tendency to establish a nesting territory of any given size, but may extend its territory to the maximum size permitted by existing natural boundaries.

The application of this principle of "edge effect" appears to have limitations, however. For example, two or more cooing perches are
Figure 9: An Area in Which Territorial Conflict Occurred Between Two Pairs of Nesting Mourning Doves in 1953.

B and C — cooing perches of male 1 during first nesting at A.

B, C, and J — cooing perches of male 1 during succeeding nestings at H.

K — roost of male 1.

E, F, and G — cooing perches of male 2 during nestings at D.

1" = 133.33'
usually located approximately on the periphery of a nesting territory. When male 1 changed nesting sites from A to H, he established a new cooing perch at J that was closer to the new nest than was the old perch at B. Possibly there is a maximum distance from the nest beyond which a dove will not establish a cooing perch. This may be related to the farthest distance at which the male is able to see the nest or the nest tree. Cooing males usually faced in the general direction of their nests.

The density of the nesting population may be so great that edge effect alone does not control the sizes of the nesting territories. In this case, mutual pressure of adjacent nesting pairs may also be a limiting factor. This was the situation that developed as males 1 and 2 sought to establish territories in the area shown in Figure 9.

Male 1 and his mate established their first nest at A in an elm tree on April 5, 1953. The most frequently used cooing perch of this male was on the peak of the Botany and Zoology Building at B. A second cooing perch was in a black walnut tree at C. This dove frequently flew in a large circle over the periphery of the park-like area south of B, and would usually chase any dove that was within this area. Any dove that flew over the area was subject to being followed by male 1 until it had passed through.

Male 1 was trapped on this first nest and he and his mate were both marked so as to be individually recognizable. Male 2 and his mate were never trapped or marked. These birds were identified only through long periods of observation of their use of familiar perches or of the nest. A minimum of confusion was experienced since males 1 and 2 were the only ones nesting in the immediate area.
Male 2 and his mate established their first nest at D, in an
elm tree, on or about May 2. The nestlings of male 1 were then ap-
proximately six days of age. At this stage of the nesting cycle male
1 cooed relatively little and exhibited more laxity in the defense of
his territory than during any other portion of the cycle. Male 2 also cooed
very little and was seldom seen on the area except when engaged in in-
cubation duties. Occasionally male 2 attempted to coo on the eaves of
the building at E. He was usually thwarted at this by male 1; the latter
driving him off the building.

During the period from May 10 to May 20 the nestlings of male
1 had left the nest, and he spent a maximum amount of time on his coo-
ing perches. This male seldom allowed male 2 to alight anywhere within
the area except in his own nest tree. At no time was male 1 observed
to attack either male 2 or his mate when they were in their nest tree.
In fact, both females remained relatively independent of the entire
struggle. Once when pair 1 was feeding on one of the walks within the
area, male 2 flew over. Male 1 immediately flew after him to the Dental
Clinic at F, where both alighted. The two birds then rushed at each
other and began fighting with such vigor that the sounds of their wings
striking together could be heard for a considerable distance. The
fighting consisted of repeated rushes and intermittent jockeying for
positions. The entire fight lasted less than one minute and was ended
by male 2 taking flight in retreat. During the struggle female 1 con-
tinued feeding; her only reactions were to nervously squat and lower
her head when the sounds of the struggle reached a peak.
This was the only time that two male doves were observed to actually establish contact with each other in a fight. Most skirmishes ended by one male bluffing the other into retreating. This was accomplished by frequent charges and by fluffing the neck feathers and promenading stiffly around the opponent. When a male dove rushes an adversary, he appears to bound forward with both legs striking the ground together, in the manner of a sparrow. This is quite different from the dove's normal walking gait, in which one foot strikes the ground at a time. The charge and the display appear to be executed in the same manner by a male engaged in courtship behavior with a female.

Male 1 and his mate renested in another elm tree at B on May 23. At about this time he became increasingly tolerant of an attempt by male 2 to establish a cooing perch on the roof of Hamilton Hall at C. A few days later the nestlings of male 2 had left the nest and this male was cooing with greater intensity than male 1, who was incubating.

During the remainder of the nesting season male 1 was no longer dominant to male 2. This latter was then recognized as owning a territory that might be described as an ellipse, with F and G as terminal points of the long axis. Male 1 gradually abandoned his cooing perch at B in favor of a new one that was closer to the nest, at J. His territory then took the form of an elongated ellipse with J and B as terminal points of the long axis.

The renesting of pair 1 in a different tree, after the first nesting, probably was a result of trapping activities at the site of the first nest. The subsequent change in the location of the cooing perch of this male from B and C, and J indicates that the male mourning
dove maintains his territory, in which he coos, around the nest. The male's territory is not maintained in a separate location from that of the nest, as is the case with some of the waterfowl. This knowledge further validates the spot-mapping technique as a device for censusing the population-density of breeding doves. Briefly, this census technique involves making several visits to a given area, and later plotting the positions of all cooing males that were observed. This method has lately been tested by Hopkins and Odum (1953).

Referring again to Figure 9, K represents the roosting site, in an apple tree, of male 1. On several occasions, before sunrise, this dove was flushed from the roost along with one or two unidentified doves. It might be speculated that these birds were juveniles from one of this male's previous broods.

C. Nest Construction

The selection of a nest site appeared to be closely related to courtship activity. On several occasions pairs of doves were observed when they were exhibiting courtship behavior on a fork of a tree branch. This behavior was often followed, within a few days, by the establishment of a nest at the same location.

Male doves assume the initiative in the search for nesting sites. The male of a pair walks back and forth on one after another of the branches of a tree until he finds an acceptable fork. He then squats in the fork of the branch and begins emitting "nest coos". The female, who has been feeding or preening unconcernedly nearby, responds by flying and perching beside him. The two birds then engage in a lengthy period of courtship activity. Finally the female may replace the male on the fork of the branch; or if this site is not acceptable, both doves
begin searching for a new one. During such a search a pair of doves may inspect nearly all of the branches of a tree.

Once the female has settled on an acceptable site, the male begins to search for nest material. He usually finds this material at a distance of less than fifty feet from the nest. One male, however, obtained at least a portion of his nesting material at a distance of 180 feet from the nest. The male walks along the ground, picks up a stick in his bill, shakes it, and drops it. Several sticks are usually picked up and dropped before one is retained. This process results in the elapse of an average of three to four minutes of time between successive trips to the nest by the male. Male doves were often observed searching for nest material; nest sites were frequently discovered in this manner.

The male dove flies to the nest with a stick in his bill and deposits the stick in the nest under the female. In no instance was a female observed to take the stick from the bill of the male, as several writers have stated. The male may deposit the stick in the nest behind the female. She continually changes her position in the nest and arranges the nest material around her.

Craig (1911) stated that each time the male brings a stick to the nest, the pair exchanges caresses. This type of behavior was seldom observed during this study, however. On one occasion a pair of doves was building a nest near the tip of a limb of an oak tree. The female was sitting in the nest while the male was on the ground searching for nest material. As he flew into the tree, the female ducked and closed her eyes. The male alighted directly on her back, quickly deposited
his stick in the nest, and immediately returned to the ground. This sequence was repeated each time the male returned to the nest.

Most of the nest construction is accomplished early in the morning; doves usually abandon nest building activities during the afternoon. From three days to a week or more were required for the entire construction of a single nest. Moore (1940) stated that the average period of time required for the construction of a nest was seven days.

The nest of the mourning dove is notoriously flimsy. In rare instances it may be so thin that the eggs can be seen in it when viewed from directly below. The nest is constructed, without the use of any adhesive, of dry sticks, straws, pine needles, or similar material. Its upper surface is nearly flat. Once when a dove flushed from a nest, it caused one of the eggs to roll to the brim of the nest. It did not appear that the dove could have incubated or retrieved the egg in this precarious position, so the author prodded the egg back into the center of the nest with a pole. Subsequently this egg hatched on the normal date.

Nice (1922) listed the frail nest of the mourning dove as one of the species' main disadvantages in its struggle for survival. Webb (1949) expressed a somewhat contrary opinion when he described dove nests by stating: "Apparently, because of their small size and perforated structure, they seem to withstand weather conditions fairly well". There is a report of a single nest structure persisting during nine consecutive years of use (Wood, 1951). Inclement weather was found to be the main cause of nest mortality during this study. Apparently this factor usually did not operate directly by destroying nests; rather, it operated
indirectly by causing adult doves to leave the nest long enough to allow the eggs to addle. After abandonment, dove nests were soon destroyed by various weather factors.

Since the nesting range of the mourning dove extends over the entire United States, this species has proved to be extremely adaptable in its utilization of nesting sites. A large percentage of the nesting population of the Prairie States nests on the ground. In North Carolina, Taylor (1941) found nests at altitudes ranging from the ground to 80 feet above the ground. He calculated the average height of 324 nest locations to be 18 feet. During this study more nests were found at heights ranging from 10 to 15 feet than at all other heights combined.

The type of substratum on which doves nest also varies considerably. Dove nests commonly were found on the following substrata: robin nests, squirrel nests, accumulations of pine needles on branches of pine trees, window ledges, and artificial substrata. One type of artificial substratum utilized were the bodies of Stewart's automatic nest trap. This trap is described in Chapter III, and an illustration of this substratum is shown in Figure 1. Another type of artificial substratum, a simple cone constructed of heavy roofing paper, has been used a great deal by nesting doves. These were nailed to trees on The Ohio State University Campus in 1945 and 1946 (Calhoun, 1945). Calhoun stated, "Practically all of the doves in the area used the cones at some time...."

Many more nests were found on branches than in the crotches of tree trunks. Nice (1922) ascertained that two-thirds of the nests in her sample occurred on branches, whereas only one-third occurred in
crotches. She also estimated that nests located in crotches were twice as successful as those located on branches.

No attempt was made to calculate the percentages of the total number of nests that were located in various species of trees. This information was supplied by Webb (1949) from observations that were made in Ohio in 1947 and 1948. A preliminary inspection of the nesting data from this study revealed the same pattern of utilization of tree species as that found by Webb. Of 321 nesting attempts, 51.4% occurred in four species of trees. The remaining 48.6% occurred in 35 other species of trees. The four most commonly used trees, in the order of decreasing importance, were red pine, *Pinus resinosa*; American elm, *Ulmus americana*; Norway spruce, *Picea abies*, and crabapples, *Malus* spp. For the results of this study this sequence was changed to the following:

1. Norway spruce
2. American elm
3. red pine
4. crabapples

In part, the high utilization of these four species of trees for nesting trees might be attributed to their abundance on the Area. While white pines, *Pinus strobus*, were much less numerous on the Area than either the Norway spruce or the red pine, it was surprising that not one of these trees was utilized as a nesting site.

Nests established early in the nesting season, before the leafing of the deciduous trees, were practically all in conifers. Groves of conifers also served as preferred roosting sites for flocks of doves. For these two reasons, the planting of conifers (especially Norway spruce
and red pine) should be considered a good management practice for the mourning dove. It should be noted that several small groves that provide a maximum "edge effect" will support more nests than one large grove containing the same number of trees.

D. Incubation Period

The first egg is laid approximately one week after the start of nest construction. Craig (1911) stated that there is an elapse of slightly less than six days between the first copulation and the date that the first egg is laid. The second egg follows the first after an interval of one day. The length of the incubation period rarely varies by more than one or two days from the average of fourteen days duration.

The male dove usually incubates the eggs continuously from two and one-half hours after sunrise until two and one-half hours before sunset. The female then assumes the incubation duties from 4:30 P.M. until 8:30 A.M. This behavior, however, is not invariable. On several occasions, female doves were observed to relieve their mates on the nest for an hour or more between 10:00 A.M. and 2:00 P.M. This was especially likely on very hot or rainy days. On two occasions male doves were observed to be engaged in incubation on the nest before 7:00 A.M.

While engaged in incubation duties, doves dozed and frequently preened themselves. Occasionally they would stand in the nest and turn the two dull, white eggs with their bills. Their position was frequently changed with respect to the direction that they faced. Doves on the nest often faced into the wind.

Craig (1911) writes that each time a sitting bird is relieved there is an exchange of affection. This was never observed during this study. Instead, one of a pair usually flew into the area and alighted
in a tree near the nest tree. Frequently the bird on the nest would immediately fly directly out of the area. The other dove might preen for three or four minutes before flying to the nest tree and alighting on the nest. More often, however, some cooing occurred during an exchange of doves on the nest.

When a male arrived within the vicinity of the nest, prior to relieving the female, he usually emitted several coos. The only times that females were observed to emit a "perch coo" were prior to their relieving the male on the nest. Sometimes the dove on the nest cooed. At such times its mate appeared to have no inclination to assume the nest duties and the cooing might have served to stimulate it to do so.

As has been previously discussed, doves will abandon their nests more readily during the incubation period than later during brooding. Most of the nest mortality occurs during the incubation period. More doves die in the egg than at any other age.

E. Brooding Period

The length of the brooding period is considerably more variable than is that of the incubation period. Nestlings usually became independent of the nest when they were between 12 and 16 days of age. Even then they usually remained near the nest site for approximately one week, and were fed on the ground by the adults for a day or two. Allowing seven days for courtship and nest construction, 14 days for incubation, and 14 days for brooding, one complete nesting cycle of the mourning dove requires 35 days.

The adults in sharing the responsibility of brooding the nestlings, follow a schedule comparable to that which is followed during incubation. It is less regularly adhered to, however. Late in the
brooding period the nestlings might be left unattended for an hour or more at a time. This was especially likely on a hot day.

The two eggs hatch on successive days. The adults carry the broken egg shells for 30 feet or more from the nest before dropping them. A dove nestling doubles its weight by its second day of life; therefore, when the second nestling hatches, it will be only half as large as the first. This difference in size between the two nestlings is apparent until they reach at least eight days of age.

The newly hatched nestlings are extremely altricial. Their eyes are not opened until they are about three days of age. For the first three or four days they are fed nothing but "pigeon milk" and are brooded continually. This "milk" is produced in the crop of the adult and is regurgitated by the adult when feeding the young. Adults that were trapped while feeding nestlings were found to be drooling a whitish, thickened liquid that looked, and smelled, somewhat like curdled milk.

The nestlings obtain this food by sticking their bills into the mouth of the adult. The two nestlings feed simultaneously, one with its bill in each side of the adult’s mouth. Periods of feeding may last for two or three minutes or as long as half an hour. Nestlings were fed four or more times during the day. A feeding always followed a change of adults on the nest.

Taylor (1941) stated that the "pigeon milk" is supplemented with partially digested seeds after the young reach three or four days of age. He further stated that the crop gland ceases to function after the nestlings reach six to seven days of age. Although the crop gland ceases to function at this time, the adults continue to feed the young
partially digested seeds during the remainder of the time the young are in the nest (7-10 days) and for a short period of time after they leave the nest.

An interesting record is that of a nest in late April, 1953, when one of two eight-day old nestlings fell to the ground. The adults fed both nestlings for seven days (one on the ground and one in the nest). At this time both nestlings flew to an elm tree near the nest tree, where they perched side by side and were fed by the adults for another week. It was interesting to note that, during the time the one nestling was still on the ground, when the female arrived to relieve the male on the nest, she first flew to a perch near the nest. After a few minutes she then flew to the ground and fed the fallen nestling. Shortly thereafter she flew to the nest and began to feed the other young bird. The survival of the nestling which had fallen to the ground was remarkable in the face of an intermittent rainfall of two days' duration which began the day after it fell to the ground.

By the time nestlings are eight days old they may walk out of the nest onto a nearby branch. At night they return to the nest to roost. Only a few nestlings flew to the ground before they were 12 days old. By this time the adult pair was often beginning to re-engage in courtship behavior. On a few occasions adults were renesting while the juveniles of the previous nest were still in the vicinity of the nest site.

Some writers have stated that the mourning dove excercises no sanitary care of its nest. This was not true in the case of several nesting doves that were observed to pick droppings out of the nest and eat them.
In 1952 the first nest was established on March 1; the last nesting was completed on September 20. In 1953 the nesting season extended from March 1 to September 30. Thus, for these two years, the length of the nesting season was approximately seven months.

The nesting data for 1952 and 1953 is presented in Tables 5 and 6, respectively. Nineteen pairs of doves were estimated to be the average breeding population in 1953. This compares with an estimated average breeding population of 15 pairs of doves in 1952. The greater estimated breeding population in 1953 was probably due largely to a better census technique in 1953. The experience of searching for nests in 1952 proved to benefit the same search in 1953. This was largely because many of the same nest sites were utilized in both years.

From Tables 5 and 6 it will be seen that the peak of nest establishment, in both 1952 and 1953, occurred in March and April. The success of nests established early in the season paralleled that of nests established later in the season. If nesting usually reaches a peak as early in the season as was the case in these two years, singing male censuses of mourning doves might well be undertaken as early as April. Of course, inclement weather conditions are to be expected more frequently in April than in May or June, and such conditions might seriously limit the number of censuses which could be made in April.

The practice of planting conifers to encourage early nesting of the mourning dove gains added significance if doves frequently may be expected to reach a nesting peak as early as was the case during this
Table 5. Nesting Data for 1952

<table>
<thead>
<tr>
<th>Month</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug.</th>
<th>Sept.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Nests Established</td>
<td>13</td>
<td>15</td>
<td>8</td>
<td>7</td>
<td>12</td>
<td>4</td>
<td>1</td>
<td>60</td>
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<tr>
<td>Number of Nests of which the Outcome was Determined</td>
<td>11</td>
<td>13</td>
<td>7</td>
<td>5</td>
<td>10</td>
<td>4</td>
<td>1</td>
<td>51</td>
</tr>
<tr>
<td>Number of Successful Nests</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>Per Cent Nesting Success</td>
<td>72.8</td>
<td>69.2</td>
<td>71.4</td>
<td>60.0</td>
<td>50.0</td>
<td>75.0</td>
<td>0</td>
<td>64.7</td>
</tr>
<tr>
<td>Number of Juveniles Produced</td>
<td>2</td>
<td>14</td>
<td>15</td>
<td>10</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>63</td>
</tr>
</tbody>
</table>

The estimated average number of breeding pairs in 1952 was fifteen.

It should be noted that most of the juveniles that are listed as produced in a given month were raised in the nests that were established during the previous month.
### Table 6. Nesting Data for 1953

<table>
<thead>
<tr>
<th>Month</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug.</th>
<th>Sept.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Nests Established</td>
<td>19</td>
<td>16</td>
<td>13</td>
<td>10</td>
<td>8</td>
<td>7</td>
<td>2</td>
<td>75</td>
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<tr>
<td>Number of Nests of Which the Outcome was Determined</td>
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<td>14</td>
<td>13</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>2</td>
<td>69</td>
</tr>
<tr>
<td>Number of Successful Nests</td>
<td>12</td>
<td>9</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>47</td>
</tr>
<tr>
<td>Per Cent Nesting Success</td>
<td>70.6</td>
<td>64.3</td>
<td>61.5</td>
<td>75.0</td>
<td>75.0</td>
<td>57.1</td>
<td>100.0</td>
<td>68.1</td>
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<tr>
<td>Number of Juveniles Produced</td>
<td>2</td>
<td>19</td>
<td>19</td>
<td>13</td>
<td>14</td>
<td>10</td>
<td>10</td>
<td>87</td>
</tr>
</tbody>
</table>

The estimated average number of breeding pairs in 1953 was nineteen.

It should be noted that most of the juveniles that are listed as produced in a given month were raised in nests that were established during the previous month.
study.

Very few nests were established in September in both 1952 and 1953. By the first of October both nesting seasons had terminated. Whether or not a hunting season would have been objectionable for any other reason, it would not have resulted in the harvest of any nesting adults from the breeding population of this Area if held after the first of October.

The numbers of nesting attempts per pair of doves are given in Table 7. A record of the renesting attempts of four pairs of marked doves is given in Table 8. Note especially the five successful nesting attempts that were made in 1953 by pair A.

The production data are presented in Table 8. The combined average number of juveniles produced per pair for 1952 and 1953 was 4.81. This is slightly less than the figure of 4.6 which was obtained by Austin (1951) from his analysis of banding returns of mourning doves on Cape Cod.

A. Nesting Mortality

Most of the nesting mortality could be attributed to stormy weather. On the day following a severe storm some nests were usually found torn out of shape or dislodged. More often, however, nests were found to be abandoned, yet containing the eggs, and apparently undamaged. Perhaps the stormy weather caused the doves to leave the nests long enough to allow the eggs to fade.

On five or six occasions eggs disappeared from the nest. Mammalian or avian predators could have been responsible. On three occasions punctured eggs were found in nests. Avian predators were probably responsible for this destruction. Only one adult nesting dove was known
Table 7. Number of Nestings Per Pair of Doves

<table>
<thead>
<tr>
<th>Year</th>
<th>1952</th>
<th>1953</th>
<th>1952 and 1953 Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Pairs of Breeding Doves</td>
<td>15</td>
<td>19</td>
<td>34</td>
</tr>
<tr>
<td>Number of Nesting Attempts</td>
<td>60</td>
<td>75</td>
<td>135</td>
</tr>
<tr>
<td>Average Number of Nesting Attempts Per Pair</td>
<td>4</td>
<td>3.9</td>
<td>3.97</td>
</tr>
<tr>
<td>Number of Successful Nesting Attempts</td>
<td>33</td>
<td>47</td>
<td>80</td>
</tr>
<tr>
<td>Average Number of Successful Nesting Attempts Per Pair</td>
<td>2.2</td>
<td>2.5</td>
<td>2.35</td>
</tr>
</tbody>
</table>
Table 8. Production Data

<table>
<thead>
<tr>
<th>Year</th>
<th>1952</th>
<th>1953</th>
<th>1952 and 1953 Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Pairs of Breeding Doves</td>
<td>15</td>
<td>19</td>
<td>34</td>
</tr>
<tr>
<td>Number of Juveniles Produced</td>
<td>63</td>
<td>87</td>
<td>150</td>
</tr>
<tr>
<td>Average Number of Juveniles Produced Per Pair</td>
<td>4.2</td>
<td>4.6</td>
<td>4.41</td>
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<td>Area of Study Area in Acres</td>
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<td>185</td>
<td>185</td>
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<tr>
<td>Average Number of Acres Per Breeding Pair</td>
<td>12.3</td>
<td>9.7</td>
<td>11</td>
</tr>
<tr>
<td>Average Number of Juveniles Produced Per Acre</td>
<td>0.34</td>
<td>0.47</td>
<td>0.41</td>
</tr>
<tr>
<td>Number of Successful Nests</td>
<td>33</td>
<td>47</td>
<td>80</td>
</tr>
<tr>
<td>Average Number of Juveniles Produced Per Successful Nesting</td>
<td>1.9</td>
<td>1.85</td>
<td>1.87</td>
</tr>
</tbody>
</table>
to have been killed by a predator. Its remains were found on the ground about 20 feet from its nest. The feathers had been plucked from the body in the manner of a bird that has been killed by a hawk.

Moore (1940) placed rat traps baited with dove, quail, or pigeon eggs in dove nests that had been destroyed. He captured six flying squirrels, four blue jays, three cat birds, one mockingbird, and one oriole. Live traps that were similarly set captured specimens of Rattus norvegicus and Rattus rattus.

1. **Parasites**

Several nestlings had infestations of mites around their eyes. Unfortunately the mites were not identified. The birds apparently suffered no ill effects from these infestations.

One eight-day old nestling was found dead in the nest and infested with maggots. The same bird had appeared healthy when last observed, 2½ hours earlier. While the maggots could have been the cause of death, it is likely that the infestation occurred subsequent to the death of the bird. The eggs of some species of flies, i.e. the house fly, may hatch in less than one day.

2. **Disease**

Each year no more than five or six nestlings were found dead in nests whose deaths appeared to be due to disease. These birds had been dead too long to permit successful necropsy.

On May 27, 1953 a 20-day old juvenile which the writer had banded was captured on the Campus. This bird was too weak to fly. It had a conspicuous external throat swelling and small yellow lesions inside the throat. The dove was taken to Dr. Alan R. Wagner of the College of
Veterinary Medicine of The Ohio State University, who necropsied it. Dr. Wagner stated that the dove "...revealed caseous lesions in the oral cavity. Darkfield examinations of these areas revealed numerous trichomonads. The species is Trichomonas gallinae. Our diagnosis is that of trichomoniasis. Aureomycin seems to be very effective in correcting this condition".

Trichomoniasis has been more prevalent in southern than northern populations of mourning doves. Haugen (1952) reported an outbreak of trichomoniasis in the dove population in Alabama in the autumn of 1950. During the hunting season that followed this outbreak, in 1950, an average of 2.2 hours was required to bag a dove, as compared with 0.59 hours in 1949.
A. Description of Cooing

1. Significance of Cooing

In this chapter the term "cooing" refers to only the typical "song" of the mourning dove. This is the five-syllable "perch coo" as described by Craig (1911).

The dove emits several other types of vocal expressions, all of which are popularly referred to as coos. One of these is the three-syllable "nest coo". It may be emitted by the male and, less frequently by the female during courtship behavior. Doves that were caught in traps often uttered a single, high-pitched coo that probably functioned as an alarm note. All of these three types of coos may be issued at varying levels of intensity. Scientific analysis of recordings of the various songs of the dove would undoubtedly reveal a greater number of distinct songs than has been detected by the human ear alone.

The female dove rarely, and only poorly, emits the "perch coo". This song is a part of the normal sexual behavior pattern of the adult male. It is apparently associated with the establishment and maintenance of a nesting territory by the male dove. Territorial males cooed for a period prior to the acquisition of mates. No male dove was known to emit the "perch coo" while outside his territory. As has been concluded concerning the songs of other species of birds, the song of the male mourning dove probably serves to proclaim its territory against the encroachments of other male doves and to attract a female. In writing about the song sparrow, Nisw (1934) states: "The most spectacular
use of song with this species is the proclamation of territory... a
warning to other males, an invitation to a female."

2. Cooing by Females

Female doves have been heard cooing on a few occasions. The female's
coo is a hoarse, weak imitation of that of the male. Females were heard
cooing at 7:00 A.M., 1:00 P.M., and 4:30 P.M. In every instance the
male was on the nest and the female soon relieved him. The females cooed
at the rate of approximately one coo every one to two minutes and emitted
only three to six coos. For purposes of estimating populations
based on singing male censuses, it might be considered that the female
does no cooing.

3. Singing Perches

Singing perches were found to be a very real thing. In the three
best-known cases, each male had two cooing perches, one on the opposite
side of the nest from the other. In each case, one "perch" consisted
of the roof of a building and the other in a large tree. None of the
doves restricted itself to any particular perch in the tree, nor to any
particular spot on the roof. Any dove or pair of doves that alighted or
flew low within the area between these perches was usually chased by the
territorial male, especially if such intrusion occurred during the interval
between broods. The cooing perch and the nest were always within the
nesting territory. On one occasion a pair of doves renested outside of
the original territory. The male then established a new cooing perch
within the new nesting territory.

4. The Male Cooing on the Nest

At 4:15 P.M. on May 5, 1953, a male dove cooed for approximately
ten minutes while brooding one eight-day old nestling on the nest. During this interval he cooed only 14 times. Some of the coos were "perch coos", while almost half of them were "nest coos". During this time his mate was feeding nearby. When she alighted near the nest, he flew from the nest. She then assumed the brooding duties. His cooing might have stimulated her to relieve him on the nest.

5. Seasonal Trends in Cooing

On this area the first cooing of a new breeding season may be heard on any unseasonably warm day in January. In 1952 the first cooing was heard on February 5. Doves were heard cooing on January 19, 1953 at a time when the temperature was 50°F. September 8 was the last day on which cooing was heard in 1953.

During February and March, male doves consistently could be found cooing on their perches during the late afternoon. Early-morning cooing reached a peak through April, May, and the first half of June; whereas the latter half of this period was characterized by increasingly sporadic cooing in the evening. On a few occasions during the summer, males were not even observed within their territories during a two-hour period preceding sunset. Possibly, relatively high evening temperatures at this time of year were responsible for a greater cooing intensity in the morning. Also, doves were known to drink at a nearby pond with regularity in the evenings of the summer months.

The seasonal curve of cooing intensity maintained its highest plateau throughout May and the first half of June. After mid-June the curve gradually declined until mid-July, when it fell abruptly off and ended in early September.
6. Daily Trends in Cooing

Doves were heard cooing at almost every hour of the day. In general, two main periods and one lesser period of cooing were noted. The period extending from one-half hour before sunrise until one and one-half hour after sunrise was found to be the period of highest cooing intensity. The interval extending from two hours preceding sunset until sunset was characterized by appreciably less-intense cooing. This is in contrast with the following statement by Craig (1911): "Zenaidura is a vesper bird; as compared with other doves, he sings less in the morning and relatively more in the evening." The third and least important period extends approximately from 11:00 A.M. until 1:00 P.M. This interval corresponds with the time at which the male is most frequently, if at all, relieved from his daytime incubation duties by the female.

Cooing usually did not begin until 30 minutes before sunrise. This was frequently one-half hour after the first robin began to sing. The histogram in Figure 10 shows the distribution of coos that were emitted by one marked male on May 19, 1953. This was the highest cooing intensity that was observed. Figure 11 is a histogram showing the combined distribution of the calls of two marked males in May, 1953. Each of the seven observation periods of these two males was characterized by a high cooing intensity.

From an examination of Figure 11 it will be seen that very little cooing occurred prior to 30 minutes before sunrise. The cooing intensity rose sharply at 30 minutes before sunrise to a peak that was maintained until sunrise. The cooing intensity gradually diminished from sunrise until 30 minutes after sunrise. At this point it dropped abruptly and
Figure 10. Histogram showing distribution of coos of one marked male on May 19, 1953.
Figure 11. Histogram showing distribution of calls of two marked males during May, 1953. Both males were in an interval between nestings. The cooing intensity was high for each observational period. (Sample includes 7 observations).
became very erratic. From 70 minutes after sunrise until 100 minutes after sunrise a minor plateau was established.
B. The Effect of Certain Factors on Cooing

A series of records of the cooing of marked male doves was made in order to determine if various factors have any effect on cooing. A form was made, after Ruffing (1952), for recording this data, that involves a horizontal line divided along its length into segments representing minutes before or after sunrise (Figure 12). Each segment is subdivided into lengths representing 15 seconds. Thus the time of utterance of each coo can be recorded by merely drawing a mark across the horizontal line.

Three pairs of doves were captured in nest traps in 1953 and marked in such a manner that individual recognition was made possible. It was planned to make as many observations of the cooing activities of these three males as possible. It was soon found that there was considerable variation in the daily cooing activities of any one dove. Similarly there were variations among the cooing activities of several doves on any one day. Much of this variability was soon credited to the effect of mating activities. The frequency of cooing during the two-hour early-morning period varied from practically no coos when the male had young nestlings in the nest to 323 coos when the male was in an interval between nestings. These frequent "silent" periods coupled with a male's occasional unexplainable failure to appear within the nesting area during an observation period resulted in no coos being recorded on approximately one-third of all observation periods. It was thought that enough coos were recorded in the data of the remaining observation periods, 24, to validate their use in a consideration of the effects of weather on cooing.
Figure 12. A Specially Designed Form (After Ruffing, 1952) for Recording Chronological Records of Cooing Activities of Individual Male Doves.

<table>
<thead>
<tr>
<th>NEST</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
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</table>

(MINUTES AFTER SUNRISE)

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<th>00:03</th>
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<tr>
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<table>
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</table>

80
Of the three marked males, dove A was seen cooing on only one of five observations. On this occasion he was engaged alternately in courting his mate and selecting a new nest site. The birds of this pair were known to have been at least two years old since they had been trapped. If this male had a cooing perch, it was never discovered. The nest site was surrounded closely by buildings, thus making it very difficult to observe the birds' comings and goings. Consequently, observations of male A were abandoned.

The nest of dove B was situated in a similarly confined location, but this male utilized two cooing perches which were easily observable. On this area, however, the density of nesting doves was very high. This created confusion in the identification of cooing doves as well as of birds flying overhead. For this reason only eight of the 24 usable observations were made of dove B.

The third marked male, C, had a nest located on the edge of a park-like area. For this reason his activities were more readily discernible, and, since he proved to be a persistent cooer, 16 of the usable observations were made of his activities. Fortunately a fourth and unmarked pair later nested near enough to male C to enable the observation of both males at the same time. Also, the timing of their nesting cycles was staggered in such a manner that one was in a "silent" period when the other was actively cooing.

While the number of usable observations of marked males is too small to permit statistical analysis; the data obtained should, when compared with the data from 49 observations of the cooing of unmarked males, provide a basis for the formation of some hypotheses concerning
the effects of certain factors on cooing.

6. The Effect of Weather on Cooing

1. Temperature

Temperature readings were obtained from thermograph recordings made on the Campus at a weather station operated by the Department of Physics and Astronomy of The Ohio State University. In addition, the observer recorded temperatures from a thermometer which was carried with him as a check against the thermograph readings.

An examination of the data from observations of the cooing of unmarked males reveals the following temperature extremes at which males were seen cooing on their cooing perches: $28^\circ$ F. at 8:00 A.M. on February 4, 1953, and $93^\circ$ F. at 12:00 noon on July 1, 1953. After inspection of all the cooing records, viz. 85 observations of varying duration covering practically all hours of the day and extending from January 19 to September 8, the impression was gained that relatively few periods of persistent cooing were observed at temperatures in excess of $70^\circ$ F.

That relatively lower temperatures favor high cooing intensity also was suggested by an examination of ten early-morning observations of the cooing of two marked males during May 1953. Each of these periods extended from one-half hour before sunrise until one and one-half hours after sunrise. The mode of the mean temperatures of these periods fell between $53^\circ$ F. and $57^\circ$ F. The intensity of cooing for all records falling within or below this temperature range was as high as expected for that time of year, after the factors of nesting stage and other weather conditions had been taken into consideration. On the contrary, the cooing intensity on one morning, with the temperature
slightly above the mode, 64° F., was considerably lower than the expected norm. Although this male was in an interval between broods, and other climatic factors seemingly were favorable, he emitted less than half the total number of calls throughout the period than he emitted in each of three successive periods in which the mean temperature fell within the range of 53° F. to 57° F. It appeared that temperature was the only factor that varied appreciably among the four periods. It therefore appeared that, for the sample of observations made relative to this study, a sunrise temperature in excess of about 60° F. during the month of May was associated with reduced cooing intensity.

2. Barometric Pressure

A micro-barograph located on the Campus provided records of barometric pressure. Pressures were recorded for the beginning and end of each period of observation, and a notation was made as to whether the barometer was rising, falling, or steady. In addition, any abnormal pressure change that occurred within the preceding or succeeding 24 hours was recorded.

An examination of all cooing records revealed the following extremes of barometric pressure at which doves were seen cooing: 0.07, and falling, at 6:00 P.M. on April 30, 1953; and 0.95, and rising, at 4:00 P.M. on February 9, 1953. Recordings of 0.26, rising, on May 12, 1953 and 0.66, steady, on June 25, 1953, were extremes of pressure which occurred during the early morning periods of observation of marked males. In both instances the cooing intensity was judged to be high.
At the beginning of this study it was expected that, as has been suggested by Ruffing's study of the crowing of the ring-necked pheasant (Ruffing 1952), low barometric pressure might be associated with low cooling intensity. This hypothesis is not supported by the observation of a marked male on the morning of May 19, 1953. The reading of 0.32, rising, which was recorded for that date was one of the lowest pressures recorded for the early-morning observations of marked males, and was characterized by the highest cooling intensity recorded during this study.

It must be concluded that for this study no correlation was found to exist between barometric pressure and cooling intensity of the mourning dove.

3. Wind Velocity

The velocity of the wind was measured by the use of an anemometer held at a height of approximately five feet above the ground. One-minute readings were taken at first, but these were later accompanied by readings of a duration equal to that of the individual gust of wind. A comparison of these two readings gave not only the average and maximum wind velocities, but an indication as to the duration and frequency of "gusts" of wind as well.

Experience has shown that poor results may be expected if roadside "coo counts" are conducted on mornings when the wind velocity exceeds a Beaufort rating of power two, viz. 4-7 miles per hour. It should be noted that a Beaufort reading is more nearly a reading of maximum rather than average wind velocity. This study has revealed no lowering of cooling intensity to correspond with wind velocities as high as 10 to 12 miles per hour. It would seem, then, that low
intensities recorded on roadside "coo counts" with wind velocities as high as Beaufort three may be credited largely to difficulties in hearing the coo under such conditions.

At 4:45 A.M. on May 18, 1953, a one-minute anemometer reading revealed a wind velocity of 13.9 miles per hour; gusts were at a velocity of approximately 20 miles per hour. At this time, one-half hour before sunrise, a marked male emitted his first coo from a large black walnut tree. After a few minutes, as was his normal behavior, he flew to the peak of a neighboring building. Upon attempting to alight, however, a gust of wind tossed him off his course and this appeared to cause him to return to the tree. He remained in the tree until 5:16 during this time A.M.; the cooing intensity of this bird was about 50% below normal. At this time he flew to the peak of the building and began cooing at a normal intensity. The average wind velocity then had dropped to 5.9 miles per hour.

4. Light Intensity

Since many species of birds are known to begin morning activities at a level of light intensity too low to be recorded on an ordinary exposure meter, it was thought necessary to devise some other method for measuring light intensities. For this purpose a series of the letter X was drawn on a plain sheet of white paper, each letter being drawn with lines slightly wider than those of the preceding one. This device had been used by previous workers but did not prove satisfactory for use in this study. It was soon discovered that the Study Area was so brightly illuminated by street lamps that all of the X's were visible at all times. What effect, if any, that this type of artificial lighting has on the normal behavior pattern of the mourning dove
is not known. Consequently, no data were collected on the effect of light intensity on cooing.

5. Nebulosity

An approximation of the degree of nebulosity was arrived at by estimating the percent of the sky that was overcast. One hundred per cent overcast was further described by the adjectives light, medium, or heavy. Clouds were described according to type, as cumulus, cirrus, or cumulo-nimbus.

While no definite correlation could be established between nebulosity and cooing intensity, it seemed fairly certain from several records that a 100% light overcast did not result in a lowering of cooing intensity. Insufficient data were obtained on heavily overcast days to afford a conclusion as to the effect of this condition on cooing intensity. On mornings experiencing a heavy overcast, however, the onset of cooing was delayed by as much as 15 minutes.

6. Relative Humidity

Records of relative humidity were obtained from a hygrograph that was maintained on the Study Area. Examination of the data from 11 early-morning observations of one marked male dove revealed a variation in relative humidity among these periods of only from 73% to 83%. The relative humidity was 85% on seven of these mornings. No correlation could be established between relative humidity and cooing intensity.

7. Precipitation

Records of rainfall were obtained from a rain gauge located on the Campus.
While a very heavy rain resulted in a total cessation of cooing, and a light rain seemed to have no inhibiting effect whatever, the data were insufficient to establish any rate of fall at which rain becomes a critical factor. In several instances during light rainfalls doves were observed to make no effort to attain cover; they perched in the open on a telephone wire or other exposed object and cooed at a normally high rate.

D. The Effect of Mating Activities on Cooing

For the observations of this study the factor of mating activities seemed to be closely correlated with cooing intensity. It appeared that weather factors served merely as subordinate modifying influences on a cycle of cooing intensity which reached its peak in the interval between broods. Cooing nearly ceased during the middle of the brooding period, and increased to a new peak prior to the next nesting attempt.

Between successive broods, a pair of doves begins to display courtship behavior anew. At this time the female is, of course, free from incubation duties. Thus she can be seen in the early morning feeding with the male. At more or less regular intervals he will "puff up" and strut in front of her, or will hop after her with legs held stiff and head erect, offering a somewhat menacing appearance. This latter "charge" appears to be very similar to that displayed by two male doves toward each other when engaged in combat. During this display toward the female, the male halts at fairly regular intervals to emit the long-drawn perch coo. This is the time when the male can most often be found cooing on the ground. The territorial instincts of the male are also strongest during the interval between broods. At
this time he will chase almost every dove that flies into his territory.

During the incubation and early brooding periods the male can
be found on his cooing perches in the early morning almost as regularly
as when in an interval between broods, but he now spends a large por-
tion of his time in preening and correspondingly less time in cooing.

F. The Effect of Cooing by Other Males

Whether or not the cooing of one male dove can stimulate other
males to coo is a question that can not be decisively answered. In-
interpretations of this type of behavior vary with the ability and
personal beliefs of the observer.

Ruffing (1952) concluded that the crowing of one cock pheasant
did not stimulate other cocks to crow.

Frequently during this study it appeared that the cooing of one
male dove stimulated another male to coo. On several occasions four
or five doves were cooing simultaneously within hearing distance of the
observer. A few minutes later no cooing could be heard.

On several occasions a male was observed loafing and preening
on his cooing perch. When a neighboring male began to coo, the loaf-
ing male quit preening and also began cooing.

If the cooing of one male does stimulate other males to coo,
we might expect a higher average cooing intensity per male in a dense
population than in a widely scattered population. The pattern of cooing
behavior of rural male doves might be quite different from that of urban
males, such as were observed in this study.
IX OBSERVATIONS ON THE FEATHER MIGT

A. Maintenance and Breeding of Captive Doves

On February 9, 1953, one male and two female doves were captured at the same time in a baited trap. The three birds were placed in a large house cage with a male dove that had been confined there for several months.

On February 22, one pair of doves was placed in each of two large house cages. Roofed nesting boxes were nailed at a height of about seven feet in each cage. Shortly thereafter vandals damaged one of the cages, allowing one of the females to escape.

The male of the remaining pair began to coo regularly but would not tolerate the female on the same perch with him. On April 9, she laid one egg that was apparently infertile. Shortly after this, the pair finally became mated. Subsequently, they raised four nestlings, from three broods.

If breeding pairs are to be maintained in captivity the doves should be isolated by pairs no later than January. This is done to give a pair of doves sufficient time to become mated before the onset of the breeding season.

One worker kept four doves together in a large cage throughout a winter. When the breeding season arrived, he separated the birds into two pairs and placed each pair of doves by itself in a cage. In either case the two doves of a pair did not associate with each other. After some time the females were switched to different males. Both pairs of doves then began to nest.
B. Data on the Rate of Feather Molt

In 1949, wings were collected from 1,223 mourning doves which were shot by hunters in Texas (Swank, 1950). These doves were aged through the use of a technique of determining the ages of juveniles by checking the rate of replacement of the primary wing feathers. The success and peaks of the breeding season could then be calculated.

Since this aging technique was developed in the southern states, it was considered advisable to check its accuracy with northern doves. A record was kept of the replacement of the primary wing feathers of four captive doves whose ages were known (Table 9). This data is compared with data obtained by Swank in Texas and Jenkins in Georgia. Their figures were received in mimeographed form from Harold S. Peters. Dove A, in the table, was 40 days old on June 24. Doves B and C were 42 days old on August 2. Dove D was 35 days old on October 13. The results in the table correspond closely with Swank's figures for doves in Texas.

The wing primaries are the outer ten flight feathers on the wing of a dove. The primaries are numbered from 1 to 10. Number 1 is the innermost primary, number 10 is the outermost primary. Juvenile feathers are recognized by their light colored tips (Figure 13). The juvenile wing feathers in this photograph are the number 8, 9, and 10 primaries, and the outermost two primary coverts. The frayed tips of these juvenile primaries are visible in the photograph.

The primaries are the last feathers to be lost. They molt progressively starting with the number one primary; number 10 is the last primary to be lost.
Table 9. Data on the Rate of Feather Molt

<table>
<thead>
<tr>
<th>Age of doves in days at time of molt of juvenile primaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Feather Number</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>A, B, C, and D Combined</td>
</tr>
</tbody>
</table>

Swank's Data (Texas)  25 30 37 45 54 66 80 96 117 142

Jenkin's Data (Georgia)  40 45 56 68 78 90 98 115 130 150

It should be noted that Swank combined data from captive and wild doves by subtracting 17 days from the ages of the captive birds. Jenkin's data is entirely from captive doves.
Figure 13. An 83-day Old Dove. The white leading edges of the outer three primaries indicate that these are juvenile feathers. The outer two primary coverts are also tipped with white.
1. An intensive study of the nesting behavior of the mourning dove was made during the nesting seasons of 1952 and 1953.

2. The study area, 185 acres in size, comprised the campus of The Ohio State University, in Franklin County, Ohio.

3. Nesting doves were trapped at the nest and marked so as to make possible the identification of individuals.

4. Three different types of nest traps were tested. One of these was devised during the study.

5. Some of the doves were captured in baited traps. These birds were marked; and an attempt was made to follow their movements.

6. Three different types of baited traps were used. One of these was devised during this study.

7. It was speculated that bait-trapping of mourning doves might be most successful early in the summer when the dove population is swelled by flocks of early juveniles and the food supply is not so abundant as in the autumn.

8. All of the doves that were captured, including nestlings, were banded with official U. S. Fish and Wildlife Service numbered aluminum leg bands. A total of 102 doves were banded. There were nine recoveries of banded birds.

9. Three methods of marking doves were tested. The use of a plastic tag pinned to the skin of a dove's back proved to be a promising technique. This practice was not allowed by the U. S. Fish and Wildlife Service, however, on the grounds that it might result in poor public relations for the
entire program of migratory bird research. Subsequently doves were marked with airplane "dope" and a powdered aniline dye.

10. The peak of the dove population on the Study Area occurred from late July through August.

11. Courtship and mating are described.

12. A discussion of the permanency of mating of the mourning dove is given. Four marked pairs of doves remained mated throughout the nesting season of 1953. Two pairs of banded doves were trapped in one season at the same nest sites that they had utilized during the previous season. Observations are given indicating the possibility that some pairs of doves may remain mated between successive nesting seasons.

13. The earliest breeding territories were established by male doves in mid-February. Males maintained cooing perches within their territories. An incident of prolonged territorial strife between two pairs of doves is described and illustrated with a map of the areas involved.

14. The construction and location of nests are described. Nests established early in the nesting season, before the leafing of the deciduous trees, were practically all in conifers.

15. The activities of nesting pairs of doves during the incubation and brooding periods are described. Allowing seven days for courtship and nest construction, 14 days for incubation, and 14 days for brooding, one complete nesting cycle of the mourning dove requires 35 days.

16. Each nesting season extended approximately from March 1 to October 1. The peak of the nest establishment occurred in March and April. There was an average of eleven acres per breeding pair. The nesting success was 64.7% in 1952 and 68.1% in 1953. Each pair attempted an average
number of approximately four nests. An average of 4.4 juveniles were produced per pair.

17. One marked pair of doves established five successful nests in 1953.

18. The most important cause of nesting mortality was inclement weather.

19. One sickly juvenile dove, necropsied by Dr. Alan R. Wagner of the College of Veterinary Medicine of The Ohio State University, was found to be suffering from trichomoniasis.

20. Female doves were observed to emit a weak coo on rare instances.

21. An observation of a male dove cooing on the nest is described.

22. The seasonal curve of cooing intensity maintained its highest plateau throughout May and the first half of June. After mid-June the curve began to gradually decline.

23. The period extending from one-half hour before sunrise until one and one-half hours after sunrise was found to be the period of the day in which the cooing intensity was highest. Throughout this period the cooing intensity maintained a high peak from 30 minutes before sunrise until sunrise. The curve then gradually diminished until 30 minutes after sunrise. After this point the cooing intensity became rather erratic.

24. A series of records of the cooing of marked male doves was made in order to determine the effect of various factors on cooing.

25. Cooing behavior was exceedingly variable. On one morning from one-half hour before sunrise until one and one-half hours after sunrise a marked male emitted 323 coos. A few days later, during the
same period, the same male failed to issue a single coo.

26. Indications were that a temperature at sunrise in excess of 60°F during May was associated with a reduced cooing intensity.

27. Wind did not appear to effect the cooing intensity until it reached a velocity in excess of about ten miles per hour. Cooing counts could be carried on when wind velocities do not exceed 10 miles per hour were it not for the fact that the hearing of the field worker may be impaired and result in low coo counts.

28. A light overcast was not correlated with a diminished cooing intensity. On mornings when the sky was heavily overcast, the onset of cooing was delayed by as much as ten minutes.

29. No correlation was found among barometric pressure, relative humidity, and cooing.

30. A light rainfall did not oppress cooing. The rate of rainfall at which cooing ceases was not determined.

31. Nesting activities exerted a profound influence on cooing behavior. There appeared to be a cycle of cooing intensity that reached its peak during the interval between broods. Cooing nearly ceased during the middle of the brooding period, and increased to a new peak prior to the next nesting attempt.

32. It appeared that the cooing of one male sometimes stimulated another male to coo.

33. Four captive juvenile doves were reared. A record was maintained of the dates on which their primary wing feathers were lost. The average rate of feather molt of these birds was very similar to that which has been found for doves in Texas.
1. In both years of this study the establishment of nests had nearly reached a peak before the leafing of the deciduous trees. These early nesting attempts proved to be as successful as those that were established later in the season. Almost all of these early nests were located in conifers. It would seem that the planting of conifers, to be used as nesting sites early in the season, would be a favorable management practice for mourning doves. Such plantings also would serve as valuable winter cover for the over wintering population, in the northern states.

Norway spruce, *Picea abies*, and red pine, *Pinus resinosa*, would be desirable species for such plantings since they furnished preferred nesting sites for doves during this study. These plantings should be interspersed with clearings in order to provide a maximum "edge effect" and consequently a denser nesting population.

2. In both 1952 and 1953 the nesting season terminated prior to October 1. A hunting season with opening day on October 1, would be unlikely to result in the harvest of any nesting doves. Since the dove population in this area is very low in October, hunting success would probably be very poor.

3. It would seem advisable to conduct a study of the cooing behavior of two or three marked pairs of doves in a less concentrated, rural population. A study in such an area would alleviate the problem of associating coos with the dove that is issuing them. In addition, in a sparse population, the effect that the cooing of a dove would have on the cooing of another bird would be reduced in importance. Artificial lighting would
also be eliminated. What effect this factor had on the population that
was observed in this study is not known.

4. If a series of early-morning cooing dove censuses reveals a
pronounced depression between two peaks in the curve of cooing intensity,
weather data for preceding dates should be thoroughly examined. A severe
storm might have disrupted the nests of many of the breeding pairs on
the area. These doves might have renested on about the same date, thus
causing their individual nesting cycles to become synchronized. Since
there appears to be a cycle of cooing intensity of a duration that cor-
responds with the length of one nesting cycle, all of these doves would
reach the "quiet period" of their cooing cycle at about the same time.

5. Much speculation has occurred concerning the minimum number of
times that an individual cooing census route should be covered. Perhaps
there should be a minimum span of time over which cooing routes are run.
Thus ten trips, on one route, evenly spaced over a period of 35 days might
be preferable to 20 trips run on consecutive days. The figure of 35
days is mentioned advisedly since it is the approximate length of one
complete nesting cycle and, consequently, of one cooing cycle. Ten or
more trips distributed evenly over this period would reveal a mean cooing
intensity for the given population. This figure could be validly compared
with figures of the mean cooing intensities of other populations if all
were arrived at in the same manner.

6. Female doves were rarely observed cooing. For the purpose of
"coo counts" it might be considered that only male doves coo.

7. The period of the day in which coo-counts are conducted, viz.
one-half hour before sunrise until one and one-half hours after sunrise,
was the period in which cooing intensity was highest during this study.
On the contrary individual males cooed quite erratically in the period just preceding sunset. Cooing cooing males at this time of day does not seem advisable.

8. Data collected during this study indicated that a sunrise temperature in excess of about 60° F. during the month of May was associated with reduced cooing intensity.

9. Cooing censuses should not be discontinued due to either a light rainfall or a light overcast, as neither of these factors appeared to influence the intensity of cooing.

10. Cooperators in conducting cooing counts should standardize their methods of recording weather conditions. In this manner a considerable volume of comparable data regarding the relationships of cooing intensities and weather might be accumulated.
XII LITERATURE CITED


