

Effectiveness of a Statewide Cooperative Wood Duck Nest Box Program

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Abstract: Fifty of >1,000 landowners participating in the South Carolina Wildlife and Marine Resources Department (SCWMRD) wood duck (*Aix sponsa*) nest box program were selected at random to evaluate the program's effectiveness. We inspected 311 of 8,561 boxes bi-weekly throughout the 1987 nesting season. Most (95%) of the boxes allocated had been installed, and 82% of those installed were considered acceptable for use by wood ducks. Most (90%) cooperators had at least 1 nest start, and 69% of the available boxes were used. There were an average of 6.5 ducklings produced per available box. Estimated duckling production in 1987 from all boxes in the SCWMRD program was 42,833 ducklings. Cooperator nesting activity reports provided an accurate estimate of duckling production.

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Wood duck nest box programs have been evaluated by statewide inspections only twice since widespread use began. From 1949 to 1951, McLaughlin and Grice (1952) annually inspected 1,200 of 6,000 boxes erected in Massachusetts. Of the 3,597 boxes inspected, 394 (11%) boxes were non-functional with 1,427 (45%) boxes being used. Hawkins and Bellrose (1940) inspected 1,000 boxes erected by the Illinois Natural History Survey and found 25% box use. At least 2 other surveys have been conducted to evaluate wood duck nest box programs over large areas. Soullierre (1986) evaluated the economics of a statewide wood duck box program in Wisconsin and concluded that the program should not be expanded. Zicus and Hennes (1987) used data from cooperators to determine use and success rates for nest boxes in northern Minnesota. They concluded nest boxes were useful in monitoring cavity-nesting waterfowl populations and production over large areas.

SCWMRD began a statewide wood duck nest box distribution program in 1982. Funds for the program are derived from sale of state waterfowl stamps (Strange 1986). Wood duck boxes, posts, and predator guards are distributed free of charge to private landowners throughout the state who submit an application and are

approved. Cooperators erect structures based on guidelines prepared by the department. They are asked to maintain structures, monitor nesting activity, and provide annual nesting reports to SCWMRD. Data from the cooperators have been used as a minimum estimate of nest box use and duckling production for all cooperators in the program. As the number of cooperators has increased, the percentage of cooperators reporting has dropped by about 10% each year, down to 46% reporting for 1987 (Prevost 1987).

The objectives of our study were to (1) determine the percentage of nest boxes installed and available, (2) determine box use rates, (3) estimate total duckling production for the SCWMRD cooperative wood duck box program, and (4) determine the accuracy of annual cooperator nesting activity reports.

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Methods

There were 1006 cooperators in the statewide wood duck nest box program in 1986, according to a list provided by SCWMRD. Preliminary analysis indicated about 70% of the cooperators were in the Coastal Plain and 30% were in the Piedmont. We selected a stratified random sample of 5% ($N = 50$) of the cooperators. Thirty-five cooperators were chosen at random from the Coastal Plain and 15 from the Piedmont. Selected cooperators were notified of the study by mail in December 1986 and asked to grant researchers permission to inspect boxes on their land. About $\frac{2}{3}$ of the originally selected cooperators responded. Attempts were made to contact non-respondents by telephone; however, randomly-selected alternate cooperators were needed to reach the desired number. In all 83 cooperators were contacted. The final 50 selected cooperators represented 4.5% of 1,112 cooperators in the SCWMRD program in 1987 and 3.6% of 8,561 boxes allocated in the program.

Nest boxes constructed and distributed by SCWMRD were similar to a U.S. Fish and Wildlife Service (1976) design, but differed by having a hinged lid instead of a door on the side, and a 10.2-cm diameter circular entrance hole instead of an oval entrance. For our study, we rated the structures as either acceptable or unacceptable for nesting by wood ducks based on condition of the box. Boxes without nesting material were rated unacceptable even though some were used. Condition of the predator guard was recorded as installed properly or improperly, damaged, or missing, but it did not influence the acceptability rating. We made no attempt to repair boxes or correct other problems.

Boxes were inspected every 2 weeks from February through July. Incubating hens were allowed to flush freely; no hens were captured or handled. Dump nests, nests in which 2 or more hens lay eggs in the same nest, were identified by a clutch size of >15 eggs (Grice and Rogers 1965:39). Competitors or predators at nest boxes were noted but not removed.

Only boxes considered acceptable for nesting wood ducks were used in analyses of box use. Individual nesting activity reports for our subsample of cooperators were obtained from SCWMRD; summary data for all cooperators in the SCWMRD program were reported by Prevost (1987). Comparisons of box use were made between Piedmont and Coastal Plain and between our data and cooperator-reported data using Z tests of proportions (Bethea et al. 1985) (probabilities obtained by doubling values in Steel and Torrie 1980, Table A.4). Estimates of total duckling production for all cooperators in the program were based on number of allocated boxes, because this number was known and did not rely on cooperator reports. Statistical significance was accepted at the 95% probability level ($P = 0.05$) and bounds given for means and percentages are exact 95% confidence bounds, computed by multiplying the appropriate t -statistic by the standard error.

Results

Cooperators Sampled

Box Installation and Maintenance—Of 311 boxes allocated, 294 (95%) had been installed. Five had not been installed but were retained by the cooperators to which they were allocated, 5 were given away (by 1 cooperator), 1 was not received, and 6 could not be located. Of the boxes installed, 275 (94%) were standing throughout the 1987 nesting season and 241 (82%) were considered available for use by wood ducks. Predator guards were missing on only 2 boxes and were considered ineffective on 15% of boxes installed because of insufficient height (≤ 15 cm) above water.

Box Use—Of 50 cooperators sampled, 45 (90%) had at least 1 box with 1 wood duck nest started (Table 1). Percentage of cooperators with nesting was not significantly different ($|Z| = 1.55$, $P > |Z| = 0.879$) between Piedmont and Coastal Plain regions. Because 1 cooperator with 10 boxes withdrew from our study, box use was calculated for 231 available boxes. Of those 231 boxes, 118 (51%) had 1 nest start, 38 (16%) had 2 nest starts, and 3 (1%) had 3 nest starts in the same season. A total of 159 (69%) of the available boxes were used by wood ducks. Twelve of 34 boxes considered to be unavailable contained an additional 13 nests. Percent use was not significantly different ($|Z| = 1.95$, $P > |Z| = 0.849$) between Piedmont and Coastal Plain regions.

Duckling Production—We found 216 wood duck nests started in the 311 inspected boxes; 135 of the nests (63%) were successful and 66 (31%) were abandoned. Of 3,328 eggs laid in these nests ($\bar{x} = 15.4 \pm 1.2$), 1,574 (47%) hatched, and 1,556 (99%) of the ducklings left the boxes. Mean duckling production was 6.5 ± 1.1 per available box, or 5.0 ± 0.9 per allocated box, which, when extrapolated

Table 1. Installation and use of boxes allocated to cooperators for each region and statewide in a random sample from all SCWMRD wood duck nest box cooperators, 1987.

Area	<i>N</i> Cooperators Sampled	<i>N</i> Cooperators Successful	<i>N</i> Boxes Allocated	<i>N</i> Boxes Installed	<i>N</i> Boxes Available	<i>N</i> Available Boxes Used ^a
Piedmont Region	15	12	68	65	51	29
Coastal Plain Region	35	33	243	229	190	130
Total	50	45	311	294	241	159

^aAn additional 12 boxes (1 Piedmont, 11 Coastal Plain) considered unavailable also were used.

for all cooperators in the SCWMRD program, produced an estimated 42,833 ± 7,608 ducklings, with 82% of these coming from boxes in the Coastal Plain. While 29 (64%) of the 45 cooperators with nesting had 1 or more dump nests and 40% of all nests were dump nests, excessive dump nesting was found for only 5 cooperators. These sites had 100% use of available boxes, ≥50% of the nest starts were dump nests, and an average clutch size of ≥20 eggs for all nests started. Reduced duckling production was evident for 4 of these, while the fifth had better than average production.

Competition and Predation—Use of wood duck boxes by non-target species included passerine birds, screech owls (*Otus asio*), rat snakes (*Elaphe obsoleta*), squirrels, and flickers (*Colaptes auratus*). Hooded mergansers (*Lophodytes cucullatus*) also nested in 3 boxes. Nine instances of predation on active wood duck nests were observed. Rat snakes, the most common predator, destroyed 6 active wood duck nests from late April through June. Two cases of unidentified mammal predation also were observed. Except for 1 instance, pecking of wood duck eggs by birds occurred after nests had been abandoned and thus was not counted as predation.

Nesting Reports from Cooperators Sampled

Thirteen (26%) of the 50 cooperators we sampled returned usable annual nesting activity reports to SCWMRD, and all 13 correctly reported the presence or absence of wood duck nests. Ten had nesting and 3 did not. Nine (69%) correctly reported the number of boxes used, with incorrect reports underestimating the number of boxes actually used. Eight (62%) correctly reported the number of nest starts and 7 (54%) correctly reported number of successful nests. The 47% box use from the 13 cooperator reports was not significantly different ($|Z| = 1.34, P > |Z| = 0.180$) from the 58% use based on our observation of boxes for these 13 cooperators. Cooperators were least accurate in reporting numbers of eggs laid and eggs hatched. Only 1 of 10 cooperators reporting nesting correctly reported the number of eggs laid. Broken eggs and eggs eaten by mammals in abandoned nests were mistakenly reported as hatched eggs. The estimated number of ducklings produced for all 50 cooperators sampled, based on the 13 cooperator reports, was 1,296 ± 371, compared to 1,556 ducklings produced based on our observation.

Nesting Reports from All Cooperators

Box Use—Of the 1,112 participating cooperators in 1987, 511 (46%) provided nesting activity reports. Of those reporting, 336 (66%) reported nesting. This was significantly lower ($|Z| = 5.07, P > |Z| < 0.001$) than the 90% cooperator success in our 5% sample. Of 3,806 available boxes for reporting cooperators, 2,075 (55%) were reported used by wood ducks. This was significantly lower ($|Z| = 4.45, P > |Z| < 0.001$) than the 69% use in our 5% sample.

Duckling Production—Indicated production from reporting cooperators was 19,859 ducklings. There were 4,230 boxes allocated to these cooperators, or 49% of 8,561 boxes allocated in the program. Total duckling production for the program was estimated to be 40,192 ($\{19,859/4,230\}8,561$) or 4.7 ducklings per box allocated. Based on our 5% stratified random sample, total duckling production was estimated to be $42,833 \pm 7,806$ ($\{1,556/311\}8,561$) or 5.0 ± 0.9 ducklings per box allocated. Estimates of duckling production from cooperator reports are well within the 95% confidence intervals of estimates based on our sample.

Discussion

Use and Production

Most boxes allocated to the cooperators sampled were used by wood ducks. Although dump nesting was common, it was lower than reported by some authors (Strange et al. 1971, McCamant and Bolen 1979, Semel and Sherman 1986). At lower levels, such as in our study, dump nesting increases production (Grice and Rogers 1965:41, Clawson et al. 1979, Haramis and Thompson 1985). A wood duck box program such as the SCWMRD cooperative program distributes small numbers of boxes to many different landowners, resulting in low densities of nest boxes at most sites. This may help keep densities of breeding birds below levels where excessive dump nesting limits production.

Interspecific competition for nest boxes was considered to have little impact on wood duck nesting. Other researchers have also reported that use of boxes by passerine birds and other species identified in our study generally has minimal impact on total wood duck nesting (McLaughlin and Grice 1952, Cunningham 1968, Odom 1970, Strange et al. 1971, Doty and Kruse 1972, Muncy and Burbank 1975, Goetz and Sharp 1980). Conical, metal predator guards provided with SCWMRD boxes were effective when installed and maintained properly, as evidenced by the low level of predation observed. Rat snakes have been reported as serious predators in other wood duck nest box studies in the southeastern United States (Odom 1970, Strange et al. 1971, Fendley 1980).

Cooperator Reports and Performance

Of the cooperators sampled, those who provided reports were maintaining boxes well, and most cooperators who did not provide reports also were adequately maintaining boxes. Minor repairs often were neglected but this appears to have had

little impact on box use thus far. There was no indication from our 5% sample that cooperators with no nesting activity or those with low use were less likely to provide nesting activity reports. Although sample size for direct comparison of reports with our data was small, these reports tended to underestimate box use and number of nests started and overestimate number of eggs hatched, but could be used to accurately estimate total production.

Comparison of our data with data from all reporting cooperators in the program indicated that nesting activity reports provided a reasonably accurate estimate of duckling production from nest boxes in the SCWMRD program. However, if the percentage of cooperators reporting continues to decline, accuracy of these estimates may be reduced. Therefore, it is important that the current trend of declining cooperator reporting be halted or reversed. A survey by Zekor and Kaminski (1987) of Mississippi Delta farmer's attitudes toward waterfowl management on their lands indicated offering incentives or prizes might increase landowner interest in programs such as a wood duck nest box program. Assuming that attitudes of landowners in South Carolina would be similar, incentives could be offered to increase the percentage of cooperators reporting.

Overall, the program was operating efficiently and was considered successful, but efforts should be made to increase cooperator interest and participation in monitoring and reporting nesting activity.

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