Breeding Waterbird Use of Louisiana Rice Fields in Relation to Planting Practices

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Abstract: Rice (*Oryza sativa*) fields are managed wetlands that have high potential value to wildlife, especially waterbirds. To better understand factors influencing use of rice fields by breeding waterbirds, we compared nest densities in water- and dry-seeded rice fields in southwestern Louisiana, May–July 1993. Densities of waterbird nests in dry- and water-seeded plots were similar (paired $t = 0.69$, df $= 13$, $P = 0.505$). Minimum density of waterbird nests surveyed in Louisiana rice fields averaged ($\pm$SE) 37.2 ± 4.4 nests/km^2 ($N = 28$, range = 0–92.7). Nests of king rails (*Rallus elegans,* 15.9 ± 3.1 nests/km^2), fulvous whistling ducks (*Dendrocygna bicolor,* 15.1 ± 3.3 nests/km^2), and purple gallinules (*Porphyrula martinica,* 5.1 ± 1.4 nests/km^2) were common, but common moorhen (*Gallinula chloropus*) and least bittern (*Ixobrychus exilis*) nests were rare (<1 nest/km^2). Waterbird nesting densities tended to be greater in "dense" than in "less dense" stands of rice (paired $t = 2.08$, df $= 13$, $P = 0.058$). Densities of waterbird nests were not affected by planting practices during the year of study, but hatching success of fulvous whistling ducks might be greater in water- than in dry-seeded rice fields. Further study is required to clarify effects of planting practices on nesting success of waterbirds and survival of young in rice fields. Research also is needed to better understand factors influencing waterbird use of rice fields throughout the planting cycle and in other rice growing areas. Such information is essential for developing management options for rice cultivation that maximize benefits to both producers and waterbirds.

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Rice is cultivated throughout the southeastern United States and in California. Between 1987 and 1993, 0.95–1.24 million ha of rice were planted annually nationwide; 170,000–247,000 ha were planted annually in Louisiana during the period. Rice fields are managed wetlands that have high potential value for wildlife, especially waterbirds. Rice prairies in eastern Texas, for example, provide wintering habitat for >2 million waterfowl (Hobaugh et al. 1989). In Louisiana and California, harvested rice fields receive high use by feeding and resting waterbirds in winter and during spring and fall migration periods (Miller 1987, Heitmeyer et al. 1989, Rave and Cordes 1993). Recognizing the importance of rice fields as habitat for wintering waterbirds, the U.S. Fish and Wildlife Service (USFWS) through the Gulf Coast Joint Venture of the North American Waterfowl Management Plan (USFWS and Can. Wildl. Serv. 1986) began leasing private rice fields in southwestern Louisiana in winter 1988–89; currently, about 7,300 ha of rice fields are managed as "mini-refuges" under this program (C. Parker, USFWS, pers. commun.).

Fields planted with rice also provide habitat for breeding waterbirds, including nesting king rails (Meanley 1969), common moorhens (Helm et al. 1987), purple gallinules (Meanley 1969, Helm et al. 1987), least bitterns (W. L. Hohman and J. L. Moore, unpubl. data), fulvous whistling ducks (Lynch 1943, McCartney 1963), and mottled ducks (*Anas fulvigula*) (W. L. Hohman and J. L. Moore, unpubl. data). Densities and fates of waterbird nests and factors influencing breeding waterbird use of rice fields, however, have not been studied.

Most rice farmers in southwestern Louisiana plant in water ("water seeding"); i.e., pre-germinated seed is aerially dispersed over fields following discing, flooding, leveling or dragging with a blade, and settling of particulate matter. Fields generally are drained within 24 hours of planting but are reflooded 7–14 days after rice has sprouted until 2–3 weeks before harvest. "Dry seeding" (seed spread or drilled in fields prior to flooding) is practiced by about 20% of rice farmers in this region (R. Levy, La. Coop. Ext. Serv., pers. commun.). Dry- and water-seeded fields are managed similarly after rice has sprouted. Water seeding is preferred by farmers to control weeds. Nonetheless, enforcement of water quality regulations specified under the Clean Water Act will eventually prohibit discharge of silt-laden water and require farmers practicing water seeding to hold water on fields for at least 15 days before discharge. Consequently, it is anticipated that dry seeding of rice will become more common in southwestern Louisiana.

Our objectives were to: (1) estimate densities of waterbirds nesting in rice fields in southwestern Louisiana and (2) compare densities of waterbirds nesting in water- and dry-seeded fields.

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Methods

This study was conducted in Acadia, Evangeline, and Vermillion parishes in southwestern Louisiana. In March and April 1993, we contacted farmers to obtain permission to work on their property and specific information regarding location and acreage of dry-seeded rice fields, planting dates and methods (broadcast or drilled), and variety of rice grown. We sought fields (hereafter "plots") that were approximately 16.2 ha (40 acres), had planting dates spanning the entire planting season (March-April), and were representative of the varieties of rice (i.e., medium and long grains; semi-dwarf to tall stature) grown in southwestern Louisiana. Fourteen dry-seeded plots were selected consisting of 5 drilled and 9 broadcast-seeded fields planted with Maybelle, Mars, Cypress, Bengal, or Orion rice varieties. Water-seeded plots were chosen from nearby fields planted with the same variety of rice and on the same schedule as companion dry-seeded plots (i.e., difference in planting or heading dates $\leq$7 days). Size of plots ranged from 13 to 28.8 ha. Average number of days from emergence to 50% heading ("heading" defined as appearance of inflorescence) was 76–88 days for selected varieties of rice (Anon. 1993).

Plots were searched completely for waterbird nests when rice was $\geq$50% headed (i.e., 2–3 weeks before dewatering or 30–40 days before seed maturity [20% grain moisture]). We searched plots after rice had headed because preliminary surveys conducted in 1991 and 1992 indicated that most nests, especially those that were successful hatching $\geq$1 egg, were initiated before rice had headed. Surveys consisted of 2 persons walking systematically through the rice spaced about 20 m apart looking for openings in rice created by nest-building birds. To insure that plots were surveyed consistently, we standardized our search rate by allowing observers approximately 4 hours per 16.2 ha. Pairs of dry- and water-seeded plots were surveyed in the same day by the same 2 persons. Species, status (active or inactive), and location of all waterbirds nests were recorded. Individual nests were marked with flagging material. We determined fate of all fulvous whistling duck nests. Inactive nests were inspected during the initial visit for evidence of hatch; active nests were visited weekly until hatch of $\geq$1 egg (successful) or failure of all eggs to hatch (unsuccessful). Additional nests were located outside study plots in a concurrent study of fulvous whistling duck nesting biology and were used here to compare apparent nest success in dry- and water-seeded rice. To determine extent of nest initiation after initial surveys, 7 randomly chosen plots (25% of all plots) were surveyed a second time after fields were dewatered in preparation for harvest.

Rice yields (barrels/ha) for individual plots were obtained from farmers. We assumed that yields were correlated with plant stem density. Between paired comparisons, plots with the greatest yield were classified as "dense" and companion plots were considered "less dense." Densities of waterbird nests (nests/km^2) in water and dry plots, and dense and less dense plots were compared by using a paired t-tests.

Results

Plots surveyed between 6 July and 17 August 1993 involved 207 ha of water-seeded and 274 ha of dry-seeded rice. Waterbird nests were found in all but 1 plot. Densities of waterbird nests in dry- and water-seeded plots were similar (paired $t = 0.69$, df = 13, $P = 0.505$). Minimum density of waterbird nests in Louisiana rice fields averaged ($\pm$SE) 37.2 $\pm$ 4.4 nests/km^2 ($N = 28$, range = 0–92.7). Nests of king rails (15.9 $\pm$ 3.1 nests/km^2), fulvous whistling ducks (15.1 $\pm$ 3.3 nests/km^2), and purple gallinules (5.1 $\pm$ 1.4 nests/km^2) were common, but common moorhen and least bittern nests were rare (<1 nest/km^2). Waterbird nesting densities tended to be greater in dense (45.2 $\pm$ 7.5 nests/km^2) than in less dense (29.2 $\pm$ 3.9 nests/km^2) stands (paired $t = 2.08$; df = 13; $P = 0.058$).

Nests were initiated after initial surveys in 5 of 7 resurveyed plots; however, none of those nests initiated after heading were active at the time of the second survey because birds generally abandoned nests when fields were dewatered.

Discussion

Waterbird Nest Density

We documented nesting by 5 species of waterbirds in rice fields in southwestern Louisiana. Estimates of waterbird nest density in water- and dry-seeded rice fields averaged 37.2 $\pm$ 4.4 nests/km^2 but ranged as high as 92.7 nests/km^2. Waterbird nest densities of up to 175.0 nests/km^2 were observed in selected rice fields not included in our study (W. L. Hohman and J. L. Moore, unpubl. data). Our density estimates underestimate actual use by breeding waterbirds because some nests may have been missed during surveys and some nests were initiated after initial surveys were completed. Furthermore, birds that were present in plots but did not attempt to nest were not counted in this study.

Use of rice fields by breeding waterbirds has been inadequately quantified, so geographic comparisons and examination of historical trends in waterbird use of rice fields are not feasible. Local farmers reported that rails, especially common moorhens and purple gallinules, were formerly abundant in rice fields in summer and fall. Helm et al. (1987) found 18 common moorhen nests and 32 purple gallinule nests in a 24-ha rice field in Acadia Parish, Louisiana, in 1977; they found 32 common moorhen nests and 28 purple gallinule nests in the same field in 1978. Meanley (1969:24) found 22 active purple gallinule nests in a 4-ha section of a 10-ha rice field in Evangeline Parish. Although densities of common moorhen and purple gallinule nests in our study were substantially lower than those reported by Helm et al. (1987), king rail nests were relatively abundant in our study plots. Nesting density of king rails in 1 Arkansas rice field in 1958 (16.5 nests/km^2, Meanley 1969:21) was similar to our estimate; however, king rail populations have declined dramatically in several areas of former abundance during the past 30 years (Ripley 1977). A decrease in the king rail population nesting in Arkansas rice fields was attributed to effects of pesticide use on crayfish (Decapoda), an important food of king rails (Eddleman et al. 1988). Expansion of crayfish aquaculture in southwestern Louisiana since the mid-1970s (Huner and Barr 1991) may be contributing to the apparent increase in king rail numbers in Louisiana rice fields.

Expansion of the breeding distribution of fulvous whistling duck into the southeastern United States after the mid- to late 1800s coincided with the establishment of rice cultures in Texas, Louisiana, and Florida (Lynch 1943, Bolen and Rylander 1983, Turnbull et al. 1989). Earliest breeding records for fulvous whistling ducks in Louisiana were obtained in 1939 (Lynch 1943). Their numbers in Louisiana increased rapidly in the 1940s to perhaps 10,000 birds, but decreased in the 1950s and 1960s because of hazing practices adopted by rice farmers to reduce crop depredation (McCartney 1963) and introduction of aldrin, a pesticide used to protect seed against larvae of rice water weevil (*Lissorhoptrus oryzophilus*) (Flickinger and King 1972). Increased numbers of birds since 1970 were attributed to discontinued use of aldrin-treated seed and substitution of drill seeding for aerial seeding of treated seed (Flickinger et al. 1973, Zwank et al. 1988). Zwank et al. (1988) estimated that 7,300 fulvous whistling ducks were in the rice belt of Louisiana during April 1985. Estimated nesting densities of fulvous whistling ducks at 2 sites in southwestern Louisiana in 1955–57 (1.0–1.5 nesting pairs/km^2, Meanley and Meanley 1959) were substantially lower than our estimate.

Effect of Planting Method on Waterbird Nesting

Method of planting had no effect on density of waterbird nests, but waterbird nesting densities tended to be greater in dense than in less dense stands. Dense stands probably provided better substrate for nests than less dense stands; however, farming practices (e.g., stable water management, soil fertility, or frequency of fertilizer application) producing dense stands also may have contributed to their selection by nesting waterbirds. Other factors potentially influencing use of rice fields by nesting waterbirds included time of planting, size of fields, number of levies, edge to area ratio, stature of rice (i.e., semi-dwarf vs. tall varieties), proximity of fields to buildings and roadways, adjacent land uses, previous rotation crop, availability of foods, and proximity of brood-rearing habitat.

Although we detected no significant differences in densities of waterbird nests in water- and dry-seeded rice fields, there was some indication that hatching success varied with planting practices. We observed nests of all waterbird species to hatch in both water- and dry-seeded plots, but we did not quantify nesting success of rails or least bitterns. Apparent nest success of fulvous whistling ducks in dry-seeded rice fields (N = 56) was approximately one-half (8.8% vs. 15.9%) that in water-seeded rice fields (N = 266). We have no explanation for apparent differences in fulvous whistling duck nest success in water- and dry-seeded rice. Survival of young to fledging was unknown for all species.

Research and Management Implications

This study documented high use of rice fields by nesting waterbirds in southwestern Louisiana. Densities of waterbird nests were not affected by planting practices during the year of study, but there was some suggestion that hatching success of fulvous whistling ducks was greater in water- than in dry-seeded rice fields. Further study is required to clarify effects of planting practices on nesting success of waterbirds and survival of young in rice fields. Moreover, because rice fields also receive extensive use by waterbirds during other periods of the year, a more comprehensive assessment is needed to understand how water vs. dry planting practices influence waterbird use of rice fields throughout the year. For example, rice fields are heavily used by spring-migrating shorebirds after fields, flooded in preparation for planting, have been leveled with a blade. Dry-planted rice fields are not flooded in spring and therefore are unavailable to migrating shorebirds. Furthermore, flooding of rice fields in winter to control weeds, a common practice of farmers that plant rice in water, provides habitat for wintering waterbirds. Patterns of waterbird use of rice fields probably vary geographically because timing of planting, planting practices, and varieties of rice differ between states. Additional research is needed to better understand factors influencing waterbird use of rice fields throughout rice growing areas. Such information is essential for development of management options for rice cultivation that maximize benefits to both producers and waterbirds.

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