ANALYSIS OF WOOD DUCK ROOST COUNTS IN NORTHWEST SOUTH CAROLINA

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Abstract: Peak numbers of wood ducks (*Aix sponsa*) occurred in the piedmont region of South Carolina in mid-November. During this period of time, 85% of the birds entered a beaver pond roost as flocks (2 or more birds). Significant correlations between numbers of birds observed at equivalent light intensities were used to indicate primary diel habitats for the local wood duck population. A trend in increased flight activity at lower light intensities (foot candles) was observed from September through November. Eight-seven percent of the wood ducks departed from the roost site before official sunrise. Similarly, peak numbers of ducks arrived at the roost site after official sunset. This flight behavior made wood ducks susceptible to being shot after legal hunting hours, which, due to darkness, resulted in increased crippling and a reduced retrieval rate for downed birds. This is a significant management and law enforcemnt problem which could be resolved by mid-afternoon closure for waterfowl hunting.

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Wood ducks (*Aix sponsa*) are one of the most important waterfowl resources in southeastern United States (Benning et al. 1978). However, due to their seclusive nature and use of habitats not easily censused, population levels are difficult to monitor. Autumn roosting habits of wood ducks have been studied through out much of their range, but the usefulness of roost flight counts as a population index is controversial (Stewart 1957, Martin 1959, Hein and Haugen 1966, Hester 1966, Taberrer et al. 1971, Parr and Scott 1978).

To be a valid index technique roost counts must meet the following assumptions: (a) each wood duck roost must be a geographically discrete area which contains a wood duck population identifiable from other roosts, (b) the number of wood ducks using a roost reflects the general abundance of the species in that area, and the wood ducks congregate at the roost solely as a result of their social needs, not due to a presence or absence of food or water elsewhere, (c) all, or at least a consistent proportion, of the wood ducks fly to identifiable communal roosts in the evening, and (e) little unilateral inter-roost movement occurs (Parr and Scott 1978).

This paper involves an analysis of the fall population dynamics and flight activities of wood ducks in the piedmont region of South Carolina. Primary objectives were to (a) determine the major roosting and daytime habitats utilized by the local population of wood ducks during the fall season, (b) document population levels associated with those habitats, and (c) investigate the effects of light intensity and seasonal factors on diel flight activities of wood ducks.

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STUDY AREAS

During the fall of 1974 wood duck flight activities were studied on a beaver pond complex and a freshwater marsh located in the northwest piedmont region of South Carolina (Fig. 1). Alga pondweed (*Potamogeton conferoides*) and marsh purslane (*Ludwigia palustris*) were the principal species of submergent vegetation associated with the beaver ponds; characteristic emergent vegetation included burreed (*Sparganium*

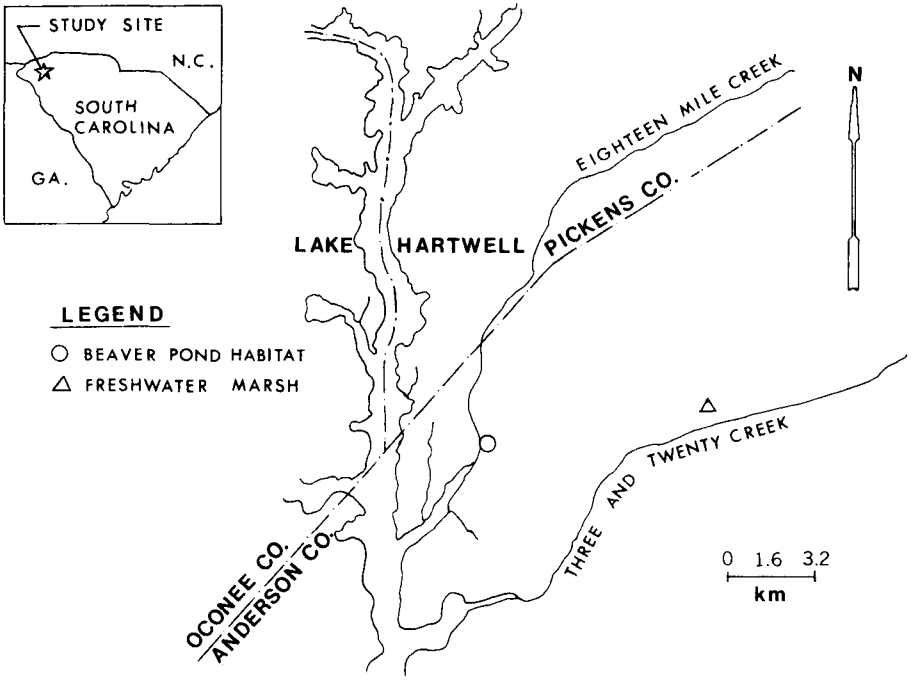

Fig. 1. Location of the study areas in the piedmont region of South Carolina.

americanum), southern rice cutgrass (*Leersia oryzoides*), smartweed (*Polygonum* spp.), silky dogwood (*Cornus ammomum*), tag alder (*Alnus serrulata*), and buttonbush (*Cephalanthus occidentalis*). During the summer and fall months the freshwater marsh, approximately 67 ha in size and located 10 km northeast of the beaver pond complex, was dominated by arrow-arum (*Peltandra virginica*) and heartleaf pondweed (*Potamogeton pulcher*); red maple (*Acer rubrum*), bulrush (*Scirpus* spp.), sedge (*Cyperus* spp.), tag alder, burreed and southern rice cutgrass were the primary species distributed along the shoreline. For detailed vegetative analyses see Hepp 1977 and Luckett 1977.

METHODS

The number of waterfowl entering/leaving the study areas was counted from census points which permitted maximum view of the sky. Each census was conducted during the 30 minutes before and after official sunrise/sunset. This 1-hour period was divided into 20, 3-minute intervals. With the aid of a Glossen Panlux lightmeter, light intensity measurements (foot candles) were made every 3 minutes. Actual time of arrival/departure of each duck was recorded.

Statistical tests were based on procedures given in Sokal and Rohlf 1969 and were calculated on an IBM System 370, Model 158 computer following the Statistical Analysis System (SAS) developed by Barr and Goodnight (Service 1972). Unless indicated otherwise, the 0.05 level of significance was used for all statistical tests.

RESULTS AND DISCUSSION

Fall Population Trends

Observations on roost flight activity of wood ducks were conducted during the falls of

1973 and 1974. Because the data taken during 1973 were part of a feasibility study designed to establish census points and refine techniques, they were not included in the follwoing analyses.

In 1974 the population of wood ducks that utilized the beaver pond complex for an evening roost site was monitored from 14 September to 16 November. As noted in Fig. 2, the number of wood ducks observed increased throughout the fall with a peak number (N=106) recorded on 9 November. Subsequent censuses prior to the opening of the 1974-75 waterfowl hunting season (20 November 1974) indicated a decline in the number of wood ducks (N=approx. 40) to levels comparable to those observed earlier in the fall. Due to heavy hunting pressure, no wood ducks were observed utilizing the beaver pond for a roost site after late November.

As a component of the fall population studies, the number of ducks that entered the roost as singles or flocks (2 or more birds) was recorded. In September, 83% of the wood ducks arrived in the evening as singles. During October, single birds declined to 38% while flocks increased to 62% of the total observations. By November, when the peak number of wood ducks was observed, over 85% of the birds entered the roost site as flocks (Fig. 3). These trends fo seasonal changes in flock composition agreed with observations made by Hester and Quay (1961) in North Carolina and Taberrer et al. (1971) in Louisiana.

These observations suggest that resident wood ducks were joined by non-resident birds for a limited period of time, then the latter switched to another roost site and/or

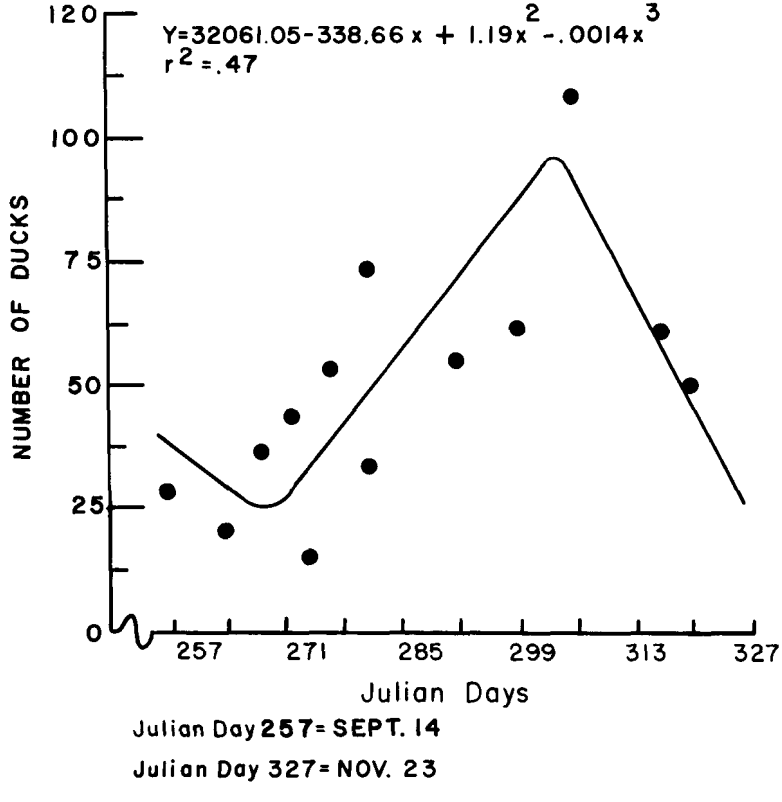

Fig. 2. Seasonal change in the utilization of a beaver pond by roosting wood ducks in piedmont South Carolina, Fall 1974.

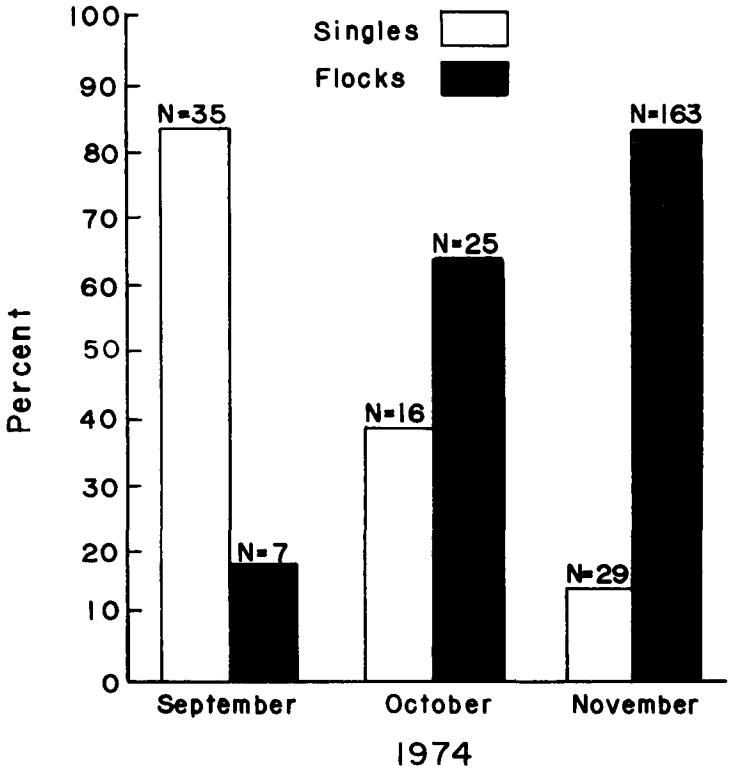

Fig. 3. Flock composition of wood ducks utilizing a beaver pond roost in piedmont South Carolina. N represents the number of singles or flocks (2 or more birds) observed per unit time.

continued their southward migration. Reports by other researchers on peak migration periods for wood ducks at various locations along the Atlantic Flyway support the idea that mid-November is a logical time for peak population levels to occur in South Carolina. Adjacent states (North Carolina and Georgia) report peak numbers just prior to and after this period of time (Table 1). Fendley (pers. comm.), however, noted that in the coastal plain region of South Carolina the highest numbers of wood ducks occurred in mid-December. His observations were made on the Savannah River Plant (federal nuclear production facility near Aiken, S.C.) where waterfowl hunting was prohibited. It is possible that peak numbers of wood ducks on our study area would have occurred in December, but heavy local hunting pressure precluded their use of this roost site during that period of time. We also have evidence from band recoveries from Alabama, Florida and Mississippi that wood ducks fledged on our study areas dispersed throughout the southeastern United States during fall migration.

Roost counts have been considered as an index to wood duck population trends in several studies. Stewart (1958) stated that among river float counts, brood counts and evening flight counts, the latter was the best means of obtaining an estimate of wood duck populations with areas where available habitats were restricted. Taberrer et al. (1971) concluded that in Louisiana, where potential habitats were abundant, roost counts were unreliable an an index of population levels. Although Hein and Haugen (1966) reported roost flight counts were useful as an index to annual changes in abundance of wood ducks

TABLE 1. Peak fall migration dates for wood ducks along the Atlantic Flyway.

Location	Date	Reference
Quebec, Ontario, etc.	Early September	Barden (1968)
Maine	Early to mid-September	Barden (1968)
Massachusetts	Mid-October	Grice and Rogers (1965)
Vermont	Early November	Stewart (1977)
North Carolina	Late October to early November	Hester and Quay (1961) Perry (1977)
South Carolina	Mid-November	This study
Georgia	Late November to early December	Almand (1965)
Florida	Mid-December	Bellrose (1976)

in Iowa, this was not confirmed by a recent study by Parr and Scott (1978). The latter, based in part on observations involving radio-telemetered wood ducks, concluded evening roost flight counts did not provide a valid index to population size because: (a) roosts were not always geographically discrete; (b) changes in food supply effected numbers of wood ducks flying to a roost; (c) due to poor light conditions, visibility, direction of flight and presence of other species of waterfowl, all birds entering a roost were not always susceptible to being counted; (d) although most wood ducks showed high fidelity to traditional roosts, some did not fly to a communal roost on certain days.

Potential habitats on our study area were limited, and because the assumptions required for roost counts to be a valid index to population trends were met, we feel that roost counts were indicative of local population levels for wood ducks. To verify this, however, research similar to that of Parr and Scott (1978) and Parr et al. (1979) should be conducted.

Effects of Light Intensity on Flight Activity

In the evenings, over 90% of the wood ducks arrived at the roost after official sunset (Fig. 4). Of this total, 75% arrived in the 10-minute interval between 20 to 30 minutes after sunset. During the mornings, 84% of the wood ducks had departed the roost site before official sunrise; peak flight (70% of total) occurred 20 to 30 minutes before sunrise.

To investigate the relationships between light intensity and flight activity, arrivals of the first, last, mode, and weighted mean duck were calculated for the respective light intensities. Sunrise flight observations indicted that the first wood duck departed the roost at a continued lower light intensity as the fall season progressed (Fig. 5). When the first observation was made (14 September 1974, Julian Day 257) the first wood duck left the roost at 1.60 foot candles. This was the maximum foot-candle reading for the departure of the first wood duck during the entire fall season. The minimum light intensity (0.07 foot candles) associated with the departure of the first wood duck was recorded on 16 November 1974 (Julian Day 320). For the entire period of observation, the average light intensity for the departure of the first duck was 0.30 ± 0.35 foot candles.

As the fall season progressed, the majority (mode duck) of the wood ducks left the roost at successively lower light intensities (Fig. 5). On 20 September 1974 (Julian Day 263), 6 days after flight activity observations were initiated, the maximum light intensity (2.7 foot candles) for the greatest number of ducks leaving the roost was recorded. Minimum light intensity (0.05 foot candles) for the mode duck during sunrise observation

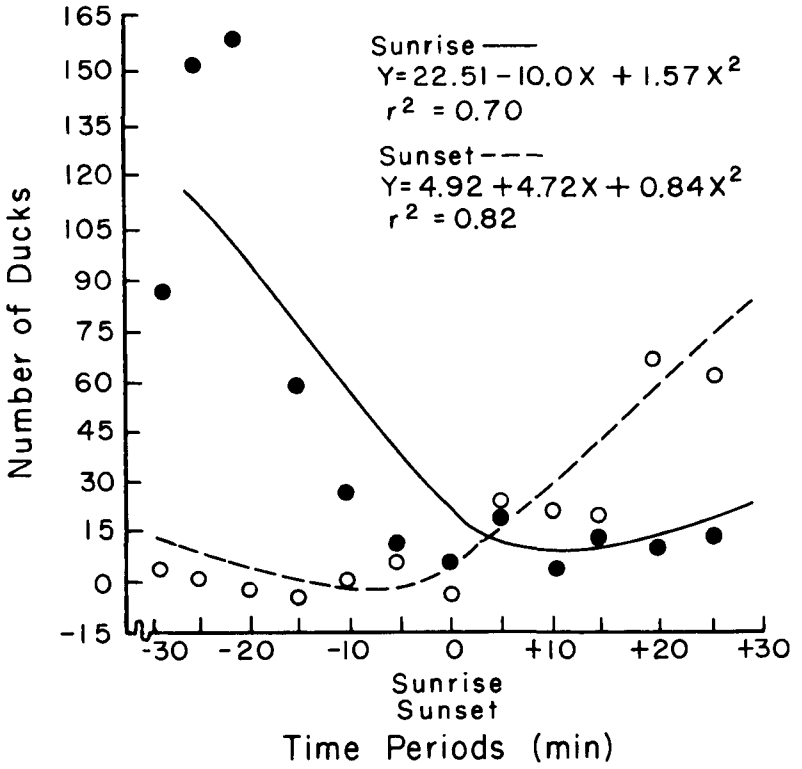

Fig. 4. Total number of wood ducks observed during 5-minute intervals at sunrise and sunset at beaver pond roost during the fall of 1974.

periods was recorded on 24 October 1974 (Julian Day 297). Average light intensity for the greatest number of wood ducks leaving at sunrise was 0.67 ± 0.74 foot candles. There were no statistically significant relationships between last or weighted mean duck at corresponding sunrise light intensities.

Preliminary research (1973) indicated that a 67 ha freshwater marsh located 10 km from the beaver pond complex was utilized extensively by wood ducks during the diurnal period. To evaluate their utilization by wood ducks, morning/evening flight activity observations were made at these 2 areas.

There was a significant correlation ($p < .001$, $r=0.94$) in the total number of wood ducks associated with respective morning and evening flight counts. When adjusted for lag times associated with flight times, the number of arrivals and/or departures of wood ducks from each area per unit time (and corresponding light intensities) were also significantly inter-correlated ($p < .001$, $r=0.92$). In the absence of known numbers of marked birds, this provides strong circumstantial evidence that these were the 2 primary habitats for the local population of wood ducks throughout the diel period of the fall season.

Based on our data and reports in the literature, light intensity appears to be the primary factor determining periods of flight activity of wood ducks from roost sites to daytime feeding/loafing areas. Martin and Haugen (1960) reported that in August evening flights were 10-15 minute before sunset; in September and October the peak

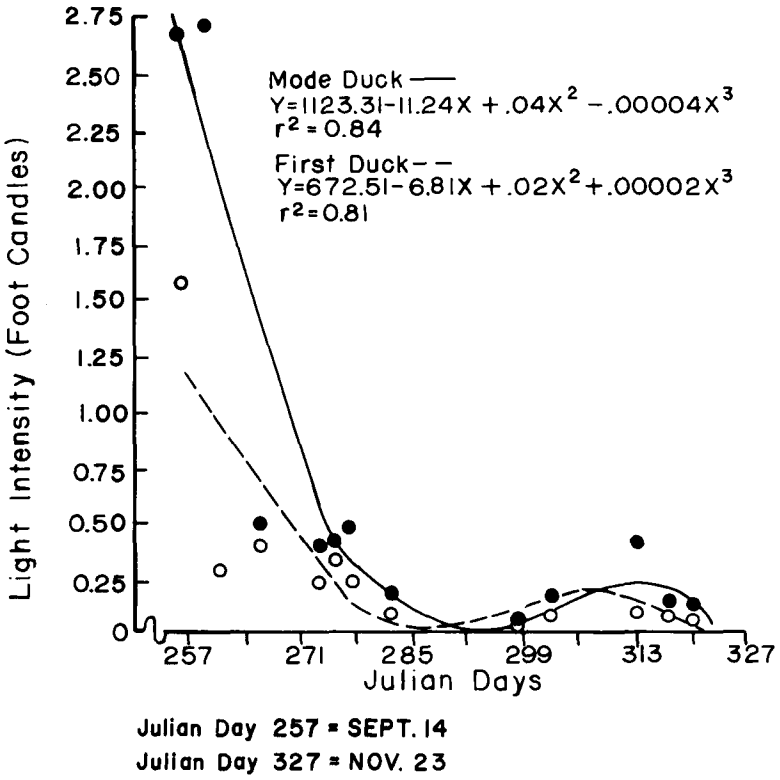

Fig. 5. Seasonal changes in departure of mode and first duck from a beaver pond roost in relation to light intensity.

number of wood ducks arrived 0-5 and 20-25 minutes after sunset, respectively. In Iowa, Hein (1962) observed the the highest numbers of wood ducks in October at approximately 25 minutes after sunset. Hester and Quay (1961) reported that the earliest, median, and latest flights in mid-October in North Carolina began 8, 17, and 27 minutes after sunset, respectively. In Louisiana, Taberrer et al. (1971) found peak numbers of wood ducks arrived at roost sites 21 minutes after sunset. From morning counts, Martin and Haugen (1960) observed that peak period of wood duck flight occurred 5-10 minutes, 15-20 minutes, and 25-30 minutes before sunrise in August, September, and October, respectively. Hein (1962) recorded greatest flight activity approximatly 20 minutes before sunrise in August, but in October it occurred approximately 28 minutes before sunrise.

Overall, it was evident that the majority of wood ducks arrived at the roost after official sunset. The legal shooting time for waterfowl in South Carolina ends at official sunset (as reported in the 1975-76 United States Fish and Wildlife waterfowl hunting regulations). Roost shooting of wood ducks is practiced commonly by waterfowl hunters in the southeast (Beshears 1974 and personal observations). Consequently, because of their evening flight behavior many wood ducks are shot after legal shooting hours. Based on limited observations we conclude that darkness does not provide adequate shooting conditions compounding the problem by increasing crippling rates and reducing successful retrieval of downed birds. More research is needed to substantiate these observations and to evaluate the possible resolution of this problem by imposing a mid-afternoon closing time for waterfowl hunting.

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