# Wildlife Session

## Estimates and Chronology of Waterfowl Use of Mississippi Catfish Ponds

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*Abstract:* Estimates from aerial surveys (Nov–Feb 1983–87) of ducks, geese, and American coots (*Fulica americana*) wintering on catfish ponds in western Mississippi are presented. Estimates did not appear to be biased by the time of day clusters were surveyed, by changing observers, or by changing clusters surveyed between years. Estimates increased from an average of 54,000 birds in 1983–84, to 121,000 in 1985–86, but decreased to 105,000 in 1986–87. Numbers of birds generally peaked from late November through early December, but declined thereafter, followed by a second peak in late December to mid-January.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 41:257–265

Within the Mississippi River Alluvial Valley (MAV) of Mississippi, commercial production of channel catfish (*Ictalurus punctatus*) has developed into an important industry, expanding from 6,944 ha of ponds in 1977 (Wellborn 1983) to 33,236 ha in 1986 (Wellborn et al. 1986). Of the approximately 43,280 ha of catfish ponds in the southeastern United States in 1985, 29,860 ha (69%) existed in Mississippi (T. L. Wellborn, pers. commun.). An average of >100,000 ducks, American coots, and geese (hereafter termed waterfowl) inhabited Mississippi catfish ponds during winter 1985–86 (Dubovsky 1987, Dubovsky and Kaminski 1987). The objectives of this study were to determine whether estimates of waterfowl abundance on catfish ponds in Mississippi's MAV were comparable among winters (1983–84 through 1986–87) and between 2 observers who conducted aerial surveys and to describe the chronology of waterfowl use.

We thank D. H. Arner, M. W. Christopher, W. R. Eddleman, E. J. Hackett, E. P. Hill, G. A. Hurst, H. A. Jacobson, J. A. Jackson, M. C. Perry, H. R. Robinette, L. M. Smith, D. E. Steffen, and R. K. Wells for reviewing previous drafts of this paper. We thank M. W. Christopher, E. P. Hill, and the Mississippi Cooperative Fish and Wildlife Research Unit for providing waterfowl estimates for 1983–84

and 1984–85. M. W. Christopher, E. J. Hackett, E. P. Hill, D. E. Steffen, and R. K. Wells assisted with the study. C. C. Wasson typed the manuscript. The present study was supported through Federal Aid in Wildlife Restoration (Proj. W–48, Study 25) and the Mississippi Agricultural and Forestry Experiment Station (Publ. 6735).

## Methods

### Study Area

The study area consisted of parts of Bolivar, Holmes, Humphreys, LeFlore, Sharkey, Sunflower, and Washington counties in west–central Mississippi (Dubovsky 1987). The area contained 97% of the catfish pond acreage in Mississippi during winter 1985–86 (Wellborn et al. 1986). Physiographic and climatic characteristics of the area were described by Dubovsky (1987).

Catfish farms in the MAV of Mississippi ranged in size from 8 to 250 ha ($\bar{x}$ = 80 ha); individual ponds were typically rectangular (formed by levees with 2.5:1 slopes), 8 ha in area, and varied in depth from 1 to 2 m (Christopher 1985).

### Aerial Surveys of Waterfowl

Christopher (1985) used an October 1983 NASA Landsat Image (1:25,000) of Mississippi's MAV to identify catfish pond "clusters" (i.e., groups of catfish ponds separated by other such groups of ponds by a distance greater than the width of a 2-lane roadway [Christopher 1985]). Outlines of the clusters were transferred to Mississippi Highway Department county road maps (1:12,500) and assigned a number (Christopher 1985). These maps were used to locate clusters aerially surveyed for waterfowl during winters 1983–84 through 1986–87.

Christopher (1985) conducted waterfowl surveys of catfish ponds between 5 November 1983 and 10 March 1984 and between 27 October 1984 and 16 March 1985. Dubovsky (1987) conducted surveys between 12 October 1985 and 15 March 1986. Christopher et al. (1986) suggested that a stratified random design would enhance survey efficiency without decreasing precision. Therefore, only 57 clusters in the study area were surveyed in a stratified random manner (2 strata, Humphreys County and elsewhere in the MAV) during winter 1986–87 compared to 92 to 115 during winters 1983–84 through 1985–86. Surveys were conducted on alternate weeks from 9 November 1986 to 7 February 1987, beginning about 0800 hours and ending between 1300–1500 hours.

Techniques for surveying catfish pond clusters for waterfowl were similar to those used by Christopher (1985). A Cessna 172 was used to conduct aerial surveys at a height of 65 m and a speed of 100 km/hour. A species-specific estimate of waterfowl numbers on each cluster was tape recorded. The time of day each cluster was surveyed was also recorded for winter 1985–86. Several passes at low altitudes ($\leq$30 m) were performed to ensure complete coverage of large concentrations of waterfowl. Birds seldom flushed during low passes. When they did, their relocation to a new pond within the cluster was noted to minimize duplicating counts. The

survey route was changed each week to reduce incidence of surveying individual clusters at approximately the same time of day each survey.

Because of the shortened 1986–87 survey period, only estimates of waterfowl from previous winters (Christopher 1985, Dubovsky 1987) within ± 4 days of the dates on which surveys were flown during winter 1986–87 were used to compare the November–February waterfowl abundances. Estimates of waterfowl abundance per survey for 1985–86 data were calculated using an unbiased estimator based on a simple random sample (Cochran 1977:249). For 1986–87, unbiased estimates were calculated based on a stratified random sample (Cochran 1977:270). Coefficients of variation (CV) for winter average numbers of waterfowl were calculated by dividing the standard deviation, based on weekly estimates, by the average number of waterfowl for each winter and multiplying by 100.

### Statistical Analysis

Several analyses were conducted to assess whether yearly estimates of waterfowl abundance were biased by: (1) time of day at which waterfowl were censused during surveys, (2) changing observers between years, and (3) surveying different random sets of clusters each year. To assess the first potential bias for each survey date in 1985–86, Pearson's product moment correlation analysis was used to test for an association between numbers of waterfowl on each cluster and time of day clusters were surveyed. To assess the second possible bias, 2 observers (J. A. Dubovsky and M. W. Christopher) simultaneously conducted (from the same aircraft on 1 March 1986) an aerial survey of waterfowl on a random subsample ($N = 26$) of clusters surveyed by Dubovsky (1987) during winter 1985–86. Both observers surveyed birds from the same side of the aircraft, with Dubovsky seated anterior to Christopher. Numbers of each waterfowl species, per cluster, were compared between observers using a paired $t$-test. To assess the third potential bias, a paired $t$-test was used to compare mean numbers of waterfowl per cluster between years for those clusters surveyed in each contrasted pair of winters.

## Results

### Possible Sources of Bias

Estimates of waterfowl present on catfish pond clusters did not appear to be influenced by the time of day that clusters were surveyed. Correlations ($P < 0.05$) between waterfowl numbers on clusters, and the numerical sequence in which clusters were surveyed, existed for only the first 2 of 8 surveys in 1985–86 (Table 1). Also, numerical sequence explained little ($r^2 \leq 0.05$) of the variation in waterfowl numbers.

Numbers of waterfowl, estimated by the 2 observers, were correlated positively ($0.86 \leq r \leq 1$, $P < 0.05$) (Table 2). Mean estimates of waterfowl per cluster were similar ($P > 0.05$) between observers for all species except the American coot.

The different set of randomly selected clusters, surveyed each winter, also did

**Table 1.** Simple-correlation coefficients ($r$) and associated probability values ($P$) for the relationship between the total number of waterfowl estimated to be present on catfish-pond clusters in Mississippi's MAV, and the sequence in which clusters were surveyed during 1985–86.

| Survey date | $r$ | $P$ ($N$ = 99) |
|---|---|---|
| 2 Nov 1985 | −0.23 | 0.01 |
| 21 Nov 1985 | −0.22 | 0.02 |
| 5 Dec 1985 | −0.08 | 0.21 |
| 14 Dec 1985 | 0.00 | 0.50 |
| 5 Jan 1986 | 0.00 | 0.49 |
| 17 Jan 1986 | 0.07 | 0.24 |
| 31 Jan 1986 | −0.08 | 0.23 |
| 15 Feb 1986 | −0.09 | 0.18 |

**Table 2.** Mean numbers of ducks and coots on the same catfish-pond clusters estimated by 2 observers during an aerial survey of 26 clusters in Mississippi's MAV on 1 March 1986.

| Species/total waterfowl | Observer 1 | Observer 2 | $t$[a] | $r$ |
|---|---|---|---|---|
| Ruddy duck | 11.1 | 20.5 | 1.33 | 0.97 |
| Scaup | 87.7 | 109.3 | 1.76 | 0.94 |
| Ring-necked duck | 10.6 | 11.5 | 0.47 | 0.86 |
| American coot | 5.2 | 8.8 | 2.67* | 0.89 |
| Mallard | 1.4 | 1.8 | 1.51 | 0.99 |
| Hooded merganser | 16.4 | 1.0 | −1.13 | 0.99 |
| Northern shoveler | 11.1 | 10.4 | −0.25 | 0.87 |
| American wigeon | 0.8 | 0.8 | 0.00 | 1.00 |
| Gadwall | 0.6 | 0.6 | 0.00 | 1.00 |
| Total | 144.7 | 165.0 | 1.18 | 0.96 |

*$P < 0.05$.
[a]2-tailed, paired $t$-test between each observer's mean estimate for a waterfowl species.

not appear to confound observed yearly changes in waterfowl numbers. Mean numbers of waterfowl on clusters surveyed during each pair of winters increased ($P < 0.05$) between 1983–84 and 1984–85, and 1984–85 and 1985–86, but not between winters 1985–86 and 1986–87 (Table 3).

### Waterfowl Abundance and Chronological Use

The average number (birds/survey) of waterfowl, estimated to be present from early November through middle February, increased from 54,291 (CV = 42%, $N$ = 6) birds in 1983–84, to 97,128 (CV = 33%, $N$ = 6) birds in 1984–85, to 120,948 (CV = 14%, $N$ = 6) birds in 1985–86. The average number of waterfowl decreased to 104,941 (CV = 40%, $N$ = 6) birds during 1986–87. Maximum estimated numbers of waterfowl neared 150,000 birds in both 1985–86 and 1986–87.

In general, numbers of waterfowl initially peaked between mid–November and early December during winters 1983–84 through 1985–86 (Fig. 1, Christopher 1985). However, during winter 1986–87, the first peak did not occur until late

**Table 3.** Mean ($\bar{x}$) numbers of waterfowl per cluster ($N$) for clusters in Mississippi's MAV aerially surveyed in both winters of a contrasted pair of winters from 1983–84 through 1986–87.

| Statistic | 1983–84 vs. 1984–85 | | 1984–85 vs. 1985–86 | | 1985–86 vs. 1986–87 | |
|---|---|---|---|---|---|---|
| $\bar{x}$[a] | 216 | 407 | 186 | 274 | 241 | 191 |
| $N$ | 38 | | 41 | | 17 | |
| $t$[b] | −2.11* | | −2.04* | | 0.96 | |

*$P < 0.05$.
[a]Means for 1983–84 and 1984–85 computed from unpublished data used with permission of M. W. Christopher.
[b]1-tailed, paired $t$-test between winter mean values.

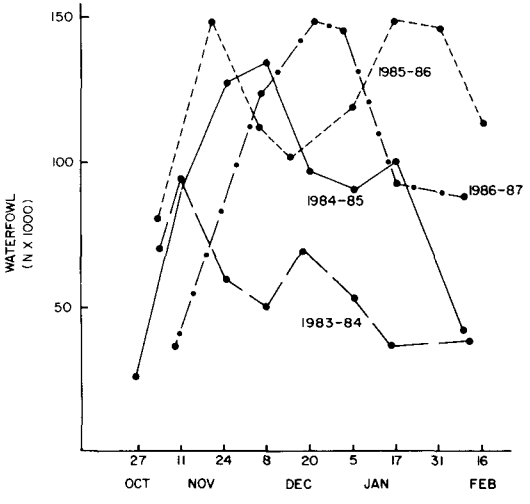


**Figure 1.** Estimates of total waterfowl on Mississippi catfish ponds in winters 1983–87. Estimates for winters 1983–84 and 1984–85 taken from Christopher (1985) with permission.

December. During the first 3 winters, the decline after the initial peak was followed by an increase in numbers of waterfowl to a second peak from mid–December to mid–January, after which waterfowl numbers declined again. A second peak was not observed in winter 1986–87.

### Waterfowl Species Composition

Although 27 species of waterfowl have been observed using Mississippi catfish ponds (Kaminski et al. 1984), northern shovelers (*Anas clypeata*), ruddy ducks (*Oxyura jamaicensis*), scaup (*Aythya affinis, A. marila*), and American coots collectively comprised 79%, 86%, 93%, and 94% of the mean number of total waterfowl estimated to be present between November and February 1983–84, 1984–85, 1985–86, and 1986–87, respectively (Fig. 2). Ring-necked ducks (*Aythya collaris*), canvasbacks (*A. valisineria*), and hooded mergansers (*Mergus cucullatus*) occurred consistently, but were not abundant (≤2%). Mallards (*Anas platyrhynchos*) and wood ducks (*Aix sponsa*) were not commonly observed on catfish ponds (Christopher 1985, Dubovsky 1987).

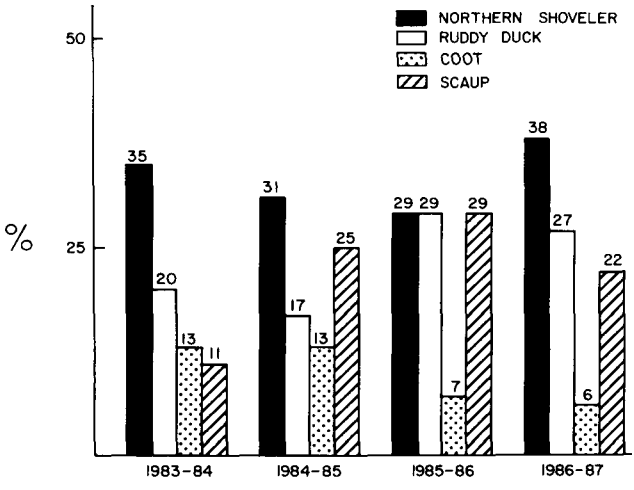


**Figure 2.** Relative abundances (%) of primary waterfowl species using Mississippi catfish ponds, expressed as a percent of the average number of all waterfowl for November through February 1983–87. Percentages for 1983–84 and 1984–85 calculated from Christopher (1985) with permission.

## Discussion

Winter estimates of waterfowl numbers did not seem to be biased by time of day that clusters were surveyed, by changing observers during the study, or by randomly choosing new survey clusters each year. Although the estimates of waterfowl abundance may be free of these biases, aerial surveys may underestimate waterfowl use of catfish ponds by about 30% (Dubovsky and Kaminski 1987).

Average numbers of waterfowl were substantially higher between successive winters 1983–84 through 1985–86. Several factors for these increases can be offered. The observed increases may have resulted from the increased availability of catfish ponds across years. Approximately 25,000, 27,000, and 28,000 ha of catfish ponds were available in winters 1983–84, 1984–85, and 1985–86, respectively. Percent increases in pond areas between winters 1983–84 and 1984–85, and between 1984–85 and 1985–86 were 8% and 4%, respectively. Percent increases in waterfowl during the same periods were 70% and 29%, respectively, which represent similar waterfowl-to-pond area ratios of 8.75:1 and 7.25:1.

A second factor could involve a shift in habitat use by waterfowl. Wells (1984) noted decreased numbers of waterfowl wintering on inland reservoirs in Mississippi. Wells (1984) and Christopher et al. (1988) suggested that waterfowl have immigrated to catfish ponds from reservoirs and other wetlands.

Another factor influencing the increase in waterfowl use of catfish ponds during winters 1984–85 and 1985–86 could have been reduced "sheet water" in the MAV during those winters. Winters 1984–85 and 1985–86 were dry compared to winters 1983–84 and 1986–87 (Table 4). With decreased available sheet water in the dry years, waterfowl may have been attracted increasingly to catfish ponds with artificially maintained water availability. Christopher (1985) stated that, following heavy precipitation, mallards and northern shovelers appeared to leave catfish ponds to use flooded agricultural lands.

**Table 4.** Average monthly total precipation (cm)[a] for 10 cities[b] in western Mississippi.

| Month | Long-term average (1951–80) | Winter | | | |
|---|---|---|---|---|---|
| | | 1983–84 | 1984–85 | 1985–86 | 1986–87 |
| Nov | 11.7 | 21.9 | 13.7 | 6.9 | 31.3 |
| Dec | 13.8 | 33.2 | 3.2 | 9.2 | 8.4 |
| Jan | 13.5 | 10.7 | 9.9 | 1.2 | 9.1 |
| Feb | 12.2 | 16.6 | 14.4 | 4.0 | 20.8 |
| Total | 51.2 | 82.4 | 41.4 | 21.3 | 69.6 |

[a]Data were obtained from National Oceanic and Atmospheric Administration.
[b]Belzoni, Greenwood, Greenville, Minter City, Moorhead, Nitta Yuma, Onward, Rolling Fork, Stoneville, and Yazoo City.

Only a few species comprised the majority of the waterfowl using catfish ponds (Christopher et al. 1988, this study). Northern shovelers, ruddy ducks, scaup, and coots comprised ≥79% of the mean number of total waterfowl between early November and early February of each winter. These species use large, open and moderately deep wetlands (0.3 to >1 m) (White and James 1978, Fredrickson and Taylor 1982), similar to the habitat conditions available in catfish ponds.

The northern shoveler was the most abundant species using catfish ponds. Neither Johnsgard (1975) nor Bellrose (1980) mentioned the MAV of Mississippi as a wintering area for shovelers. Christopher (1985) reported averages of approximately 17,000 and 23,000 shovelers on catfish ponds during winters 1983–84 and 1984–85, respectively. Numbers of shovelers wintering in the Mississippi Flyway have fluctuated, but a trend of increasing numbers in Mississippi has occurred (U.S. Fish and Wildl. Serv. 1984–86). However, surveys indicate no concurrent decreasing trend in numbers of shovelers in Alabama, Arkansas, Louisiana, and Tennessee. Decreases in the production of shovelers have also occurred from 1983 to 1985 (U.S. Fish and Wildl. Serv. and Can. Wildl. Serv. 1986). Thus, the increased use of catfish ponds by shovelers does not appear related to an increasing continental population. Perhaps shovelers were attracted to catfish ponds from other areas, but not in numbers large enough to detect decreases elsewhere.

The ruddy duck, generally, was the second most abundant species using catfish ponds. Estimates of ruddy ducks on catfish ponds increased from averages of 12,000 and 14,000 birds during winters 1983–84 and 1984–85, respectively (Christopher 1985), to 29,000 birds during 1985–86, and then decreased to 26,000 in 1986–87. Numbers of ruddy ducks observed during Midwinter Waterfowl Surveys have increased each year in the Mississippi Flyway from 1984 to 1986 (U.S. Fish and Wildl. Serv. 1984–86). Numbers of ruddy ducks wintering in Mississippi also increased during the same time period. Increased use of catfish ponds by ruddy ducks may reflect an overall increase in numbers of this species wintering in the Mississippi Flyway and Mississippi.

Although both lesser and greater scaup inhabit Mississippi catfish ponds, Bellrose (1980) stated that greater scaup winter primarily in the Atlantic Flyway. Bellrose (1980) also did not mention scaup wintering in the interior of Mississippi, but did state that approximately 12,000 scaup wintered on fishponds in Arkansas.

No trend of increasing or decreasing numbers of scaup wintering in Alabama, Arkansas, Tennessee, or Louisiana has been observed (U.S. Fish and Wildl. Serv. 1984–86). Production of scaup on breeding areas has decreased during the same time period (U.S. Fish and Wildl. Serv. and Can. Wildl. Serv. 1986). Scaup also may be shifting their winter habitat from other areas, but the number of scaup associated with the shift may be too small to detect major decreases in their numbers elsewhere.

The American coot was the fourth most abundant species. An estimated peak number of 200,000 coots winter in Mississippi (Fredrickson et al. 1977). Christopher (1985) estimated averages of approximately 6,000 and 11,000 coots on catfish ponds during winters 1983–84 and 1984–85, respectively, and Dubovsky (1987) estimated an average of approximately 11,000 coots during winter 1985–86.

Coots usually migrate south ahead of most species of ducks (Ryder 1963). Numbers of coots on catfish ponds increased to a peak in late October and early November (Christopher 1985, Dubovsky 1987). Coot numbers peaked in August and September in Colorado (Gorenzel et al. 1981) and in mid–October in Iowa, Illinois, and Missouri (Fredrickson et al. 1977). In Oklahoma, numbers of coots peaked in early to mid–October and few birds were observed after 1 November (Eddleman et al. 1985).

## Management Implications

Although significant numbers of waterfowl winter on Mississippi catfish ponds, these ponds cannot be considered as ecological substitutes for natural wetlands used by mallards and wood ducks because these species seldom use catfish ponds. Small numbers of other dabbler species (e.g., gadwall [*Anas strepera*], American wigeon [*A. americana*]) have been observed on catfish ponds. Dabblers more commonly use flooded natural and agricultural wetlands in the MAV of Mississippi (Wells 1984, Christopher et al. 1988).

Christopher (1985) suggested that continued surveys of wintering waterfowl are necessary to monitor trends in winter waterfowl use of catfish ponds. Surveys, combined with estimates of "sheet-water" availability, would result in an improved understanding of the importance of catfish ponds and sheet water to waterfowl wintering in the MAV. Surveys of waterfowl in winter are also useful to provide information on arrival dates, peak population dates, departure dates, and distributions of waterfowl for the public.

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