An Evaluation of a Wood Duck Nesting Program in Eastern Tennessee

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Abstract: Wood duck (*Aix sponsa*) nest boxes ($N = 190$) were placed along the lower Holston River and the lower French Broad River in eastern Tennessee and were maintained and checked from 1976 to 1979. Wood ducks used 1.3% of the boxes inspected during the 4-year study. Night brood counts ranged from 0.42 to 0.68 broods/km of river and did not indicate an increase in brood production. Nest box use and brood production in this study were significantly less than reported for a study on the upper Holston River. We believe that aquatic vegetation, valuable as a food base for wood duck broods, was a more limiting factor in our study than the availability of nest cavities.

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Natural nesting cavity availability has been considered to be a factor limiting wood duck production on the Holston River in eastern Tennessee (Minser 1968, Muncy and Burbank 1975). When a large number of wood duck nesting boxes were made available to the Tennessee Wildlife Resources Agency (TWRA) by the Tennessee Valley Authority (TVA), a wood duck nest box program was begun.

The objective of this management project was to determine if wood duck numbers on the lower Holston River and French Broad River could be increased with an intensive nesting box program. This paper represents an evaluation of that management effort.

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Methods

The study area lies in Knox County, Tennessee, and includes the lower 27 km of the Holston River and the lower 19 km of the French Broad River to the point

where the confluence of the 2 rivers forms the Tennessee River at Knoxville. Each river is characterized by long, bending pools broken intermittently by rocky sections or shoals. Water flow fluctuations vary greatly depending on discharges from hydroelectric dams located upstream on each river. The average width of each river is about 100 m.

The rivers flow through broad valleys extending between parallel wooded ridges. Alluvial plains are generally present on 1 or both sides of the river. Land use along the rivers is approximately 80% pasture and cropland and 20% woodland (Hill and Brown 1980). Borders of trees are normally present between agricultural fields and the river. Occasionally wooded ridges extend to the river's edge, or within 100–300 m of the river. These wooded areas served as wood duck nesting sites (Minser 1968). Wooded islands occur in each river.

The raccoon (*Procyon lotor*) is a major wood duck nest predator in some areas (Grice and Rogers 1965). However, the raccoon was considered scarce in most areas of eastern Tennessee during this study period (Minser and Pelton 1982).

Nesting structures were constructed from unseasoned, roughcut yellow poplar (*Liriodendron tulipifera*) boards of 2.54 cm thickness following a design similar to that described by Bellrose (1955).

Nest boxes (N = 190) were erected at about 0.3-km intervals in trees along the shorelines of both rivers during January, February, and March 1976. Boxes were attached 2 to 15 m high depending on tree shape and availability of tree limbs. Nest box locations were selected opportunistically without regard to tree species or nest box orientation to the river. Variables in nest box placement do not influence cavity selection by wood ducks (Hawkins and Bellrose 1941, Schreiner and Hendrickson 1951, Henson and Keran 1977, Goetz and Sharp 1980). Five to 10 cm of wood shavings were added to each nest box. Each nest box was marked for identification; map locations were plotted.

Nest boxes were inspected for nesting use during the spring months (March through May) from 1976 through 1979. Criteria for wood duck use were: presence

Table 1. Wood duck use of nesting boxes on the lower Holston and French Broad rivers, Tennessee, 1976 to 1979.

		N boxes checked			% use[a]		
Month	Year	Holston River	French Broad River	Total	Holston River	French Broad River	Total
May	1976	94	80	174	1.1	3.8	2.3
Mar/Apr	1977	91	92	183	1.1	0.0	0.5
Apr/May	1977	90	83	173	0.0	0.0	0.0
Apr/May	1978	101	83	184	2.0	1.2	1.6
Late May	1978		67	67		4.5	4.5
Apr/May	1979	89	85	174	1.1	1.2	1.1
May/June	1979		81	81		1.2	1.2

[a]Denotes the number of wood duck nest starts, expressed as a percent of total boxes inspected per river segment.

of an incubating hen, presence of down in the nest, or presence of wood duck eggs or shell fragments. Lack of use or nest competitors was noted.

Pre-nesting maintenance was conducted during winter (December, January and February) 1976–77, 1977–78, and 1978–79. Periodic replacement of some boxes was necessary due to weather damage, vandalism, poor construction, etc. Wood shavings were changed to prevent duplication of data on use in successive years.

Night-float counts were made to monitor changes in wood duck production each summer from mid-June to mid-July. Floats were conducted over 9 km segments of each river. Each shoreline was scanned simultaneously by 2 crews of 2 observers each from canoes (Minser and Dabney 1973). Hand-held spotlights were used to locate broods.

Results and Discussion

Box inspections (N = 1,036) were made during the 4-year study period to ascertain nesting cavity use. Only 13 wood duck nest starts were made in boxes during the 4-year study: 5 on the Holston River and 8 on the French Broad River. This total made up only 1.3% of the nesting structures inspected (Table 1). Of these 13 nest starts, 77% (N = 10) contained eggs. Of these, 5 resulted in successful hatches, 4 others advanced into incubation of the clutch with final hatching unverified, and 1 ended in abandonment. The remaining 3 nest starts consisted of the presence of down but no evidence of eggshell fragments.

Nest box use was low compared to an earlier study on an upstream portion of the Holston River. In a 5-year study beginning in 1971, Muncy and Burbank (1975) identified an annual increase in wood duck use of nest boxes of 3 designs, one of which was identical to that used in our study. Muncy and Burbank's (1975) combined increase in box use went from 6% use in 1971 to 44% in 1975. When considering the wood duck box design identical to that used in our study, the annual increase in use found by Muncy and Burbank (1975) was even more pronounced, rising from 12% in 1971 to 55% in 1975, as compared to the overall 1.3% use in our study.

Cottrell (1979) expanded the Muncy and Burbank study area to 40 km on the upper Holston River and monitored wood duck use of an increased number of nest boxes from 1975 to 1977. No distinction was made between use of different box designs. Cottrell (1979) found percentage occupancy by wood ducks to be 35% in 1975, 25% in 1976, and 29% in 1977.

Night Float Counts of Wood Duck Broods

Number of broods sighted ranged from 0.42 to 0.68 broods/km on both the lower Holston and French Broad rivers during our 4-year study period (Table 2). Using night floats on the upper Holston River during the same time period as our study, S. D. Cottrell (unpubl. data) observed a mean of 2.0 wood duck broods/km. The 2.0 broods/km mean of Cottrell was similar to the mean 2.7 broods/km observed by Minser and Dabney (1973) on the same study area in 1973. The produc-

Table 2. Broods observed during night-float counts on the Holston River and French Broad River in eastern Tennessee, 1976–1979.

Year	Broods/km	
	Lower Holston River	French Broad River
1976	0.68	0.68
1977	0.64	0.42
1978	0.42	0.49
1979	—	0.56

tion on the upper Holston River exceeded greatly that attained on either the French Broad River or lower Holston River. This indicated a much higher wood duck population on the upper Holston River.

Aquatic Vegetation

Nesting sites did not appear most limiting for wood ducks on the lower Holston and French Broad rivers. Other habitat factors such as food or cover for broods may have been more limiting. While data concerning shoreline cover, natural nesting cavities, and land use patterns were not collected, these habitat characteristics on both the upper and lower Holston River appeared to be similar. The most obvious difference in habitat between the lower and upper Holston River was the difference in the abundance of aquatic vegetation.

Young and Dennis (1983) found that annual net primary production of aquatic macrophytes on the upper Holston River far exceeded the production values for freshwater submersed macrophytes in temperate climates given by Westlake (1983), and even exceeded the values for tropical systems. Young and Dennis (1983:28–29) stated that " . . . no other river in the Tennessee Valley approaches this production rate and no other published values for temperate North America have been found that are comparable." They attributed this high productivity rate to an environment with optimum growing conditions and an assemblage of macrophyte species that partition this environment for maximum use. Young and Dennis (1983) further stated that 70% of the upper Holston River was colonized by aquatic macrophytes, compared to only 34% of the lower Holston River (L. Bates, R. C. Webb, and W. M. Dennis, unpubl. data, TVA). Sago pondweed (*Potamogeton pectinatus*) was shown to be the dominant aquatic macrophyte on the upper Holston River, comprising 44% of the total plant biomass (Young and Dennis 1983). On the lower Holston River, sago pondweed was found only in scattered occurrence (L. Bates, R. C. Webb, and W. M. Dennis, unpubl. data, TVA). Tomljanovich and Webb (1988) surveyed submerged and floating aquatic macrophytes along the lower French Broad River, encompassing our study area, and identified no locations colonized by sago pondweed.

Watts (1968) evaluated wood duck habitat on John Sevier Lake, on the upper Holston River. He found that dense masses of aquatic vegetation concentrated wood ducks. He concluded that the aquatic vegetation was the major attraction for wood ducks during the breeding season.

Minser (1968:67) concluded: ". . . that abundant growths of aquatic vegetation make the upper Holston the excellent duck habitat that it is." Allen (1971:33) supported this conclusion by stating "Nesting habitat in this area would be classified as fair; however, the large amounts of aquatic vegetation present in the river . . . make this area highly preferred by wood ducks." Hocutt and Dimmick (1971), studying on the upper Holston River, indicated that uprooted and floating sago pondweed tubers, in addition to associated invertebrates, were of singular importance as an energy-rich food source for all age classes of wood duck broods. The authors further stated that a reduction in abundant plant life would reduce the habitat quality for wood ducks, and significantly lower the carrying capacity of the upper Holston River habitat. This relationship seems evident on the lower Holston River where reduced aquatic plant biomass and a different plant species composition is associated with a decrease in wood duck brood production as compared to the upper Holston River.

Conclusions

Nest box use by wood ducks during a 4-year study on the lower Holston and French Broad rivers was only 1.3%. We concluded that the addition of nesting boxes failed to increase brood production because the availability of nesting sites was not the most limiting factor. Aquatic food base was likely a more limiting factor. Managers should make a careful evaluation of wood duck habitat, including brood feeding and loafing cover, before beginning a wood duck nesting box program.

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