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BREEDING BIOLOGY AND HABITAT OF UPLAND SANDPIPERS ON PRAIRIE-CHICKEN SANCTUARIES IN ILLINOIS

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ABSTRACT

Between 1963 and 1984, 33 upland sandpiper (*Bartramia longicauda*) nests were found while nest searching 2,940 ha of grassland on prairie-chicken (*Tympanuchus cupido*) sanctuaries in Jasper County, Illinois. Twelve of 24 nests of known fate hatched and nest success was calculated at 48% using Mayfield's (1975) method. Sandpipers selected diverse stands of grasses and forbs for nesting, and avoided fields of uniform grass and legumes. Selected vegetation heights ranged from 15-30 cm; cover over 60 cm was unsuitable. Selected brood habitat consisted of wheat stubble fields, recently hayed legumes, old redtop meadows, and moderately grazed pastures.

INTRODUCTION

During the late 1800s, thousands of upland sandpipers were slaughtered annually by market hunters. Upland sandpiper numbers dwindled until the Migratory Bird Convention Act of 1916 ended market hunting in the United States, after which populations gradually recovered (Mitchell 1967, Kirsch and Higgins 1976). Recent declines in numbers of upland sandpipers in Illinois have been attributed to decreases in habitat quality and quantity (Graber and Graber 1963).

Upland sandpipers are listed as endangered in the Illinois Endangered Species Act of 1972. According to Jurek and Leach (1977), upland sandpipers bred in 22 states and were transients in 13 other states. Its population status was listed as

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common in 12 states, and uncommon, endangered, peripheral, or irregular in 24 states; sandpiper habitat was decreasing in 11 states and static or unknown in 14 states. Upland sandpipers were not known to be increasing anywhere and there were no known improvements in habitat of significant scale. Continued degradation prompts a continuing need for information to better manage habitat that remains. The purpose of this paper is to provide information on the breeding biology of upland sandpipers in Illinois.

STUDY AREA AND METHODS

The study was conducted on sanctuaries in Jasper County, Illinois, managed as grasslands for the preservation of a local remnant flock of greater prairie-chickens (*Tympanuchus cupido pinnatus*). The sanctuaries consist of eight 7-94 ha units dispersed over nine contiguous sections. These sanctuaries are currently owned or leased for management by the Illinois Chapter of The Nature Conservancy and the Illinois Department of Conservation. Major plant cover types seeded on the sanctuaries are redtop bentgrass (*Agrostis alba*), common timothy (*Phleum pratense*), smooth brome (*Bromus inermis*), prairie grasses (*Andropogon gerardi, Panicum virgatum, Sorghastrum nutans*), legumes (*Trifolium pratense, Lespedéza stipulacea, Trifolium hybridum, Medicago sativa*), and weedy grass meadows (fields of mixed forbs and grasses). Cover is managed on an annual basis by a variable combination of prescribed burning, harvesting grass seed by combine, rotary mowing, or haying (Sanderson et al. 1973, Westemeier 1973, and Westemeier and Buhnerkempe 1983).

Nest searches in late May through August, 1963 through 1984, were primarily for finding the remains of prairie-chicken nests (Westemeier 1973, Westemeier and Buhnerkempe 1983). Active nests, including those of upland sandpipers, were checked approximately twice a week until the fate of the nest was determined. Mayfield's (1975) method was used in calculating nest success.

The log-likelihood ratio, goodness-of-fit test (Zarr 1984) was used ($P<0.05$) to determine if the upland sandpiper showed a preference in nest habitat. Expected values for the goodness-of-fit tests were calculated by multiplying the relative proportion of a particular habitat available on the sanctuaries by the total number of nests found. Plant nomenclature follows Scott and Wasser (1980).

In 1983 and 1984, breeding censuses were conducted during late April through May to determine the number of upland-sandpiper pairs on each sanctuary unit. The censuses began 0.5 hour before sunrise and continued for approximately 3 hours. All sanctuary boundaries were walked and all sandpipers heard or seen, on and off the sanctuaries, were recorded. Censuses were limited to rainless mornings with wind speeds of less than 25 km/hr.

RESULTS AND DISCUSSION

Arrival Date

From 1963 through 1984, the earliest spring arrival date noted for an upland sandpiper on the Jasper County Prairie-chicken Sanctuaries was 6 April, 3 days earlier than the earliest arrival date at Urbana, Illinois (126 km, N), reported by

Smith (1930). The average arrival date on our study area was 10 April, and nest initiation typically began 2 weeks later during the first week of May. In Wisconsin, Ailes (1980) reported that the upland sandpiper began nesting approximately 2 weeks after spring arrival.

Nesting

Data were obtained on 33 upland sandpiper nests found while searching 2,940 ha of potential nest habitat (1 nest/90 ha). Each completed nest of known fate (n = 24) had four eggs — the typical number for clutches of the family Scolopacidae (Johnsgard 1981). Based on Kendeigh's (1963:453) definition of incubation, the incubation period for two nests was 23 days. Higgins and Kirsch (1975:99) summarized incubation periods of 21-28 days ($\bar{x}$ = 24 days) for 12 clutches reported in the literature, and their data on 9 clutches ranged from 22-27 days ($\bar{x}$ = 24 days). Sizes of 6 upland-sandpiper eggs measured on this study averaged 32.5 mm × 42.4 mm.

Of 24 nests whose fate was known, 12 hatched (50%), 11 were destroyed by mammalian predators, and one was abandoned. Buss and Hawkins (1939), Kirsch and Higgins (1976), Bowen (1976), and Kaiser (1979) reported nest success rates of 66, 65, 59, and 80%, respectively. Mayfield's (1975) method for calculating nest success was used to take into account problems of estimating nest success. We found a survival rate of 0.97 nest/day from 128 observation days of 10 active nests. Thus, because egg-laying and incubation average 28 days, the nest success was calculated to be 48%, which was similar to the observed nest success of 50%.

Egg success was calculated from eight clutches. Among 32 eggs, 29 hatched (91%), two were judged infertile, and one contained a dead embryo. Higgins and Kirsch (1975) observed that 94% of 400 upland-sandpiper eggs hatched, and Buss and Hawkins (1939) found that 97% of 101 eggs hatched.

Upland sandpipers were selective of cover types ($G = 22.55$, $P < 0.001$) (Fig. 1) used for nesting. Use of predominant redtop-timothy meadows for nesting was similar to expected; however, selection was shown for mixed grasses and forbs. No plant species were clearly dominant in the latter fields. No nests were found in fields of mixed wheat stubble-legumes.

Selection of nest habitat based on the management conducted prior to the nesting season was significantly different ($G = 52.84$, $P < 0.001$) (Fig. 2) from expected. Upland sandpipers selected fields that had been rotary mowed or burned the previous season. Grass meadows harvested for seed the previous year were used for nesting significantly less than other available grasslands. However, the number of nest seasons elapsed since a field was burned had no apparent effect on sandpiper nest densities ($G = 4.29$, $P > 0.50$). The number of nests found in undisturbed or hayed fields was not significantly different from expected. Thus, upland sandpipers did not selectively nest in fields past their first year of growth since a burn.

Selection of nest sites among the various age classes of grassy cover available on the study area was not random ($G = 38.80$, $P < 0.001$) (Fig. 3). Until 5 years after seeding, sandpipers showed little selection among fields for nesting. However, nest densities were notably higher in fields more than 5 years after seedings and especially high in sods past the eighth season of growth.

Upland sandpipers selected fields of seeded grasses being invaded by forbs for nesting; such habitat was typical of young, rotary-mowed seedings and of older grass seed meadows. Fields containing relatively uniform stands of grass (such as redtop) that had been harvested for grass seed the previous year, or those seeded to smooth brome, were rarely selected by nesting sandpipers. Kirsch and Higgins (1976) noted that 75% of upland sandpipers nests in North Dakota were in "fair cover" characterized by "stubble fields, moderately grazed pastures, mowed areas with heavy regrowth, brush clumps with some understory vegetation, and undisturbed (not mowed or grazed) vegetation on poor soils," rather than "tall, undisturbed stands of grass." Other studies have reported nests of upland sandpipers in old-field habitats (Dorio and Grewe 1979), in tuffs of grass in pastures (Bent 1929, Buss and Hawkins 1939), and in idle fields (Buss and Hawkins 1939, Meanley 1943). In Missouri, Skinner (1975) found that use of grasslands by upland sandpipers increased with a light scattering of forbs but declined drastically when forbs predominated. Higgins et al. (1969) and Buss and Hawkins (1939) found little nesting by sandpipers in relatively homogenous fields of seeded legumes. These studies, together with our findings, indicate the importance of forbs (diverse structure) in the nesting habitat of upland sandpipers.

Upland sandpipers most frequently chose habitats having a mixture of medium height, narrow-leaved grasses (redtop bentgrass, common timothy, bluegrass) and forbs for nesting (Table 1). Tall, rank prairie grasses such as big bluestem, Indian grass, and switchgrass were not found at nest sites, although fields containing these grasses occupied 15% of the area searched. Kirsch and Higgins (1976) and Kaiser (1979) also found a large proportion of the upland-sandpiper nests surrounded by short or medium height, narrow-leaved grasses, especially bluegrass (*Poa* spp.). On Illinois' largest remaining tract of native mesic tall-grass prairie (Goose Lake Prairie) upland sandpipers restricted nesting to patches of bluegrass and did not use the taller prairie grasses (Birkenholz 1973).

Upland-sandpiper nests on our study area were located in cover from 17-33 cm in height (n = 15), such as weedy fields that had been rotary mowed the previous summer or in old redtop-timothy meadows invaded with forbs and Kentucky bluegrass (*Poa pratense*). Only one nest was in a field of prairie grass, but that field had been burned the preceding winter and the vegetation was sparse and short at the time of nest initiation early in the growing season.

Upland sandpipers have been reported nesting in vegetation of the following heights: 22.5-35 cm (Dorio and Grewe 1979) and 18-35 cm (Lindmeier 1960) in Minnesota; 15-31 cm in North Dakota (Kirsch and Higgins 1976); 12-64 cm (42% of nests in cover 13-33 cm high) in South Dakota (Kaiser 1979); and nesting in fields averaging 23 cm high and feeding and loafing largely in fields 10-30 cm high in Missouri (Skinner 1975). These studies suggest that sandpipers selectively nest in cover of mixed weedy forbs and grasses ranging from about 15 through 35 cm and do not normally use cover in monotypic stands or stands that exceed 60 cm. Buss and Hawkins (1939) suggested that vegetation should be no taller than the sandpiper's back in order to provide freedom of vision. Other factors considered important to the upland sandpiper in selecting a nest site are loafing and feeding cover near the site (Buss and Hawkins 1939) and the proximity of a small shrub or tree (Dorio and Grewe 1979).

Brooding

Movements of two broods were watched during this study. By the third day after hatching, one brood had ranged up to 170 m from the nest site. The other brood had traveled up to 410 m from the nest site by the fifth day after hatching. Dorio and Grewe (1979) observed one upland sandpiper brood move 297 m in two days and another move 495 m in four days.

At Bogota, broods were observed primarily in fields of wheat stubble (n = 13), recently hayed legumes (n = 10), old and weedy redtop (n = 10), and on moderately grazed pastures (n = 10). Upland-sandpiper broods also use old fields and overgrazed pastures (Dorio and Grewe 1979) and often feed in newly mowed hay fields (Buss and Hawkins 1939). Good brood habitat appears to be short (< 20 cm), open, and weedy; such cover facilitates movements of the chicks and offers an abundance of insects for food. Once the brood reaches an "acceptable" brooding area, daily movements are short (< 100 m) and within 20 ha. Broods were generally found within an area of 20-40 ha (Ailes 1980).

Population Status

The apparent decline of upland-sandpiper nest densities on the prairie-chicken sanctuaries in Jasper County over the past 20 years (Fig. 4) is of concern even though samples are small. Recent censuses on the prairie-chicken sanctuaries in Jasper County, Illinois, showed 8 breeding pairs in 1983 and 7 pairs in 1984 — about one pair per 40.5 ha of grassland. The increased availability of managed grasslands suitable for breeding sandpipers from 12 ha in 1963 to 72 ha in 1984 has not effectively altered the decline. Whether the decline can be attributed to habitat conditions surrounding the sanctuaries or to regional declines in numbers of upland sandpiper is unclear. The gradual decline in upland-sandpiper numbers in Ohio since the 1920's has been attributed to the loss of grassland habitat (Osborne and Peterson 1984).

On the basis of this study, seeding and management of cool-season introduced grasses, such as bluegrass, redtop, and timothy appear beneficial to upland sandpipers when given time to age (5+ years) and diversify. To promote diverse mixtures of grasses and forbs, such seedings should be allowed to reach 10-12 years of age before reseeding. Management of seeded fields of the above grasses may include a 3-year rotation of rotary mowing to a height of 15-30 cm, no disturbance, and prescribed burning. Moderate grazing of cool-season grasses and prairie grass would also provide suitable nesting and brooding cover, but further research on grazing under Illinois conditions is needed. Mowing of likely sandpiper nest-brood habitat, if necessary, should be delayed until 1 July or later if possible, to avoid losses of eggs and young.

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Table 1. Vegetation occurring <25 cm from the rim of the nest bowl of 23 upland-sandpiper nest sites from 1963-83 on the Jasper County Prairie-Chicken Sanctuaries in Illinois. The dominant was the species with the greatest proportion of stems.

Plant Species	Frequency of Occurrence	Dominant at Nest Site
Redtop Bentgrass (*Agrostis alba*)	13	7
Common Timothy (*Phleum pratense*)	11	7
Brome (*Bromus* spp.)	8	2
Goldenrod (*Solidago* spp.)	7	2
Aster (*Aster* spp.)	6	1
Bluegrass (*Poa* spp.)	5	2
Ragweed (*Ambrosia* spp.)	5	0
Common Yarrow (*Achillea millefolium*)	5	0
Fleabane (*Erigeron* spp.)	3	0
Carolina Horse-nettle (*Solanum carolinense*)	3	0
Lettuce (*Lactuca* spp.)	2	1
Flowering Euphorbia (*Euphorbia corollata*)	2	0
Rush (*Juncus* spp.)	2	0
Fescue (*Festuca* spp.)	1	1
Alfalfa (*Medicago sativa*)	1	0
Black-eyed Susan (*Rudbeckia hirta*)	1	0
Buckhorn Plantain (*Plantago lanceolata*)	1	0
Common Dandelion (*Taraxacum officinale*)	1	0
Yellow wood-sorrel (*Oxalis dillenii*)	1	0
Deptford pink (*Dianthus armeria*)	1	0
Northern Dewberry (*Rubus flagellaris*)	1	0
Milkweed (*Asclepias*) spp.	1	0
Mountainmint (*Pycnanthemun* spp.)	1	0
Ox-eye Daisy (*Chrysanthemum leucanthemum*)	1	0
Panicum (*Panicum* spp.)	1	0
Prairie-dock (*Silphium terebinthinaceum*)	1	0
Red clover (*Trifolium pratense*)	1	0
Sweetclover (*Melilotus* spp.)	1	0
Grasses	20	13
Forbs	18	10

FIGURE 1. Numbers of upland-sandpiper nests observed and expected in various cover types on prairie-chicken sanctuaries in Jasper County, Illinois, from 1963 through 1984. (RT = redtop-timothy, SB = smooth brome, PR = prairie grass, GF = mixed grasses and forbs, LC = legumes).

FIGURE 2. Numbers of upland-sandpiper nests observed and expected in cover according to type of management conducted prior to the nesting season on prairie-chicken sanctuaries in Jasper County, Illinois, from 1963 through 1984. (UND = undisturbed, MS = mowed for seed harvest, MH = mowed for hay, RM = rotary mowed, PB = prescribe burned).

FIGURE 3. Numbers of upland-sandpiper nests observed and expected in fields according to the season of growth since seeded on prairie-chicken sanctuaries in Jasper County, Illinois, from 1963 through 1984.

FIGURE 4. Fluctuations in upland-sandpiper nest densities from 1963 through 1984 on prairie-chicken sanctuaries in Jasper County, Illinois.

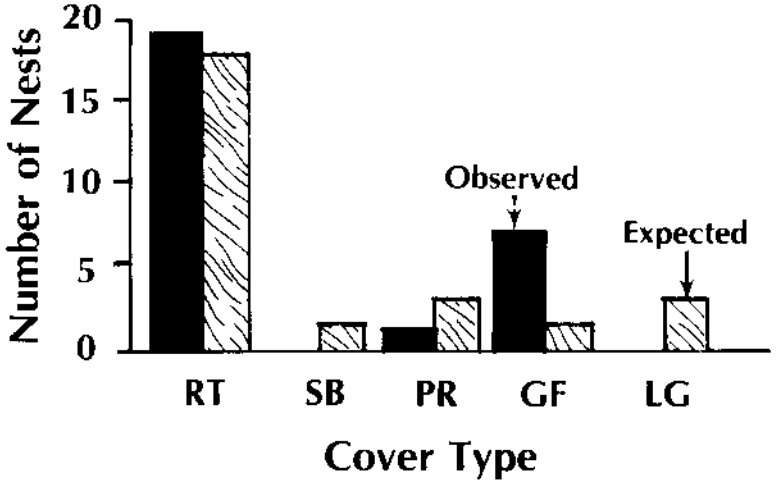

Figure 1

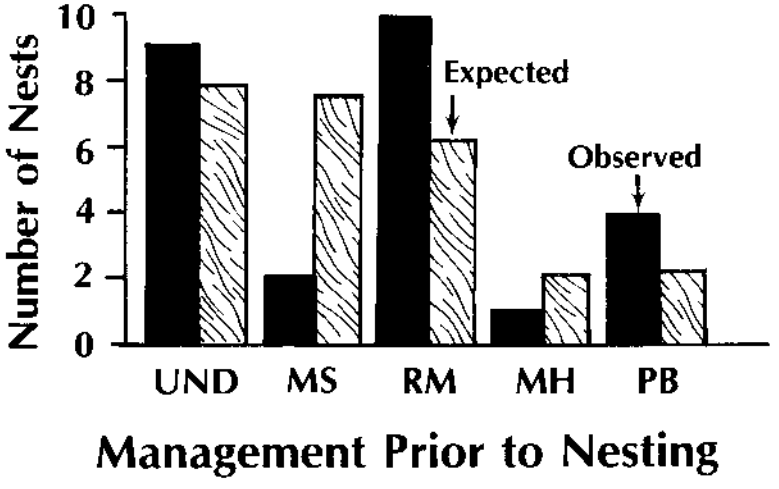

Figure 2

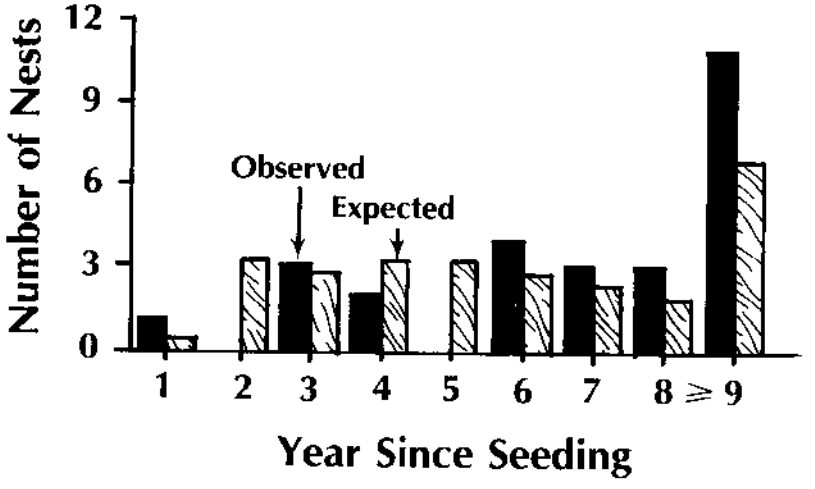

Figure 3

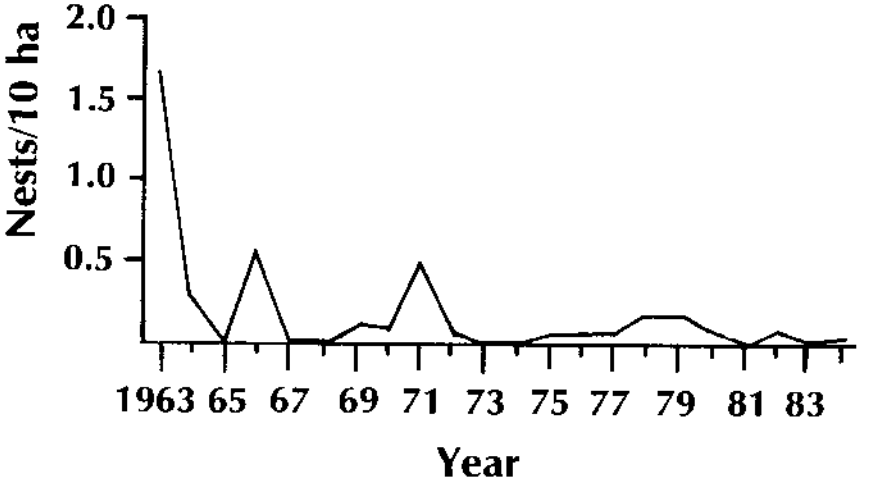

Figure 4