

The lack of correlation between increasing eye (eye lens weight) and increasing testicular weight and volume of young of the year may be attributed to the variability in growth of testes of young cottontails born at different times during the breeding season.

From other data gathered during the study it was found that the general onset of breeding was initiated by the females in February or March. The timing of this onset was highly variable, depending on temperature and other concomitant factors at that time of year. The similar onset of testicular activity in late December, 1965 and 1966 opens the question as to the importance of environmental factors (other than photoperiodicity) on male cottontails in Georgia.

In summary these data support the use of several adult testicular parameters in determining the reproductive status of a cottontail population.

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WOOD DUCK PRODUCTION AND TRANSPLANTS ON NATIONAL WILDLIFE REFUGES IN THE SOUTH ATLANTIC STATES

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ABSTRACT

A management investigation was initiated on Savannah National Wildlife Refuge in 1965 to determine the feasibility of producing pen-reared wood ducks, imprinted to artificial nesting structures, for use in starting new nesting colonies. To date 780 young woodies, imprinted to nest in nest boxes, have been produced, transferred, and released on six national wildlife refuges in Georgia, Florida, and South Carolina. Nesting in artificial structures had not previously occurred on three of these refuges. Transplanted birds nested in boxes on four of the release sites the first nesting season after release, including three refuges with no history of nest box use. The second season after release over 50 nesting attempts occurred on one refuge that had no previous use of nest boxes by wood ducks.

INTRODUCTION

The wood duck (*Aix sponsa*) is an important bird to the duck hunter in the Atlantic Flyway, being third in numbers harvested during the 1966 and 1967 hunting seasons. During the 1967 season it was the number one duck harvested in Georgia, South Carolina and North Carolina (Croft and Carney, 1968). It is the only duck that nests in significant numbers in most southeastern states. This duck normally nests in tree cavities, but present day timber management has removed many of the trees with suitable nesting cavities. Clearing timbered bottomlands for reservoirs and agricultural use has also destroyed many natural nesting sites (Hankla and Carter, 1966).

The willingness with which wood ducks accept artificial nesting structures in many regions of the United States is well documented (Bellrose and McGilvrey, 1966). Except in small isolated areas, efforts to establish box-nesting colonies in Florida, Georgia, South Carolina, and the southern half of North Carolina have not been successful. This region has many farm and mill ponds, fresh water streams and thousands of acres of swamplands. On many of these potential production areas, the paucity of suitable natural cavities is believed to be a major factor limiting wood duck production.

Wood duck nest boxes were erected on Savannah, Harris Neck, and Blackbeard Island National Wildlife Refuges prior to 1966, but no nesting attempts were observed. In 1965 a study was initiated at Savannah to determine the feasibility of producing, imprinting, and transplanting pen-reared wood ducks to establish box-nesting populations. Previous studies indicate that ducks hatched in artificial nest structures tend to accept like or similar structures for nesting. This phenomena is generally known as "imprinting".

METHODS

Production

Several methods were tried to determine the best means of producing wood ducks in captivity at Savannah. These included incubation by chickens, hand-reared mallards, electrical incubators and wood ducks. The latter was the most successful and is presently the principal method used.

Our experience at Savannah indicates that a flight and breeding pen with a poultry-wire top is best. Besides allowing the birds free flight, it offers protection against predators. The primary facility used at Savannah is a large pen, 100 x 55 x 10 feet, with approximately three-fourths of the floor space covered with water. Small clumps of giant cutgrass (*Zizaniopsis miliacea*) are maintained for cover.

All pens have watering facilities that can be regulated. Adequate fresh water is a requirement in producing and maintaining wood ducks in captivity and pressurized water is desirable for cleaning purposes. Sides of the large pen are of 1/8 inch mesh wire which extends into the ground for a depth of 18 inches and outward for 18 inches. The top is of 1-inch hexagonal mesh wire. Since newly hatched wood ducks are efficient climbers, it is necessary to install an obstacle, such as sheet metal strips, on the sides of the pen to prevent escape through the large mesh top.

At Savannah 36 nesting structures of different materials and designs are mounted at varying heights on posts throughout the pen. Three are made of styrafoam, one of fiberglass, one of plywood, and the remainder of rough cypress lumber. Of the available nesting structures wood ducks preferred a modified version of the wooden box described by Webster and Uhler (1954). This modified version is constructed of 1-inch rough cypress with inside dimensions 10 to 12 inches square. The depth of the box is 25 inches in front and 23 inches in the back. The box has a sloping top, which overhangs three inches and is removable for inspection and cleaning purposes. Entrance holes are four inches in diameter. Four small holes are drilled in the bottom of the nest boxes for drainage. Nesting material consists of fresh, unpacked wood shavings eight to ten inches deep.

Incubation

Three types of incubators for the eggs hatched artificially were used: (1) forced-air incubator, 3-tray, 15-dozen capacity with a crank handle for turning; (2)

round, metal incubator with a capacity of five to seven dozen eggs, (3) a styrafoam incubator with a four to five dozen capacity. When the eggs pipped, they were moved from the incubator to a hatcher, which was a forced-air type with a capacity of eight dozen eggs.

Ducklings hatched artificially require special handling in order to imprint them to nest boxes. To accomplish this a structure (imprinter) was designed to simulate ducklings being hatched in a nest box. When they are about 24 hours old, the ducklings are transferred from hatcher to imprinter without having seen light. The imprinter consists of two "nest-box" compartments at each end of a larger central compartment. Round exit holes near the top of the "nest-boxes" face the center compartment, which has two small holes for ventilation. The "nest-boxes" are equipped with thermostatically controlled heating elements, which also provide heat for the central section. A temperature of 95°F is maintained in the imprinter. Wood shavings are placed in all sections. A single lid, which has a plexiglass window over the central compartment, covers the entire unit. This window allows natural light to enter the central compartment, enticing the ducklings to exit through the holes. Twenty-four to 36 hours after the ducklings have emerged from the "nest-boxes", they are moved from the imprinter to electrically heated brooders. At this time the ducklings are dropped into a pail of water from a height of approximately five feet. Suggested by Dr. Frank Bellrose, this procedure, for some unexplained reason, releases the feeding mechanism of the bird. An adjustable thermostat in the brooder maintains the desired temperature range from 70° to 90°F, depending on the birds' age. Attached to the heating element is a light which attracts the ducklings at night. The brooders are constructed of half-inch plywood tops, 3 x 4 feet, on 12-inch legs. Rubberized canvas, scalloped at the bottom, encloses the sides.

Feeding

Providing adequate, high quality, dry feed is an important factor in wood duck production. Different types of feeders were used. The most satisfactory design was a round, 10-quart, galvanized metal poultry feeder with a conical top that extends well over the base.

In an effort to provide a balanced diet to different age groups, commercial game bird feeds were made available as follows: medicated for birds up to four weeks of age; flight and maintenance mixture for birds from four weeks to breeding age; and a laying mixture for brood stock 30 days prior to and during nesting season. Grit in the form of coarse sand and crushed oyster shells was available at all times to birds over four weeks of age.

Transplants

Transplants were made with ducks ranging in age from two days to 12 weeks. Those up to three weeks of age were released with a brood hen. Older transplants were released without hens.

In some instances the ducks were released on the same day. On other occasions the birds were retained in pens at the release sites for periods ranging from several weeks to four months.

All transplants large enough to retain bands were leg-banded. Younger birds released as broods were web-tagged to permit identification if retrapped later in the summer. In some instances transplants were temporarily color-marked to permit identification after release. Seventy of the 1966 Piedmont transplants were marked with yellow or red dye. At Savannah, a simple but effective method of marking permitted identification of birds in flight at distances up to one-fourth mile. This method consisted of bleaching wing or tail feathers with a combination of commercial products used for bleaching human hair. These products may be obtained from any beauty supply company. Good results were obtained by following the same directions recommended for human hair.

The ducks were moved by truck from Savannah to the release sites. Crates used in transferring the ducks have adequate ventilation and floor space of approximately 35 square inches per bird. These crates are eight inches high and are covered with burlap to reduce injury if birds become excited.

Holding pens for the transplanted birds at the release sites vary with each refuge, but a minimum of six square feet per bird is recommended.

Release Sites

Two primary requirements were considered in the selection of release sites: (1) limited or no use of nest boxes by wood ducks prior to the transplant program; and (2) satisfactory production habitat. Three of the refuges selected (Savannah, Harris Neck, and Blackbeard Island) had recorded no previous use of nest boxes. St. Marks, Piedmont and Carolina Sandhills had limited use of nest boxes prior to the transplants; however, it was believed that the breeding populations on these refuges were considerably less than the available brood habitat could support. All release sites possess the essential requirements of brood habitat described by Webster and McGilvrey (1966). In all cases, nest boxes are available in the release areas.

At Savannah release sites are located in fresh water impoundments where there is good interspersed of emergent vegetation and areas of open water. Principal plant species include giant cutgrass (*Zizaniopsis miliacea*), maidencane (*Panicum hemitomon*), alligatorweed (*Alternanthera philoxeroides*), white waterlily (*Nymphaea odorata*), waterprimrose (*Jussiaea Michauxiana*), various spikerushes (*Eleocharis* spp.), southern naiad (*Najas quadalupensis*), and muskgrasses (*Chara* spp.).

Releases at Harris Neck were made in Woody Pond, a 32-acre timbered slough that has been flooded for several years. Much of the wooded area is now a tangle of downed timber and shrubs. Duckweeds are abundant. The margins of this pond contain a variety of marsh plants including soft rush (*Juncus effusus*), spike rushes, buttonbush (*Cephalanthus occidentalis*) and lizard's tail (*Saururus cernuus*).

At Blackbeard Island releases were made in impoundments having marshy borders of variable width extending into open water. Principal plant species include cattail (*Typha* spp.), softstem bulrush (*Scirpus validus*), pennywort (*Hydrocotyle* sp), spikerushes, duckweeds, and willow (*Salix* sp.).

Transplants to St. Marks Refuge were released in Stoney Bayou Pool, a 700 acre marsh impoundment supporting moderate to dense stands of emergents interspersed with open water. The most common plants include cattails, *Sagittaria*, white waterlily, spikerushes, Baker's cordgrass (*Spartina Bakeri*) and bladderwort (*Utricularia* spp.).

Releases on Piedmont Refuge were made on seven man-made lakes ranging in size from two to 40 acres and on a series of beaver ponds. The largest of these, Allison Lake, is generally open water with scattered clumps of willow and dense stands of submerged coontail (*Ceratophyllum demersum*) and bladderwort. The lakeshore has good marginal stands of various spikerushes, soft rush, alder (*Alnus rugosa*) and willow. Several beaver ponds with similar vegetative cover are nearby. The other impoundments have some open water near the dams, but standing dead timber occurs over most of their surface. Shoreline vegetation is similar to that on Allison Lake. The Beaver ponds used for Releases range up to 20 years in age. In the older ponds where timber is almost completely down, dense stands of burrweed (*Sparganium americanum*) occur with some patches of cattail and soft rush. The more recent beaver ponds have standing timber and smaller quantities of herbaceous cover.

The release site at Carolina Sandhills is a wooded impoundment of 39 acres. The lower portions of this impoundment are permanently flooded and the higher areas are managed as a green tree reservoir.

RESULTS AND DISCUSSION

To date 780 young wood ducks, imprinted to nest in artificial structures, have been produced at Savannah and released on six national wildlife refuges in Georgia, Florida and South Carolina. Table I summarizes the number of wood duck nesting attempts in artificial nest boxes before and after the release of imprinted birds.

Savannah NWR

The first wood duck release at Savannah, made in January, 1967, consisted of 25 females and 14 males held in pens at the release site since the previous summer. During the 1967 nesting season, 28 nesting attempts were recorded. Two hens nested

TABLE 1

Number of available nest boxes and nesting attempts before and after transplant releases.

	Before Release		After Release	
	Available Boxes	Nesting Attempts	Available Boxes	Nesting Attempts
Savannah	36	0	94	86
Blackbeard Is.	12	0	25	12
Harris Neck	14	0	40	31
St. Marks	39	3	43	3
Carolina Sandhills	107	26	115	40
Piedmont	189	25*	189	73

*Total boxes used--not number of nesting attempts.

more than once, and one of these successfully hatched three clutches. Fifteen of 19 hens checked for bands during incubation had been released in January, 1967. Seventy-seven nest boxes were available during the 1967 breeding season.

In January, 1968, 11 females and 13 males were released. During the 1968 nesting season, when ninety-four nest boxes were available, 58 nesting attempts were recorded. These included nine by females released in 1968 and eight by females released in 1967. The others were unbanded.

Blackbeard Island NWR

The initial release on this refuge, consisting of 23 wood ducks of mixed sexes, was in 1967. These birds had been retained in a pen at the release site four months prior to release. Shortly after release, the habitat deteriorated due to severe drought, and no nesting attempts were recorded in the 15 nest boxes available.

A second release of 21 females and 28 males was made in January, 1968. Twelve nesting attempts in the 25 boxes available were recorded during the 1968 nesting season. All nesting birds were from the 1968 release.

Harris Neck NWR

In September, 1965, six immature woodies (four females and two males) escaped from a holding pen. During the 1966 nesting season, four nesting attempts occurred in the 13 nest boxes available.

In January, 1967, 18 females and 4 males were released. Fifteen nesting attempts were recorded during the following nesting season in the twenty nine boxes available. Of nine hens checked during incubation, six were birds released in January. The other three were unbanded.

Even though no releases were made on this refuge in 1968, 31 nesting attempts were recorded in 40 available nest boxes. No releases were made in 1968 because it was determined that the imprinted population established on this relatively small refuge would fully utilize the brood habitat.

St. Marks NWR

A single release of 47 young ducks was made in August of 1967. The ducks were retained in a pen at the release site for one to two months prior to release. The three recorded nesting attempts in 1968 were made by ducks other than those released. Based on the belief that the technique of transplanting and releasing will be successful in starting new breeding colonies, 150 additional woodies were transferred to this refuge in the summer of 1968. These birds will be held at the release site for four to five months.

Carolina Sandhills NWR

One transplant, consisting of 41 woodies, has been made to this refuge. Seven of the birds were released on the day of transfer (June 30, 1967) and the remainder were released 19 days later. Of 19 incubating hens checked during the 1968 breeding season, only one was from the 1967 release.

Piedmont NWR

Releases were made on this refuge in 1966 and 1967. In all cases releases were made on the day of transfer. The 1966 releases included four broods with hens and 151 immature birds without hens. Three of the broods were released with mallard hens and one with a wood duck hen. Survival of the brood releases was believed poor as none of these young ducks were observed later than 30 days following release. Another release in May, 1967, consisted of 100 birds three to seven weeks old. No releases were made in 1968 at Piedmont.

Incomplete checking of nest boxes during 1967 did not permit obtaining specific nesting data for the 1966 releases, although a total of 32 boxes are known to have been used by wood ducks. All nest boxes at Piedmont were regularly checked during the 1968 nesting season, and a total of 73 nesting attempts were recorded in the 189 nest boxes available. Seven of these nesting attempts were by birds released in 1966 and three were by birds released in 1967. The most promising results were obtained from a group of 36 birds, three to six weeks of age, which were released on Allison Lake May 31, 1966. Eleven of these 36 birds were retrapped later in the summer on Allison Lake. Two were retrapped in early 1967 several miles from the release site and one was shot in December 1966 about 15 miles from the release site. Four hens from the same group, recaptured on nest boxes during 1968 on Allison Lake within 400 yards of the original release site, accounted for six of the 1968 nesting attempts. Two hens from the 1967 release were recaptured on nest boxes in beaver ponds about one-half mile from the release site.

The limited data obtained in this study indicate that transplanted birds contributed little to the wood duck nesting populations on St. Marks and Carolina Sandhills. Piedmont releases, however, apparently have made a substantial contribution to the local nesting population. It should be noted that the birds were released on these refuges on the date of transfer or not later than two months following transfer.

Savannah, Harris Neck and Blackbeard Island Refuge had no history of wood duck nesting in boxes prior to transplants. The data from these refuges indicate that the released birds resulted in the establishment of box nesting wood duck colonies. Birds released on these areas were held in pens from August until the close of the waterfowl hunting season the following January.

These results indicate that holding the imprinted birds at or near the intended release site for four to five months is desirable in order to successfully establish a nesting population; however, if it is impractical to maintain a holding pen, birds may be released on the date of transfer. Possibly a holding period reduces the urge to return to the area from which the birds were transferred. This holding period also allows time for the selection of mates. Upon release in January, when the breeding urge is intensifying, the birds quickly begin seeking nesting sites. For this reason it is important to place nest boxes near the release site.

Based on knowledge gained during this study the following recommendations are made in addition to those already presented.

1. All pens and feeding facilities, especially those for young ducklings, should be kept as clean as possible.
2. Breeding and holding pens should be located away from human disturbances.
3. After transplant birds are released, food should be made available at or near the release site for three to six weeks. This allows time for the birds to gradually adapt to feeding in the wild.
4. The nests should be checked at three-week intervals during the nesting season to determine the success or failure of the transplant.
5. Some nesting hens are difficult to capture on the nest for identification by leg band; therefore, a method to identify the released birds in flight is desirable. The simplest method used at Savannah is the bleaching of wing or tail feathers.

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FOREST GAME COMMITTEE REPORT

Victor Schmidt resigned as chairman of the Forest Game Committee. Walter Rosene, president of the Southeastern Section of the Wildlife Society, appointed Don Strode as the new chairman of this committee.

The Forest Game Committee consists of approximately 25 persons representing State and Federal agencies, private industry, and organizations interested in forest game management and research. This Committee and its chairman are appointed annually by the president of the Southeastern Section of The Wildlife Society, with the concurrence of the president of the Southeastern Association of Game and Fish Commissioners. The chairman of the Forest Game Committee appoints the various subcommittees which carry out the functions of the Forest Game Committee.

At the present time there are seven subcommittees. They are as follows: Wild Turkey, Deer Harvest, Forest and Woody Plants, Fire and Wildlife, Rare and Endangered Species, Deer Population Dynamics, and Steering Committees.

Wild Turkey Subcommittee

Tentative plans were developed to sponsor the Second National Wild Turkey Symposium. At this same time, the North Central Section of the Wildlife Society was formulating plans to hold a turkey symposium. After considerable exchange of ideas, the responsibility for planning and executing the Symposium was assigned to the North Central Section. The Wild Turkey Subcommittee will assist the North Central Section group in planning the Second National Wild Turkey Symposium.

Fruit and Woody Plants Subcommittee

This subcommittee was initiated in 1964 for the purpose of assembling and publishing information about fruit-producing woody plants and their importance to the deer, squirrel, timber, and grouse of the southern forests.

Regional assignments were made to 6 coordinators and to 37 other persons to prepare writeups and take photos of 105 woody species. As of October 1, 1968, 34 writeups have been received. Thirty species have been photographed, but only about 15 of the photographs meet the quality standards set for the publication.

If each person can complete his assignment in 1968 or 1969, the publication should be ready in 1970. On the other hand, if only a few contribute, the task will be delayed for several more years.