# UTILIZATION OF AGRICULTURAL WETLANDS IN A MISSISSIPPI RIVER BOTTOMLAND BY WOOD DUCK AND HOODED MERGANSER BROODS

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*Abstract:* Forty artificial nesting cavities were placed in 5 wetland areas containing no natural tree cavities suitable as nest sites for wood ducks (*Aix sponsa*) or hooded mergansers (*Mergus cucullatus*). These wetlands were surrounded by agricultural fields; wetland sizes were between 0.4 ha and 10.6 ha. In 1976, 5 successful wood duck nests were observed. In 1977, 11 successful wood duck nests and 4 successful hooded merganser nests were observed. Visual searches failed to discern the presence of broods or their hens after the days on which the broods exited their nest boxes. Two wood duck hens followed by radio tracking led their broods away from the broods' natal agricultural wetlands to larger, more isolated wetlands that contained more aquatic vegetation. Several comparisons were made between the largest agricultural wetland (which produced 16 duck broods) and a nearby wetland of similar morphology but surrounded by a bottomland hardwood forest. In comparison to the forest-surrounded wetland, the agricultural wetland was much more turbid and contained fewer taxa of aquatic plants that provided less cover. The relative lack of aquatic herbaceous plants in the wetland, which was typical of the other agricultural wetlands studied, may have been an important factor in the lack of brood-usage of the wetland.

Proc. Ann. Conf. S.E. Assoc. Fish & Wildl. Agencies 33: 81-87

Hardwood bottomlands bordering streams and containing freshwater lakes provide the best, and perhaps the most extensive, type of habitat for wood ducks in the southern United States (Sincock et al. 1964). These areas also provide habitat for the region's hooded mergansers. Loss of this habitat by land-clearing, particularly in the Mississippi Delta region (Fig. 1), has adversely affected wood duck populations (Bellrose 1976:178). A maximum of 26% of the Mississippi Delta floodplain's original bottomland hardwood forest remains (DiGiulio 1978). Some wetlands often are left when hardwood bottomlands are cleared. The removal of mature trees from these remnant wetlands leaves them without cavities suitable for nesting sites. The purpose of this study was to determine if duck broods are reared or could be reared on agricultural wetlands.

Financial support for this study was provided by the Louisiana Department of Fisheries and Wildlife, the Louisiana Agricultural Experiment Station, and the National Skeetshooting Association.

## MATERIALS AND METHODS

All wetlands studied were located in Concordia Parish, Louisiana (Fig. 1). Concordia Parish lies at the southern end of the Tensas Basin, a low-lying area of little relief in the alluvial valley of the Lower Mississippi River (Harrison 1961). The terrain is dominated by tributary streams, abandoned channels, oxbow lakes, backswamps, and natural levees (Gulf South Research Institute 1976).

Approximately 93% of the total area of Condordia Parish originally supported bottomland hardwoods (Yancey 1970). In 1961, about 75% of the Parish's original forest

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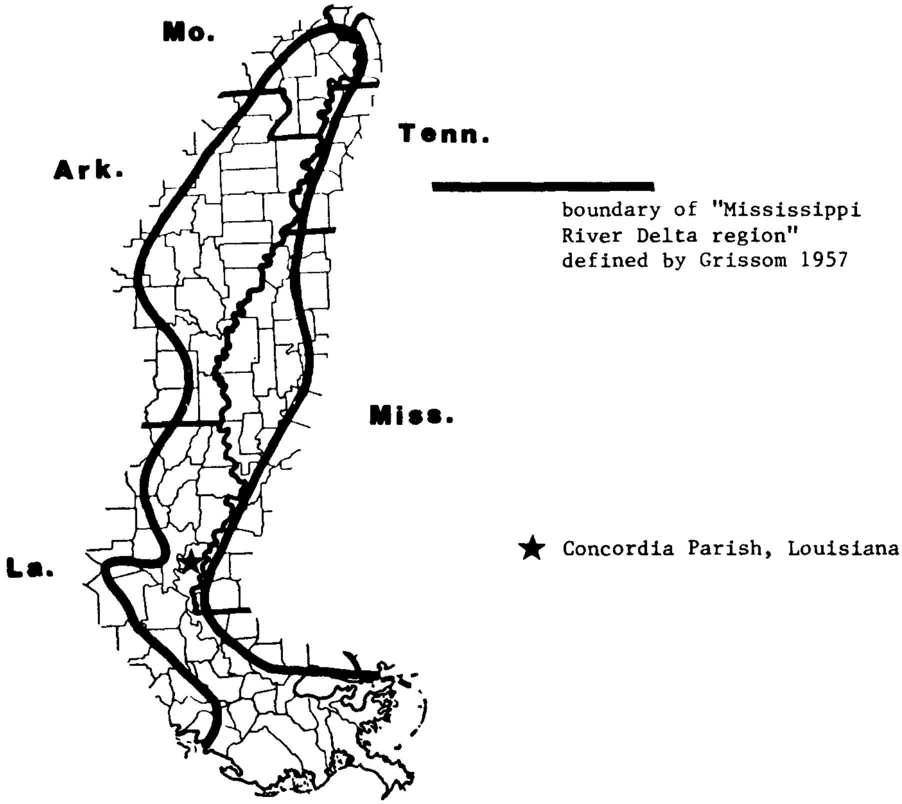


Fig. 1. The Mississippi Delta region and the location of Concordia Paris, Louisiana.

remained (Yancey 1970). Since that time, land-clearing has proceeded rapidly; in 1976, a maximum of 35% of the original forest area in the Parish remained uncleared (T.J. Smith, personal communication). The cleared land is used for the production of soybeans, cotton, and cattle (Gulf South Research Institute 1976).

Nine agricultural wetlands in Concordia Parish ranging in size from 1.4 ha to 11.7 ha were initially selected for study. These wetlands lacked suitable natural nesting cavities for ducks, were surrounded on all sides by at least 1 km of agricultural fields, and had histories of retaining water during the spring and early summer in most years.

These wetlands were divided into 2 groups based on similar morphological and vegetative features, and mapped using the stadia method (Brinckler and Taylor 1955: 189-190). Overstory vegetation was sampled with a clear-glass prism as described by Mueller-Dombois and Ellenberg (1974: 103). Understory and aquatic vegetation was sampled with $5 \times 10^{-4}$ ha circular plots. Frequency and average cover were calculated for each plant taxon as described by Aldous (1944).

To increase the probability of brood use, wooden duplex nest boxes were erected on 5 wetlands (treatment group); 34 cavities were available in 1976 and 40 in 1977. The 4 remaining wetlands served as a control group. All wetlands were searched each week for broods during the 1977 brood-rearing season (see Stewart 1957).

During the 1977 nesting season, radio transmitters were attached to nesting duck hens during the latter stages of incubation. Because of transmitter failures and nest desertions, only 2 hens with broods were followed.

The largest agricultural wetland studied (10.6 ha, Parish Lake) was compared with a wetland of similar morphology (12 ha, Snag Lake) that was surrounded by at least 1 km of bottomland hardwood forest to determine if ecological differences existed between the 2, which would likely affect brood prosperity. Vegetation in Snag Lake was sampled with the same methods employed for the agricultural wetlands. The limits of visibility, an indication of turbidity, was measured with a Secchi disk (Welch 1948: 159-60) during late spring, 1977. Five Seechi disk measurements were made in each wetland. During this time, invertebrates were collected from the upper 30 cm of the water columns with a 30 cm diameter wire-mesh dip net. In each wetland, 24 sweeps (6 m per sweep) were made and total invertebrate biomass was determined.

## RESULTS

### Brood Production

Of the 17 nest attempts by wood ducks observed during the 2-year study, 15 occurred in the Parish Lake system; 2 of the 4 hooded merganser nests also occurred in this system (Table 1). The Parish Lake system includes 10.6 ha Parish Lake and 2 small wetlands (0.8

TABLE 1. Summary of nesting efforts in agricultural wetlands.

| Year | Species | No. Nest Attempts[a] | No. of Successful Nests | Ave. Clutch Size (Successful Nests) | Clutch Size Range (Successful Nests) | % Hatching (Successful Nests) |
|---|---|---|---|---|---|---|
| 1976 | wood duck | 5 | 5 | 12.8 | 11-15 | 100 |
| 1977 | wood duck | 12 | 11 | 12.4 | 10-15 | 85 |
| 1977 | hooded merganser | 4 | 4 | 14.0 | 12-16 | 91 |

[a]A nest attempt is a nest in which incubation began.

ha and 0.3 ha) within 0.5 km of the lake and joind to it by canals. The other 4 nest attempts occurred in 2 other agricultural wetlands of 1.0 ha and 2.5 ha.

All hooded merganser nests were begun in February, 1977. Wood duck nest starts in this year occurred from late February to late May.

### Visual Observations

Broods hatched from nest boxes were not observed on their natal wetlands after the days on which they exited their nest boxes. Neither were other broods, nor other hens possibly associated with broods, observed in any of the 9 agricultural wetlands studied.

### Radio-telemetry

Both wood duck hens followed by radio-telemetry led their broods away from the natal wetlands on the days the ducklings exited their nest boxes. One brood travelled overland at least 1 km from its natal wetlands of 2.5 ha. This initial movement was into a thickly vegetated swamp bordering Black Lake (120 ha). This swamp formed an approximately 0.2 - 0.6 km border around the lake and was dominated by a thick growth of common buttonbush (*Cephalanthus occidentalis*; average cover = 33%) punctuated with baldcypress (*Taxodium distichum;* basal area = 8.4 $m^2$/ha).

On the following day, the hen and her brood had moved to another swamp (250 ha Cypress Brake) where most radio locations during the 30-day monitoring period were made. This movement involved at least 1.2 km of overland travel. Cypress Brake had a relatively dense overstory dominated by tupelo gum (*Nyssa aquatica;* basal area = 15.8 $m^2$/ha) and baldcypress (basal area = 12.1 $m^2$/ha). The understory contained a thick growth of duckweeds (Lemnaceae; average cover = 85%) and numerous clumps of common buttonbush (average cover = 16%).

The second brood orginiated in Parish Lake. It was radio-tracked for only 3 days after which time contact was lost, probably because of transmitter malfunction. The most probable route for this brood involved an initial overland movement of approximately 1 km to a stream that was followed for about 4.3 km into the swamp surrounding Black Lake. These movements occurred the first 2 days following hatching.

Parish Lake - Snag Lake Comparison

The most apparent vegetative difference between these wetlands is the greater abundance of aquatic herbaceous vegetation in Snag Lake (Tables 2 and 3). The average

TABLE 2. Understory vegetation within Parish Lake contributing at least 1% average cover, May, 1978, as determined from 41 plots.

| Taxon | Average Cover (%) | Frequency (%) |
|---|---|---|
| Lemnaceae | 4.8 | 24.4 |
| *Cephalanthus occidentalis* | 4.1 | 22.0 |
| *Salix nigra* | 3.6 | 43.9 |
| *Vitis* sp. | 3.6 | 33.3 |
| *Taxodium distichum* | 1.2 | 12.1 |

TABLE 3. Understory vegetation within Snag Lake contributing at least 1% average cover, May, 1978, as determined from 33 plots.

| Taxon | Average Cover (%) | Frequency (%) |
|---|---|---|
| Lemnaceae | 85.9 | 100.0 |
| *Ceratophyllum dmersum* | 12.9 | 45.5 |
| *Limnobium spongia* | 6.4 | 78.8 |
| *Myriophyllum heterophyllum* | 5.0 | 9.1 |
| *Forestiera acuminata* | 3.9 | 24.2 |
| *Cephalanthus occidentalis* | 3.5 | 27.3 |
| *Cabomba caroliniana* | 3.0 | 6.1 |
| *Potamogeton* sp. | 2.7 | 9.1 |
| *Taxodium distichum* | 2.1 | 24.2 |
| *Axolla* sp. | 2.0 | 9.1 |
| *Tilandsia usneoides* | 1.2 | 18.2 |

cover value for duckweeds in Parish Lake is probably inflated due to the sampling method in which 5% was the minimum value assigned to a taxon.

The average limits of visibility depths were 9 cm (± 1 cm) in Parish Lake and 76 cm (± 2 cm) in Snag Lake.

The invertebrates from Snag Lake weighed 5 times more than those from Parish Lake. Adult insects of the order Diptera, Hemiptera, and Coleoptera were present in both wetlands. Larval Odonata, absent from the Parish Lake samples, were abundant in the herbaceous vegetation at Snag Lake.

## DISCUSSION

### Agricultural Wetlands as Brood Habitats

The results suggest that agricultural wetlands are deficient as brood-rearing habitat for wood ducks and hooded mergansers. Some basic brood-rearing requirements for these species may be similar, but because of lack of information on the ecology of the hooded merganser in the South, the discussion will focus on wood ducks.

Critical factors affecting the suitability of a wetland as brood habitat may include size, water availability, cover, and food. McGilvrey (1968) considered wetlands of less than 4 ha marginal for wood duck broods. Hepp and Hair (1977) found significantly less brood use of beaver ponds smaller than 0.5 ha than was observed for larger ponds (1.5-3.8 ha). Klein (1955) and Stewart (1957) observed wood duck broods on wetlands smaller than 0.2 ha and concluded that these small wetlands constituted brood habitat when adequate cover was present. In this study, the 3 agricultural field wetlands which produced ducklings (potential users of the habitat) were 1.0 ha, 2.5 ha, and 11.7 ha and only the latter, the Parish Lake system, met McGilvrey's (1968) minimum size requirement. But even this largest wetland, which produced 16 of the 20 available broods, failed to retain them beyond their hatching dates. Size is therefore probably not the major factor limiting brood use of these wetlands.

A wetland must maintain adequate water throughout the ducklings' flightless stage in order to produce flying birds. The wetlands used as nest sites generally maintained ample water (≥90% of full stage surface area) through 15 May, after which much was often lost. Approximately one-half of the clutches hatched before this date. Intensive efforts to locate these early broods or their hens failed. These brood apparently had left their natal wetlands when water levels were high. The broods followed by radio-telemetry in June left wetlands that held approximately 65% of their full stage surface areas. This decline in water may have been a factor in the departure of late season broods from their natal wetlands. However, the earlier departure of broods with full water availability suggests otherwise.

Adequate cover may be the most important factor determining the suitability of wetlands for brood-rearing. Klein (1955) and Stewart (1957) found cover more important than size for wood duck brood habitat in small wetlands. McGivlrey (1968) suggested that optimum wood duck brood habitat consists of 75% cover vegetation and 25% open water; he proposed an ideal cover composition of 0 - 10% trees, 30 - 50% shrubs, and 40 - 70% herbaceous emergents. In our study, the majority of the cover where broods were available was woody vegetation, particularly black willows (*Salix nigra*) and common buttonbush. The vegetation of Parish Lake, presented in Table 2, is representative of the vegetation during the brood-rearing season in other agricultural wetlands studied; see Di-Giulio (1978). Herbaceous vegetation was uncommon on inundated wetland areas during the brood-rearing season. This absence of herbaceous vegetation may be an important factor in the lack of brood use of these agricultural wetlands.

Herbaceous emergent and submergent plants are the major food source for wood duck ducklings beyond 2 weeks of age (Coulter 1957, Hocutt and Dimmick 1971). Invertebrates are the major food source for ducklings under 2 weeks of age, and herbaceous vegetation forms the base of the food web and provides cover for these invertebrates (McGaha 1952; Collias and Collias 1965; Keiper 1965; and Krull 1970.

Inadequate food and cover availability may be critical factors in the apparent inability of agricultural wetlands to hold broods. Herbaceous emergent plants provide needed cover for broods. Both submergent and emergent vegetation are important food sources for ducklings; and these plants harbor protein-rich invertebrates that maintain the early growth and development of ducklings.

## Effects of Agriculture on a Bottomland Wetland

The differences observed between Snag Lake, surrounded by a hardwood forest, and Parish Lake, surrounded by soybean fields suggest the impact of agriculture on remnant wetlands. Perhaps the most serious direct result of agricultural activity on Parish Lake was the influx of silt. The greatly diminished visibility limit observed in Parish Lake is in all likelihood due to a silt influx. An influx of suspended solids can virtually eliminate submerged flora and associated fauna (Hynes 1963:87).

The removal of a forest surrounding a wetland subjects the wetland to increased wind disturbance. This may inhibit the establishment of free-floating aquatic plants such as duckweeds that grow best in wind-free sites (Webster and McGilvrey 1966). Parish Lake was bordered by a strip of trees about 15 m wide. This border, dominated by black willow probably did not provide the wind protection afforded by the hardwood forest that formerly surrounded the lake.

Land-clearing and subsequent agricultural activity apparently affectd this floodplain wetland in a manner that diminished its production of wood ducks, and perhaps hooded mergansers as well. Habitat disturbances apparently extended beyond the destruction of nest sites of these hole-nesting species and included brood-rearing components. Research into management practices that may protect bottomland wetlands in agricultured areas from disturbances such as silt erosion should be considered.

The apparent habitat deterioration observed in this study may apply to other wetlands in the alluvial floodplain of the Lower Mississippi River, a traditionally important area for wood duck production (Bellrose 1976:181). Protection of remaining forested areas in the region would be, in all likelihood, in the best interests of the region's breeding waterfowl populations.

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