

THE BIG LAKE WOOD DUCK: A Two-year Study of its Pre-flight Mortality, Nesting Population Growth and Migration, 1970-71

Bobby W. Brown
Manager
Big Lake National Wildlife Refuge

ABSTRACT

During a two-year period (1970-71), 3,037 hatchling Wood Ducks (*Aix Sponsa*) were web tagged and another 2,049 adults and sub-adults leg banded in an effort to measure preflight mortality, nesting population growth, and to indicate migration habits of those produced on the Big Lake National Wildlife Refuge. All ducklings web tagged were taken from nest boxes located on the refuge and all ducks were captured within or in close proximity to the nesting sites. Recoveries of web tags indicate an average annual mortality of 60.5% among preflight young, for the two-year period. Band returns indicate a 72.3% return of nesting females to the refuge and an annual growth of 60.6% in the nesting population. Direct band and tag returns indicate a dispersal of Wood Ducks from the refuge to other areas of the country starting late in the summer. The dispersal includes an early movement of drakes primarily to the north, as far as Wisconsin, and involves both adults and young-of-the-year.

INTRODUCTION

Big Lake is one of several national wildlife refuges that has made attempts at increasing the production of Wood Ducks through the use of nest boxes. In 1969 — five years after the latest nest box program began — it was estimated that the refuge produced 924 Wood Ducks, to flight-stage. Due to a general lack of basic information about ducks produced here, it has not been possible to say whether this number is satisfactory for the refuge to produce.

The production of ducks with nest boxes requires considerably more management effort than does the production of ground nesting ducks. In addition to the expense of building and erecting the boxes, they must be inspected periodically to sustain use and to make sure they remain in good repair. Before exerting the extra effort required to increase production it is desirable to know what the benefits, if any, may be.

This study is to assist in determining at what level Wood Duck production would be desirable for the refuge. It is to do this by providing information in three characteristics of Big Lake Wood Ducks. These are: (1) migration habits, (2) annual preflight survival, and (3) annual nesting population change.

DESCRIPTION OF THE STUDY AREA

The Big Lake National Wildlife Refuge is in northeast Arkansas, located in Mississippi County, 20 miles west of the Mississippi River. Most of the lands around the refuge have been cleared of timber and ditched to improve drainage. The county is reported to be the nation's leading producer of rain-watered cotton. Within the refuge are almost 11,000 acres of the so called Big Lake Sunk Lands. These lowlands exist in a flat, alluvial plain and were probably formed somewhere between 1,000 and 1,500 years ago as a result of alluvial drowning of several relic, braided stream channels by a Mississippi River crevasse channel (Saucier 1970). The topography of the refuge ranges in elevation from 230' to 240' m.s.l., three-fourths of the area is in heavy, virgin timber.

The predominant timber type throughout is bald cypress (*Taxodium distichum*). Two-thirds of the timberlands are below elevation 233.4' and are flooded by the lake to a depth of 18 inches or less. The dominant tree species in the swamps, other than cypress, are ash (*Fraxinus pennsylvanica*), water locust (*Gleditsia aquatica*), willow (*Salix nigra*), with understories of water elm (*Planera aquatica*), and swamp privet (*Forestiera acuminata*). Willows dominate the lands between elevation 232' and 231.5' in the fringes between the wooded areas and open water. There are no marshes. Elevations below 231.5' — some 2,500 acres — are open water. The lake is held by one control structure.

Most of the smaller openings of the lake contain aquatic plants such as yonkapin (*Nelumbo lutea*), coontail (*Ceratophyllum demersum*) floating pondweed (*Potamogeton americanus*), waterwillow (*Decodon verticillatus*), waterprimrose (*Jussiae diffusa*).

At Big Lake, buttonbush stands (*Cephalanthus occidentalis*) venture out into the lake beyond the willows. Over the past few years sizable portions of the buttonbush stands have been killed by climbing hempweed (*Mikania scaudens*).

METHODS

The three objectives sought in this study were accomplished through the mark and recovery of individuals in the population. Wood Ducks were marked as hatchlings, adults and sub-adults. Fledged birds were marked by use of standard Fish and Wildlife Service leg bands, while nestlings were marked with serially numbered, monel-metal, fish tags inserted in the web of the duckling's feet. The procedure for attaching the fish tags is described by Grice and Rogers (1965).

Locating and Web Tagging Hatchlings

At the start of the study there were 189 nest boxes available for Wood Ducks on the refuge. They had been scattered over most of the refuge to promote use, and were located from 6 to 8 feet above the normal level of the lake to protect them from frequent, severe flooding. Since the boxes were so scattered, all could not be included in the study. All that were included could be reached by boat, over a route covering 27 miles round trip. Since boxes were mounted high above the water, special equipment had to be devised so that they could be checked easily.

The procedures used to locate and tag the nestlings were basically the same as those used by Grice and Rogers, and Hester (1962). Since the refuge personnel staff was small and attention to other refuge matters was necessary, not much time could be spent inspecting the nest boxes. A technique was worked out whereby it was possible to predict the date each nest was to begin incubation, and when the clutch would hatch. This permitted a maximum number of ducklings to be tagged while expending a minimum amount of time inspecting boxes.

Marking Adults and Sub-adults

The hens encountered while nesting were captured on the nest during the final week of incubation and banded so that the changes in the nesting population could be estimated.

Only those hens that could be caught with a reasonable amount of effort were banded during the first year of the study. A concentrated effort was made the second year to recover those that had been web tagged and banded the year before.

Toward the end of the nesting period, bait traps were set out in order to try and capture as many of the fledged young as possible. This was done to recover the ducklings that had been web tagged and to mark others so that movements could be charted.

To start bait trapping, small platforms were moved into the nesting areas, set up over the water, and baited with wheat. When a sufficient number of ducks were noted to feed on them, a small wire trap was set up on each platform. Traps were run twice each day throughout the summer. The web tagged ducks caught in these traps were banded. These "double-marked" ducks (web tagged and leg banded) were then later used as a basis for estimating the number of other web tagged ducks which has survived to flight stage, but had not been captured in the initial try. The survival estimate for the first year of the study could not be made until the second year, because it was necessary to wait until the hens returned to the refuge to nest. This is the same technique used by Grice and Rogers, Hester, Odum (1969) and others.

For the second year of the study, however, a two-stage trap method was used which made it possible to estimate pre-flight survival in the same year that the ducklings hatched. The small traps were employed in the same manner as in 1970; however, in late August, when it was thought that most ducklings were on the wing, the small traps were closed and trapping was switched to a single, very large trap, located on the extreme south end of the refuge. The purpose for doing this was to try and estimate the number of web tagged ducks which had not been captured in the small traps. The ratio of double-marked to single-marked ducks which turned up in the big trap would indicate the ratio which existed when the small traps were closed. This ratio, it was felt, would also be the number of ducklings which had actually survived to flight stage.

RESULTS

Survival

A tabulation of information pertaining to the tagging of nestlings is presented in Table 1.

During the trapping operations that followed nesting in 1970, there were a total of 96 fledged ducks captured which had been web tagged. The following year there were 35 captured, either while nesting or in bait traps; seven of these were drakes. Grice and Roger's formula for computing survival can be used if drakes are omitted. Of the 28 hens captured in 1971, only four were double-marked (the four were part of the 96 pledged ducks with web tags that were trapped in 1970). Of the 96 caught in 1970, 48 were females. Survival is calculated:

Insert Formulas

Since 645 of the 1,290 ducklings tagged were assumed to be females, and 336 were calculated to have survived to flight, a 52% survival rate is indicated.

Of the ducklings web tagged in 1971, only 79 were captured in the small traps after they had fledged. In September of that year, trapping was switched from the small traps to the one large trap. Over the course of the next few weeks, the large trap collected 139 ducks which had been web tagged that summer. An additional 28 were collected which were both web tagged and banded. These 28 were part of the 79 which had been captured in the small traps earlier. This indicates that there were 5.96 times as many web tagged ducks available to be trapped at the time the small traps were closed, as were actually taken. The number of ducklings surviving was computed to be 471 (5.96×79). Since the total number of ducklings web tagged was 1,737, this represents a survival rate of only 27.1%.

Nesting Population Change

During the 1970 nesting season, there were known to be at least 94 different hens which brought off successful broods in the nest boxes under study. There

were another 15 hens which produced broods but they avoided capture and could not be identified. The following year there were 151 hens with broods that were captured and identified. This represents an increase in the nesting population of 60.6%.

Of the 94 hens that nested in 1970, sixty-eight of them returned to nest in 1971. One other hen was caught and killed in a trap early in the nesting season. The minimum survival for nesting hens between the two years was 73.4%.

Migration

During the two years of the study, 2,049 Wood Ducks were banded, and 3,037 were web tagged, to assist in charting off-refuge movements. In the 10 years prior to the study, 1,769 Wood Ducks had been banded, primarily to fill quotas assigned by the Bureau's Migratory Bird Population Station. The returns from all these marked birds are used to indicate migration habits of Big Lake ducks.

There have been 168 recoveries reported from the 3,818 Wood Ducks banded. However, a good portion of these were ducks banded during the migration period — believed to take place through this area between late August and mid-March — and only those banded between April 1, and August 15, are considered as truly representing the movements of refuge ducks. All web tag recoveries are considered, since there is no doubt that they were produced on the refuge.

Of the 168 band recoveries, only 22 were ducks that were banded during the breeding, or non-migration period. There have been 13 recoveries of web tags reported. Table 2 lists the recoveries believed to indicate movements of refuge ducks. Table 3 lists band recoveries of ducks banded during the migration period.

Tag returns indicate a late summer dispersal of drakes. Hunters who reported the recovery of web tags did not always provide information on the sex of the birds. However, of the 13 recoveries reported, six were drakes and one a hen. The other six are unknown.

In Wisconsin and Missouri, hunters recovered immature refuge drakes in the same year that they were hatched. This is unusual since it is a "reverse" of the usual pattern of movement — ducks fly south in the fall! Other immature ducks were recovered in Louisiana and Texas but it could not be determined if these were early dispersals from the refuge. The ducks which move to the north undoubtedly fly south as the weather turns cold, and may actually spend the winter in Louisiana, Texas or Mississippi. It can be seen in Tables 2 and 3 that these states rate high as recovery areas for Big Lake ducks, and that there is not a great degree of difference between recovery locations for ducks produced on the refuge, and those banded during the migration period.

Very few Wood Ducks spend the winter in the Big Lake area. Of the many bands and tags reported by hunters, there were only 21 which came from the vicinity of the refuge. Fifteen of these (71%) were taken by hunters before the end of November. There would no doubt be more recoveries from this area, except that Arkansas traditionally opens its hunting season in the last half of November.

Although the early dispersal of Wood Ducks seems to be among drakes, the hens migrate also. Recoveries of hens known to be refuge products, however, come from Arkansas and to the south.

DISCUSSION

Survival

The survival rate for un-fledged ducks in 1970 was 52%. This compares favorably with the findings of other researchers. However, the rate is quite low for 1971. The procedure used to arrive at this estimate is new — calculations were based upon recoveries all made in the same year as the ducklings were

tagged — and it may not be adequate for making an accurate estimate.

Switching to the single, large trap may have been too late in the year, and a significant number of ducks may have already left the refuge. A check was made for this by combining the ducks tagged into weekly age groups, and comparing the percent of each group recovered during summer trapping. If the older ducks were leaving the refuge as they became old enough to fly, they would have been under-represented in the trap samples.

There was no peculiar absence of older ducks in the sample taken by the small traps. However, examining the sample of young-of-the-year taken by the large trap, did indicate a reduction in the number of older drakes in the sample. In the sample taken in 1971, there were 139 tagged, immature ducks trapped. Sixty-five of them were older than 128 days when caught, and 74 were younger. The sex ratio of the younger group was equal (37 to 37), while in the older group only 38% were drakes (25 males to 40 females). The large trap picked up the change in the population because it was not used until after September 1. There was obviously little movement of ducks until late summer.

The earliest movement recorded for Big Lake duck was of an immature drake, 116 days old, taken on August 26, near Puxico, Missouri — some 90 miles north of the refuge.

Nesting Population

Banding the hens on the nest revealed that during the two years of the study there were 27 which produced broods in a year (8 the first and 19 the second). Two additional hens incubated second clutches after bringing off a brood but the eggs failed to hatch. Of the 27 hens with double broods, it is known that at least portions of the first broods of 16 hens survived to flight stage — they were later trapped at this age. Five of the 27 first broods were not tagged and it could not be determined if any of them survived. Three of the hens producing double broods the first year also produced two the second.

Although there was estimated to be only about a hundred pairs of Wood Ducks nesting on the refuge when the latest nest box program was started in 1965, it was obvious from the start of the study that the addition of nest boxes had not kept pace with the growth of the nesting population. There was an extreme amount of competition between Wood Ducks for the nest boxes available. The first year of the study there were 189 nest boxes available on the refuge, and 123 were included in the study. The study boxes produced a total of 125 broods. During the second year there were 215 boxes on the refuge, 131 included in the study — the study boxes produced 180 broods. Less than a dozen of the boxes went unused either year.

In competing for the boxes, up to 4 hens would lay eggs in the same box on the same day. In a great many instances, hens would continue to lay eggs in nests even after incubation had started by another hen. As a result of this, many eggs did not hatch along with the main part of the clutch. Except for the last few nests of the season, it is doubtful that any hen laid the entire clutch of eggs that she incubated.

Each summer when trapping operations were undertaken, it was striking to note that a large percentage of the ducklings captured were not web tagged, when it was known that somewhere near 50% of those produced in the boxes had been tagged. The percent of tagged birds actually being encountered was only about 25%.

Since most of the ducks being trapped were on the wing, it could not be assumed with certainty that all were refuge ducks. Part of those untagged could have moved in from other areas. In 1971, an attempt was made to trap a number of flightless young to check the tagged-untagged ratio.

During that year it was estimated that 50.8% of all the ducks produced in the nest boxes had been web tagged. Trapping that summer produced 133 unfledged

locals. Only 44 had been web tagged. From a ration and proportion formula it can be seen that only 87 of these ducklings can be attributed to the nest boxes:

$$X = B \frac{(C+D)}{C}$$

$$X = 48 \frac{(4+24)}{4}$$

X=336 females surviving to flight stage

X=44

100%

50.8%

X=87

The other 46 ducklings no doubt came from natural cavities in the woodlands. This rate, 34%, is considerably higher than natural production was thought to be at this refuge. It may be that ducks have been driven to attempt more nesting in trees since nest-box space was becoming less available each year.

Whether or not Wood Ducks will traverse back and forth freely between nest boxes and tree-cavities is unknown. A comparison of nest boxes, selected by hens nesting their first time with the box that they were born in — and supposedly imprinted to — revealed that Big Lake ducks may not be closely attached to their natal area or to the type of box that they were hatched in.

There were 16 first-year hens that nested in the study boxes in 1971. Almost two-thirds of them (62.5) chose boxes made of different material (wood or metal) than their natal box. Only about a third (37.5%) returned to the same cluster of boxes where they were born — none nested in their natal box. Five of the hens nested at least 2½ miles from their natal area, and two nested 5 miles away.

Table 1

**Wood Ducks Web Tagged From Nest Boxes
During Years 1970 and 1971**

	1970	1971
Number of ducklings web tagged	1,290	1,737
Number of broods tagged	111	150
Number of broods produced in study boxes	125	180
Number of boxes in study	123	131
Number of boxes on refuge	189	215

Table 2

Recoveries of tags and bands of Wood Ducks marked between April 1 and August 15,
(1963 thru 1971)

Web Tags		Leg Bands	
Direct Recoveries*		Direct Recoveries*	
Recovery State	No. of Recoveries	Recovery State	No. of Recoveries
		Louisiana	8
Arkansas	5	Arkansas	7
Missouri	2	Wisconsin	1
Texas	2	Texas	1
Wisconsin	1		
Louisiana	1		
		Indirect Recoveries	
		Arkansas	1
		Louisiana	1
		Michigan	1
Missouri	1	Minnesota	1
Nebraska	1	New York	1

*Direct returns are from ducks marked less than one year. Indirect returns are from ducks marked for one year or more.

Table 3

Recoveries of Wood Ducks banded between August 16 and March 31
(1963 thru 1971)

Direct Recoveries		Indirect Recoveries	
Recovery State	No. of Recoveries	Recovery State	No. of Recoveries
Louisiana	21	Louisiana	18
Arkansas	11	Arkansas	14
Mississippi	10	Wisconsin	8
Texas	8	Minnesota	6
Alabama	8	Texas	6
Missouri	5	Illinois	5
Wisconsin	3	Mississippi	5
Minnesota	3	Alabama	3
Oklahoma	2	Michigan	2
Illinois	1	S. Carolina	2
Michigan	1	Iowa	1
Florida	1	Missouri	1
		Ontario, Canada	1

LITERATURE CITED

- Grice, D., and J.P. Rogers, 1965. The Wood Duck in Massachusetts. Massachusetts Div. of Fisheries and Game, Boston.
- Hester, E.F., 1962. Survival, Renesting, and Return of Adult Wood Ducks to Previously Used Nest Boxes. Southeastern Assoc. of Game and Fish Commissioners 16:67-70;
- Odom, R.R., 1969. Nest Box Production and Brood Survival of Wood Ducks on the Piedmont National Wildlife Refuge. Proc. Southeastern Assoc. of Game and Fish Commissioners, 24:108-116.
- Saucier, Roger T. 1970. Origin of the St. Francis Sunk Lands, Ark. and Missouri. Geological Society of America Bulletin, v. 81pp. 2847-2854.

THE STATUS OF ELK TRANSPLANTS IN EASTERN OKLAHOMA

*Gene G. Stout, Fred C. Lowry and Foreman Carlile
Oklahoma Department of Wildlife Conservation*

ABSTRACT

Between 1969 and 1972 335 elk (*Cervus canadensis*) were transplanted from Wichita Mountains National Wildlife Refuge to eastern Oklahoma. Three releases (151 elk) were in the oak-hickory forest type in northeastern Oklahoma, and five releases (184 elk) were in the oak-pine forest type in the southeastern part of the state.

Cumulative known mortality in the northeastern releases (December 31, 1971) was 31 animals while known cumulative calf crop was 33 animals. Minimum population size at this time (reliable sightings) was 148 for the Northeast. Cumulative known mortality in the southeastern releases (December 31, 1971) was 24 animals while known calf crop was 39 animals. Minimum population size at this time (reliable sightings) was 117 for the Southeast. Due to terrain and elk behavior, population estimates for the Northeast are thought to be reasonably accurate while Southeast estimates are probably significantly lower than actual population size.

Primary cause of known mortality (85%) was illegal kills. *Parelaphos-trongylus tenuis* was either confirmed or suspected in 9% of reported mortality. Road kills or unknowns accounted for the remaining losses. Individual releases have had varying annual productivity rates ranging from 0 to 48 calves per 100 cows.

In general northeastern releases have remained discrete with the majority of the animals tied closely to deer refuges where they were released. Crop depredation has been a problem with these releases as the refuges are mostly surrounded by small private land holdings with agricultural interests. Most illegal kills have been reported from northeastern Oklahoma.

One of the southeastern releases has disappeared completely, and two others have almost completely disappeared. Emigration is the apparent cause of these disappearances. Dispersion from southeastern release sites has been considerable which makes evaluation of the success of transplants difficult. Two Oklahoma elk have been reported in Arkansas. One of these had moved 150 linear miles from its release site. Crop depredation and illegal kills have not been as severe in this region as in the Northeast. Potential elk range in the Southeast is considerable (Ouachita National Forest, Weyerhaeuser holdings, state lands and large private ranches) while this is not the case in the Northeast.