LOCAL MOVEMENTS OF WOOD DUCKS (*AIX SPONSA*)

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In recent years there have been widespread efforts to encourage breeding of Wood Ducks by the provision of nesting boxes, but little is known about the behavior and ecological requirements of broods after they leave the nests. In Ohio, where my studies were made, a number of questions have arisen. For how long do Wood Duck broods occupy a habitat to which they move soon after hatching; where do they go thereafter? Where do Wood Ducks go when they disappear from Ohio lakes and ponds in early October? This paper is designed to throw light on these and related questions to which answers are vital in projects to increase the Wood Duck population.

STUDY AREAS AND METHODS

During 1955 and 1956 I was in the field studying the Wood Duck almost constantly from March to October. Much of the field work was done at the Olentangy Wildlife Experiment Station, Delaware and Marion Counties, Ohio. The Olentangy Station contained 42 small ponds, mostly with less than an acre under water. These ponds contained some emergents and were surrounded by ungrazed and uncut herbaceous vegetation. There were one to three Wood Duck nesting boxes on each pond. Starting in August 1955, work was also done at Buckeye Lake, Licking and Perry Counties, Ohio. Buckeye Lake is a relatively shallow lake and contains much emergent vegetation at its upper or east end. In 1956, work was done on an 11-mile transect of the Scioto River in Ross County, Ohio. Some work was also done in a 10-mile transect of the Scioto River in Pickaway County, Ohio. In addition observations were made on Alum and Whetstone Creeks, in Delaware and Morrow Counties, Ohio, and on scattered farm ponds throughout central Ohio.

During 1955 and 1956 nearly six hundred nesting boxes were checked, and 58 Wood Duck nests were found in boxes and tree cavities. The ducklings or the females or both were color-marked in 48 nests. Trapping and banding of the young was started in early July in 1955 and in early June in 1956. Two hundred and forty-three pre-flight young were banded, and 56 repeats of these birds were recorded. Movement or non-movement of 18 broods was determined by field observations of color-marked birds. Movement or non-movement of 24 broods was determined by trapping and banding activities. During 1955, I banded a total of 230 Wood Ducks, and 30 of these were recovered in the 1955 hunting season.

ACKNOWLEDGMENTS

This paper is a contribution from the Ohio Cooperative Wildlife Research Unit: U.S. Fish and Wildlife Service, Ohio Division of Wildlife, Wildlife Management Institute, and The Ohio State University cooperating. I am grateful to Eugene H. Dustman, Unit Leader, for guidance and financial support throughout the course of the study. Eugene H. Dustman and Milton B. Trautman gave critical advice in preparation of the manuscript.

MOVEMENTS OF DUCKLINGS AFTER LEAVING THE NEST.

At the Olentangy Station in 1955 and 1956, I watched four broods leaving their nests and jumping to the water below. These broods did not long remain on the open water, for the females soon led them to concealing cover. At Buckeye Lake in 1956, I observed three broods of Wood Ducks leaving their nests a short distance from water. In each instance, soon after all the ducklings were on the ground, the waiting female started with her brood toward the nearest surface water; after reaching water, the female and her brood soon went into nearby concealing vegetation. In all cases the young jumped from the nest to the ground and reached water by walking, if they did not jump into the water from the nest. The first movement of newly hatched Wood Ducks, after leaving their nests, was toward water; the second movement was toward concealing cover.

Newly hatched ducklings went to water areas nearest the hatching places, provided vegetative cover was present at the water area. I found one brood less than a week old near a spring-fed pool only a couple of feet in diameter, which had such cover. Two broods of ducklings hatched on farm ponds with closely grazed margins were not found at their native ponds after they left their nests. Eight and ten visits were made to the two ponds, and I spent about ten hours at each pond searching for the broods. The extent of the water area appeared to be relatively unimportant. All the water areas to which ducklings moved when leaving their nests contained a substantial amount of vegetation around their margins.

Except for two broods which hatched in boxes on the same pond within the same two weeks, 24 broods observed in 1955 and 1956 at the Olentangy Station and on the Scioto River spent the first two weeks somewhat isolated from other broods of the same species. The movement of newly hatched ducklings appeared to be solely toward areas offering the combination of hiding cover and water. Except for broods hatching from nests near the same water areas, there was no apparent congregating of broods in this first movement after hatching of ducklings.

FOLLOWING RESPONSE OF NEWLY HATCHED DUCKLINGS

Very young ducklings which became separated from the female continued feeding and moving about in a compact group. One brood several days old when found on the Scioto River swam out into the current of the river and was soon carried some 3,000 feet down the river after the female flew up the river. I approached this brood to within 15 feet and followed it with a boat for more than an hour. At another time a solitary duckling, apparently lost on the Scioto River, approached and followed my boat showing almost a complete absence of fear. Fishermen on the Scioto River also reported that solitary lost ducklings several times came to them at their boat docks and remained for hours. Collias and Collias (1956:309), working chiefly with captive ducklings, showed that on the first day out of the nest, ducklings have a strong tendency to follow any moving object. In wild ducklings under natural conditions, another object is not likely to be substituted for the female unless the duckling becomes lost from the female. This trait has survival value if the probability of the lost duckling following a benefactor is greater than the probability of its following a malefactor. When in the water, in a fairly dense Wood Duck population, the chances are favorable that a lost duckling will join another brood.

CONGREGATING MOVEMENT AT ABOUT TWO WEEKS OF AGE

In observations of 36 broods during 1955 and 1956 at the Olentangy Station, on the Scioto River, and at two isolated farm ponds in central Ohio, the ducklings remained until about two weeks of age at or near the site to which they had gone upon leaving the nest. When about two weeks old, most broods moved to new areas. In this movement, broods travelled to areas occupied by other broods, and three to six broods sometimes came to occupy the same small pond or short section of the Scioto River. This was definitely a congregating movement.

In each of seven areas where three to six broods congregated, there was one brood which had reached the area as newly hatched ducklings. Those broods entering the congregation areas as newly hatched ducklings did not move at two weeks of age but were the nuclei for the congregations. Only one of 36 broods at the Olentangy Station in 1955 and 1956 remained alone on a pond after two weeks of age. One brood also remained alone on an isolated farm pond. Except for the two broods which remained alone on ponds after two weeks of age, all the 36 broods occupied areas with two or more broods.

Course of Travel of Broods.—Two color-marked broods at the Olentangy Station appeared on a pond about one-half mile from their natal ponds. These ponds were separated by woods and fields, but they were connected by a road, and tracks of small ducks observed in the mud on this

road a thousand feet from the nearest pond suggested its possible use for terrestrial movements of flightless ducks. Hochbaum (1944:104) also observed that various species of ducks follow roads in overland movements to new water areas.

Locations of broods indicated that ducklings on small streams followed the streams to larger water courses. Two color-marked broods were found on creeks at the mouths of tributary streams leading to the general localities of the ducks' natal boxes, and both of these broods had moved approximately one mile down small streams. In congregation movements, the broods moved both cross-country and along water courses; thus the movements did not always consist of a simple process of drifting up or down a water course to favorable habitat.

Distances Traveled by Broods.—Trapping a brood with the banded female showed that one brood moved 3.5 miles up the Scioto River to a congregation site. The air-line distance was only slightly more than half the river distance, but I assumed that these ducklings, like other broods observed, reached the ultimate brood habitat by following the course of the river. Those birds which arrived as day-old ducklings and furnished the nuclei for the congregations did not move to new areas at two weeks of age. The distances moved by broods to congregation points varied from zero to 3.5 miles.

Daily Range of Ducklings.—Before moving into congregation areas at about two weeks of age, three individual broods observed on the Scioto River swam along the shore ahead of my slowly moving boat as much as one-fourth mile before coming to cover overhanging the water or before running over the shore to protective cover. Older broods in congregations (in forty or more observations) swam only relatively short distances before escaping into cover.

Where the congregation area was a farm pond surrounded with herbaceous plants, the range of movements of ducklings was limited to the pond and an area 50–100 feet around all or part of its margin. At one pond with a relatively large area of emergent vegetation, the width of the marginal strip used for escape cover was somewhat narrower and less continuous, and the movement of the ducklings appeared to be confined to the water area. The daily range of ducklings in brood congregations was restricted by the extent of the escape cover.

Mixing of Broods within Congregations.—Although as many as five and six broods occupied small ponds less than a half acre in area or a short section of river, not all of the broods of a given congregation combined into a single group. The individual broods continued to maintain a moderate degree of brood purity, and mixing of broods occurred to only a limited degree.

When ducklings became lost from the original broods, they joined

other broods when these were available; sometimes one or two ducklings of an age several weeks younger or older than the main brood were seen with broods. Frequently two broods merged and moved about with one or both female ducks, but never more than 18 ducklings were observed following one or two adult females in a single group.

When two broods merged, they were usually led by one female, but sometimes by both, and sometimes by none. The fact that females seldom entered the traps with their young broods, together with the fact that these birds were trapped at corn-baited sites some distance from their brood areas, indicated that the females fed elsewhere than with their young, and that they still maintained their morning and evening feeding schedule when leading broods. This left the young alone to fend for themselves or to join other broods.

Behavior of Females when Disturbed with Broods.—When slowly approached from a relatively long distance, the females usually led their broods to cover or flew away. If closely pressed when the young were unconcealed, the females usually called, feigned injury, and conspicuously moved away as the young dived beneath or skittered over the water surface to concealing cover. The injury feigning continued until the intruder was lured as much as a half mile from the brood. Mumford (1952: 30) observed that, when disturbed, females remained longer with young ducklings than with older ones.

Abandonment of Young by Females.—About two weeks before the young were able to fly, or at about six weeks of age, the females started spending more time away from their broods. On June 30, 1956, post-brood flocking of females was first noted when two groups of three adult females were seen on the Scioto River in mid-afternoon. Because adult Wood Ducks normally feed in the morning and evening and because of the absence of feeding behavior, I thought that these females had not left their broods for feeding purposes. While the females gave their broods less attention after about six weeks of age, they did not ordinarily completely abandon them at this time.

Relations of Drakes to Young.—Bent (1923: 162), Dixon (1924: 51), and Kendeigh (1952: 186–187) reported that the males help take care of the young, but Mumford (1952: 28) reported seeing a male with a female and her brood on only two occasions. Bellrose (1955: 8) reported that drakes leave the females shortly before the eggs hatch. My observations indicated that males gathered into increasingly larger groups near the end of the incubation period or otherwise withdrew from association with the females at that time. One male came to a pond and remained several minutes in the morning of the day young came from a nest box on the pond; otherwise no males were seen with or near broods. When the ducklings hatched, the females assumed full respon-

sibility for their care. Meanwhile, local drakes gathered into increasingly larger congregations.

Disappearance of Molting Males.—In the Scioto River study area during 1956 a marked decline in the number of males occurred on about June 1, and disappearance of all males soon followed. On May 30, 1955, a post-nesting concentration of drakes numbering 28 birds was last seen at the Olentangy Station. Where the group went for the post-nuptial molt was a mystery to me, but Richard Reece, Ohio Division of Wildlife, later advised me (personal conversation) that he had observed numerous feathers and a number of flightless Wood Ducks at an isolated woodland pond six miles northward from the pond where I had last observed the flock. Wishing to trap and band flightless males, I operated a trap at this pond throughout the summer of 1956, but none was captured, nor was evidence of their presence found there in 1956.

The only molting male captured in the two years of this study was in 1956 at the chief congregation pond at the Olentangy Station. It is reasonably certain that there were no other, or at least few, molting males on this pond during the molting period. Bellrose (1955: 8) stated that males join others of their sex on secluded woodland ponds or swamps to undergo the postnuptial molt.

Possible Explanations for Brood Congregations.—It is probable that a major cause of the congregations is the suitability of the particular areas for feeding and cover. Social factors may also play an important part.

The gregarious nature of the Wood Duck is such that solitary adults are seldom seen except when incubating. Females with broods may well be attracted by the presence of other adult individuals of the same species. Many of the broods emerged from the nests in mid-May, and nearly all of the males disappeared from the nesting localities by June 1. Brood congregations commenced to form at the same time the males disappeared, presumably going into isolation preparatory to undergoing the postnuptial molt. Among adults of her own species, then, the female could seek the company only of other females, and at the disappearance of the males she would join other females, taking her brood along. The females would have knowledge of the congregation areas, because both during the incubation period and during the early period thereafter, they join other adult ducks when feeding.

Except that one pond utilized in 1955 was not used in 1956, the same four ponds were used by brood congregations in both years at the Olentangy Station, although the distribution of occupied nesting boxes was different each year. Similar to the above fact, the presence of two congregations—one of five broods and one of three broods—less than a half mile apart on the Scioto River suggests that available habitat may

be an important factor influencing the locations of congregations. Traps were operated at both of these congregation areas, and no exchange of ducklings between stations was noted, although 41 ducklings were banded and 12 repeats recorded during June and July.

In creek surveys there was further indication that congregations may be associated with discontinuous habitat. Congregations were less apparent in each of two 10-mile sections of Whetstone and Alum Creeks in central Ohio than in a 21-mile section of the Scioto River. In these creeks, Willow-herb (*Epilobium* sp.) and other low-growing vegetation formed more nearly continuous cover than the Willow (*Salix* sp.) groves, which provided cover only at isolated sand bars and islands along the Scioto River. On one isolated farm pond where there was no known additional Wood Duck habitat or brood within 2 miles, a brood also remained alone.

CONGREGATING MOVEMENTS AFTER YOUNG WERE ABLE TO FLY

When the young ducks became able to fly at eight weeks of age, further movement and congregation occurred. During 1956 at the Olentangy Station, this movement was first noticed on July 11, the same date that a flying bird-of-the-year was first noted. This duck moved a distance of 6 miles from its native pond to the congregation pond. Another duck made the same flight so that it was trapped two weeks later. There was also movement of ducks on the Scioto River at or soon after the time that the ducks first became able to fly. On August 4, 1956, a Wood Duck was trapped 5 miles down the river from the place the bird had been banded 35 days earlier at six to seven weeks of age. Four other birds taken 8 miles north of the trapping site on the Scioto River probably moved at the same time, although they were not retrapped until mid-September.

Non-movement of a Segment of the Population.—Not all Wood Ducks moved at eight weeks, but movement at this age seemed to involve a more general shuffling of the population than the earlier movements. Several Wood Ducks were trapped on the Scioto River in late September only a short distance from where they had been earlier banded as flightless young, and two were shot on the Scioto River on October 15, 1956, only a short distance from the spot where they had been banded in June as pre-flight young. As indicated by trapping at the Olentangy Station and on the Scioto River, some ducks already in the congregation area remained there.

Direction of Movement.—Movement occurred both up and down the river from given points. From one trapping station, four ducks moved 8 miles northward up the river, and one duck moved 5 miles southward down the river. It was not definitely determined whether the movements

followed only the course of the river, but late summer and fall surveys of the duck population on the lower Scioto River indicated that there had been no major change in the total number of ducks present.

Segregation of Young and Adults.—There appeared to be some segregation of locally reared young from adults in the fall. In 1956 at Buckeye Lake, none of the seven females banded earlier as incubating birds were among the 84 Wood Ducks trapped during August and September. There were, however, approximately 45 birds which were not trapped but were known to be present on the lake. Sutton (1928: 71) stated, "In the fall the locally-reared young congregate, seemingly by themselves, and the single males and females, or small groups of the adults, wander about aimlessly."

Numbers of Birds in Late Summer Congregations.—The sizes of the congregations were not controlled alone by the numbers of ducks within a standard radius of the congregation area. Six immature Wood Ducks were known to have flown approximately 8 miles from their brood sites to their post-brood congregation areas. Two groups maintained their isolation on farm ponds through September, although they were separated by slightly less than 2 miles. One of these groups consisted of only nine ducks, presumably a family group; this seemingly unusual situation may have resulted from the fact that the ducks were being artificially fed at both stations. At Buckeye Lake, which is 7.5 miles in length, a small group of 12 Wood Ducks persisted throughout September, 1955, although a group of 160 birds gathered 6 miles distant near the opposite end of the lake. This was the largest congregation observed in central Ohio. Three congregations of 100–120 birds were observed on the Scioto River, but the largest group observed at one time at the Olentangy Station was 80 ducks.

Daily Movements of Late Summer Congregations.—The extent of the diurnal movements of these late summer groups was not determined in detail. At Buckeye Lake, the ducks of the larger group roosted only about one-half mile from the feeding place. This feeding place, however, was artificially maintained in connection with a banding program, and, immediately before the banding program was initiated, the ducks had been feeding in a farmer's hog lot about one-half mile more distant from the roosting place.

The morning exodus from the roosting site was made before light intensity favored detailed observations, but, in general, the ducks left the roosting site in the morning in larger groups than those in which they entered in the evening. The evening roosting flight extended through about an hour and consisted of small groups of from one to twenty birds.

At Buckeye Lake, when the feeding site was located on a mud bar near the mouth of Honey Creek, small groups of ducks started to gather near

the feeding site in mid-afternoon. Feeding did not occur until evening. When the feeding flights took the ducks away from their water habitat to farmers' hog lots, as was the case with two groups on the Scioto River, the flights were made by all the ducks in one flock. Flocks started to assemble for such flights in mid-afternoon.

The interval between morning feeding and assembly for evening feeding was spent in small groups sitting on the water, on logs, and in low trees over the water preening and loafing.

Characteristics of Late Summer Congregation Sites.—The congregations at the Olentangy Station were at the same pond both in 1955 and 1956. This pond contained emergent vegetation over most of its area. In 1955, the emergent vegetation was chiefly Cat-tail (*Typha* sp.) 3 to 4 feet tall, but in 1956, a higher water level was maintained so that there was an increased water area covered by vegetation to a height of about 18 inches. There was a fallen tree in the shallower portion of the pond as well as several standing trees. The feeding place, after artificial feeding was discontinued, was not located. On the Scioto River, duck congregations were near their feeding places, and there usually seemed to be a wide, bare sand or gravel bar associated with congregations in this area. The birds loafed on these bars. Where the congregations occurred at Buckeye Lake, an abundance of emergent vegetation provided some isolation from fishermen; an extensive Cat-tail marsh cut off the land side, while Spatter-dock (*Nymphaea advena*) beds cut off the water side against the approach of fishermen. The Cat-tail and Spatter-dock furnished roosting and loafing retreat, and nearby farmers' hog lots furnished a food supply. Artificial feeding appeared to have been responsible for holding two small groups on private ponds throughout September.

Early Fall Dispersal of Late Summer Congregations

Disbanding of Late Summer Congregations.—Known post-brood congregations during 1955 and 1956 on a pond at the Olentangy Station, on a private farm pond, on Buckeye Lake, and on the Hocking River in Hocking County, Ohio, persisted until about the first of October. The exact dates of dispersal of late summer congregations was not ascertained in every case but was known to have been within a few days before or after October 1. On September 30, 1955, the majority of the flock of some 160 ducks suddenly left Buckeye Lake; on October 3, 1956, the number of Wood Ducks in the roosting flight declined from an earlier 145 to 15. A small flock at a farm pond near New Albany, Ohio, was last seen on October 1, 1955.

Fall Movement from Ponds and Lakes to Creeks and Rivers.—In 1955, 230 Wood Ducks were banded in Ohio as adults, flightless young, and

immatures. The subsequent recovery of 30 of these birds indicated the pattern of Wood Duck dispersal after the break up of late summer congregations. Of the 30 birds which were shot by hunters, 22 were birds banded at Buckeye Lake, and of these 22 recoveries, 14 were of birds shot in Ohio before the end of October. All of the 14 birds killed in Ohio were shot within 40 miles of the late summer congregation site, 13 were shot within 15 miles, and 12 of the 14 were shot within 10 miles of the late summer congregation site. Only two were reported shot at Buckeye Lake. Of the 12 birds from Buckeye Lake shot in Ohio elsewhere than at Buckeye Lake, all were reported shot on rivers and creeks. All 14 were immature birds which were probably hatched at Buckeye Lake.

Only four of the 66 Wood Ducks banded at the Olentangy Station during 1955 were recovered in Ohio the following fall, and two of these were known to be locally reared birds. These two birds, as well as two adults, were also shot on streams within 10 miles of the late summer congregation site.

An examination of the banding data in the files of the U.S. Fish and Wildlife Service indicates that some birds travel several hundred miles in this late September dispersal.

Direction of Movement in Fall Dispersal.—From recoveries of birds banded at Buckeye Lake and at the Olentangy Station, it is apparent that when late summer congregations of Wood Ducks disband and leave lakes and ponds, the birds scatter in all directions. These early October movements consisted of radial dispersal rather than congregation of numbers as was characteristic of earlier movements. Only 5 of 18 birds shot in Ohio had moved in a southerly direction, and flight occurred in every general direction.

Movement of Ducks in Response to Shooting.—If river habitats are the goal of the early October movement of Wood Ducks, there should be no movement of duck populations which earlier occupied river habitats. In the creek and river habitats under observation, there appeared to be no exodus of ducks before October 15—the date in 1956 of opening of the general duck hunting season. In spite of the fact that there was no open season on Wood Ducks in Ohio during 1956, there was considerable duck shooting on the Scioto River during the early part of the hunting season. A survey of the population status of Wood Ducks on the lower Scioto River on October 20, 1956, indicated that the congregations had left the river. There is little available evidence to indicate where these ducks went, but the recovery of a crippled, banded bird at Deer Creek near Williamsport, Pickaway County, Ohio, in mid-November indicated that there was at least some movement from the

Scioto River to nearby creeks. More recovery data are needed from ducks banded in river habitats.

Paul Gibson, a Union County, Ohio, duck hunter and bird watcher, advised me that he had noticed a difference, correlated with shooting, in the times of the fall when Wood Ducks left Big Darby Creek. In 1956, when there was no known shooting of Wood Ducks in two congregations, these birds remained at least until October 27. During years of shooting they normally moved out a few days after shooting started or almost two weeks earlier when shooting occurred than when it did not.

SOUTHWARD MIGRATION.

Field observations and banding recoveries of Ohio birds indicated that southward migration occurred in the last few days of October and in early November.

SUMMARY

With the aid of color-marking, banding, and intensive field observations, a study of local movements of Wood Ducks was made in central Ohio in 1955–1956.

Broods usually remained at water nearest their natal sites throughout their first two weeks out of the nest but moved to new habitats at about two weeks of age. Such moves frequently resulted in the formation of congregations of five and six broods.

The longest distance moved by a brood to a congregation area was 3.5 miles, assuming that the brood followed the water course rather than moving cross-country.

When lost from the female, very young ducklings did not show their normal fear and followed various moving animals and objects. At such times they readily joined Wood Duck broods other than their own, and some mixing of broods thus occurred.

When leading broods, females made their usual morning and evening feeding flights to other areas than those occupied by the broods. The females started gathering into small groups when their ducklings were about six weeks of age.

A shifting of population occurred when the young became able to fly, and this resulted in further congregating of Wood Ducks. Six birds moved 5 to 8 miles. Birds at the congregation centers did not move but furnished the nuclei of the congregations.

Within five days of October 1, during 1955 and 1956, Wood Ducks left ponds and lakes and moved to rivers and creeks. Movement usually amounted to less than 15 miles, and ducks moved all directions from the late summer congregation sites.

During 1955 and 1956, most southward migration occurred during late October or early November.

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