

**EFFECTS OF MANAGEMENT PRACTICES
ON GRASSLAND BIRDS:
WILSON'S PHALAROPE**

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This report is one in a series of literature syntheses on North American grassland birds. The need for these reports was identified by the Prairie Pothole Joint Venture (PPJV), a part of the North American Waterfowl Management Plan. The PPJV recently adopted a new goal, to stabilize or increase populations of declining grassland- and wetland-associated wildlife species in the Prairie Pothole Region. To further that objective, it is essential to understand the habitat needs of birds other than waterfowl, and how management practices affect their habitats. The focus of these reports is on management of breeding habitat, particularly in the northern Great Plains.

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Species for which syntheses are available or are in preparation:

American Bittern	Grasshopper Sparrow
Mountain Plover	Baird's Sparrow
Marbled Godwit	Henslow's Sparrow
Long-billed Curlew	Le Conte's Sparrow
Willet	Nelson's Sharp-tailed Sparrow
Wilson's Phalarope	Vesper Sparrow
Upland Sandpiper	Savannah Sparrow
Greater Prairie-Chicken	Lark Sparrow
Lesser Prairie-Chicken	Field Sparrow
Northern Harrier	Clay-colored Sparrow
Swainson's Hawk	Chestnut-collared Longspur
Ferruginous Hawk	McCown's Longspur
Short-eared Owl	Dickcissel
Burrowing Owl	Lark Bunting
Horned Lark	Bobolink
Sedge Wren	Eastern Meadowlark
Loggerhead Shrike	Western Meadowlark
Sprague's Pipit	Brown-headed Cowbird

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ORGANIZATION AND FEATURES OF THIS SPECIES ACCOUNT

Information on the habitat requirements and effects of habitat management on grassland birds were summarized from information in more than 4,000 published and unpublished papers. A **range map** is provided to indicate the relative densities of the species in North America, based on Breeding Bird Survey (BBS) data. Although birds frequently are observed outside the breeding range indicated, the maps are intended to show areas where managers might concentrate their attention. It may be ineffectual to manage habitat at a site for a species that rarely occurs in an area. The species account begins with a brief **capsule statement**, which provides the fundamental components or keys to management for the species. A section on **breeding range** outlines the current breeding distribution of the species in North America, including areas that could not be mapped using BBS data. The **suitable habitat** section describes the breeding habitat and occasionally microhabitat characteristics of the species, especially those habitats that occur in the Great Plains. Details on habitat and microhabitat requirements often provide clues to how a species will respond to a particular management practice. A **table** near the end of the account complements the section on suitable habitat, and lists the specific habitat characteristics for the species by individual studies. A special section on **prey habitat** is included for those predatory species that have more specific prey requirements. The **area requirements** section provides details on territory and home range sizes, minimum area requirements, and the effects of patch size, edges, and other landscape and habitat features on abundance and productivity. It may be futile to manage a small block of suitable habitat for a species that has minimum area requirements that are larger than the area being managed. The Brown-headed Cowbird (*Molothrus ater*) is an obligate brood parasite of many grassland birds. The section on **cowbird brood parasitism** summarizes rates of cowbird parasitism, host responses to parasitism, and factors that influence parasitism, such as nest concealment and host density. The impact of management depends, in part, upon a species' nesting phenology and biology. The section on **breeding-season phenology and site fidelity** includes details on spring arrival and fall departure for migratory populations in the Great Plains, peak breeding periods, the tendency to renest after nest failure or success, and the propensity to return to a previous breeding site. The duration and timing of breeding varies among regions and years. **Species' response to management** summarizes the current knowledge and major findings in the literature on the effects of different management practices on the species. The section on **management recommendations** complements the previous section and summarizes specific recommendations for habitat management provided in the literature. If management recommendations differ in different portions of the species' breeding range, recommendations are given separately by region. The **literature cited** contains references to published and unpublished literature on the management effects and habitat requirements of the species. This section is not meant to be a complete bibliography; a searchable, annotated bibliography of published and unpublished papers dealing with habitat needs of grassland birds and their responses to habitat management is posted at the Web site mentioned below.

This report has been downloaded from the Northern Prairie Wildlife Research Center World-Wide Web site, www.npwr.usgs.gov/resource/literatr/grasbird/grasbird.htm. Please direct comments and suggestions to Douglas H. Johnson, Northern Prairie Wildlife Research Center, U.S. Geological Survey, 8711 37th Street SE, Jamestown, North Dakota 58401; telephone: 701-253-5539; fax: 701-253-5553; e-mail: Douglas_H_Johnson@usgs.gov.

WILSON'S PHALAROPE
(*Phalaropus tricolor*)

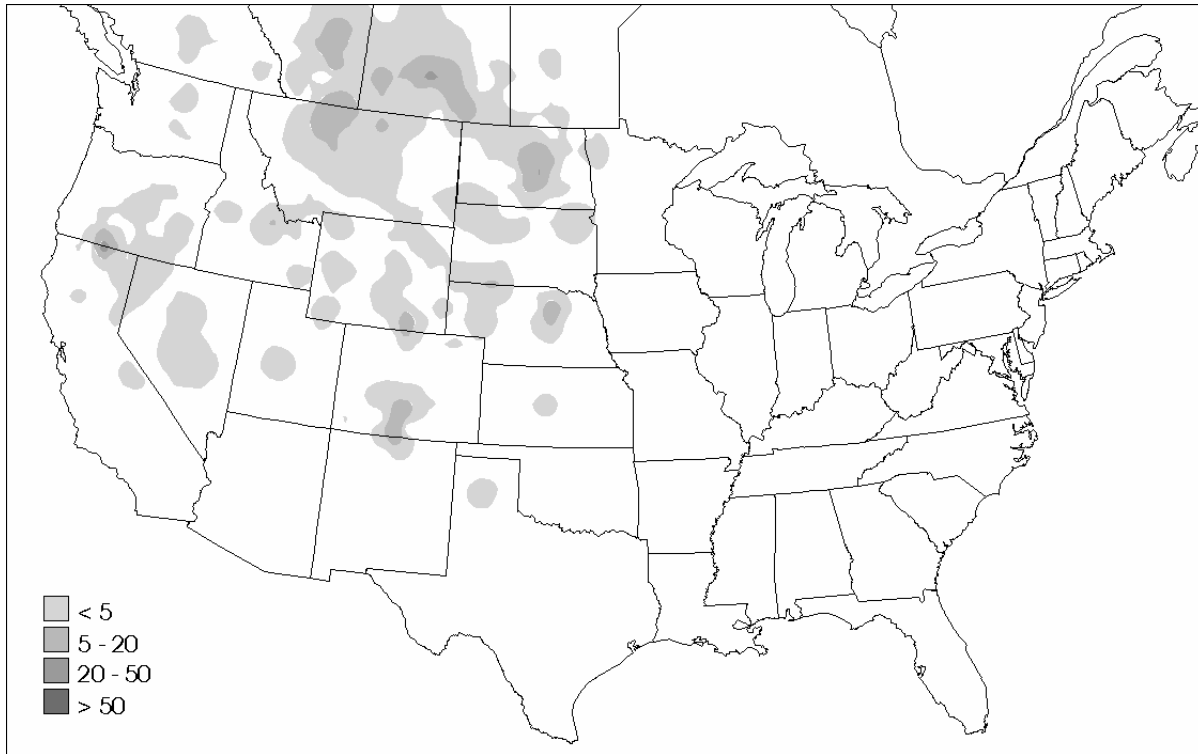


Figure. Breeding distribution of the Wilson's Phalarope in the United States and southern Canada, based on Breeding Bird Survey data, 1985-1991. Scale represents average number of individuals detected per route per year. Map from Price, J., S. Droege, and A. Price. 1995. The summer atlas of North American birds. Academic Press, London, England. 364 pages.

Key to management is providing suitable wetland (seasonal or semipermanent wetlands with open water, emergent vegetation, and open shoreline) and upland habitat (native grassland or tame hayland) throughout the breeding season.

Breeding range:

Wilson's Phalaropes breed from the southern Yukon Territories through British Columbia, southcentral Alberta and southern Manitoba, south to central California, southern Nevada, southern Colorado, northern New Mexico, and northern Texas, and east to central Kansas, northwestern Iowa, and northwestern Minnesota. They also breed from eastern Wisconsin and northeastern Illinois, east to Michigan, northern Ohio, eastern Ontario, and northern New York (National Geographic Society 1987). (See figure for the relative densities of Wilson's Phalarope in the United States and southern Canada, based on Breeding Bird Survey data.)

Suitable habitat:

Wilson's Phalaropes use both fresh and alkali wetlands with three characteristics: open water, emergent vegetation, and open shoreline (Saunders 1914, Stewart and Kantrud 1965,

Hohn 1967, Stewart 1975, Prescott et al. 1995, Naugle 1997). Nesting habitat varies widely, including wetlands, wet meadows, upland grasslands, and road rights-of-way (Roberts 1932, Bent 1962, Hohn 1967, Stewart 1975, Murray 1983, Bomberger 1984, Colwell 1987, Colwell and Oring 1990, Einemann 1991, Faanes and Lingle 1995, Dinsmore and Schuster 1997). Wilson's Phalaropes occasionally occur in Conservation Reserve Program (CRP) fields and dense nesting cover (Johnson and Schwartz 1993; Prescott et al. 1993; D. H. Johnson, *unpublished data*). In North Dakota, Wilson Phalarope densities were highest in undifferentiated tillage wetlands (wetlands with frequently tilled soils), followed by temporary, seasonal, semipermanent, fen, alkali, and permanent wetlands (Kantrud and Stewart 1984). Wilson's Phalaropes often occupied the peripheral low-prairie and wet-meadow areas of most classes of wetlands in North Dakota. In South Dakota, the occurrence of Wilson's Phalaropes was associated positively with the presence of seasonal and semipermanent wetlands, stock ponds, and intermittent streams; area of alfalfa (*Medicago sativa*) hayland; area of surface water; and the percentage of grazed shoreline (Weber 1978, Weber et al. 1982). In eastern South Dakota, the probability of occurrence of Wilson's Phalaropes in semipermanent wetlands was related positively to the proportion of untilled uplands and the number of emergent hydrophyte species (e.g., willow [*Salix* spp.]) composing $\geq 10\%$ of the vegetated wetland area; Wilson's Phalaropes were associated negatively with wetlands dominated by thick-stemmed plants (e.g., cattail [*Typha* spp.] and river bulrush [*Schoenoplectus fluviatilis*]) (Naugle 1997). Within seasonal wetlands, the probability of occurrence of Wilson's Phalaropes was related negatively to wetlands dominated by thick-stemmed plants (Naugle 1997). In Colorado, Wilson's Phalaropes preferred seasonal wetlands and habitats dominated by baltic rush (*Juncus balticus*), sedges (*Carex* spp.), and grasses <40 cm tall over semipermanent wetlands, habitats dominated by cattail and softstem bulrush (*Schoenoplectus tabernaemontani*) >40 cm tall, saltgrass habitats, or upland shrub habitats (Laubhan and Gammonley 2000).

Nest site selection varies seasonally; Wilson's Phalaropes nest in upland vegetation early in the breeding season and wet-meadow vegetation later in the season (Colwell and Oring 1990). They usually nest <100 m from shoreline (Hohn 1967, Hatch 1971, Colwell and Oring 1990, Eldridge 1992). They also exhibit annual variation in nest site selection, moving to deeper, more permanent wetlands in dry years (Hohn 1967, Colwell 1991). Nest sites in Nebraska were in wet sedge meadows (Faanes and Lingle 1995). In North Dakota and Iowa, Wilson's Phalaropes nested in wetlands associated with river floodplains (Murray 1983, Koenig 1984). Wilson's Phalaropes in Alberta, Saskatchewan, and North Dakota nested in grasses of various heights on islands or in wet-meadow zones around lakes and wetlands; in Saskatchewan, brood rearing occurred in patches of foxtail barley (*Hordeum jubatum*) (Bent 1962, Hohn 1967, Kagarise 1979, Colwell 1987). In Saskatchewan, Colwell and Oring (1990) found that nest sites of Wilson's Phalaropes had taller, denser, and more homogeneous vegetation and less bare ground than randomly selected sites. However, in the Nebraska sandhills, nest sites had shorter vegetation than random sites (Bomberger 1984). A table near the end of the account lists the specific habitat characteristics for Wilson's Phalaropes by study.

Area requirements:

There is some evidence that Wilson's Phalaropes occupying CRP fields are area sensitive; the species was rare in patches of CRP grassland that were <100 ha (D. H. Johnson, *unpublished data*).

Brown-headed Cowbird brood parasitism:

The Wilson's Phalarope is an accidental and unsuitable host of the Brown-headed Cowbird (*Molothrus ater*), an obligate brood parasite (Friedmann 1963, Hatch 1971). In North Dakota, 0 of 20 nests were parasitized (M. Winter and D. H. Johnson, *unpublished data*). In Saskatchewan, 1% of 386 nests were parasitized (Colwell and Jehl 1994). One record of multiple parasitism has been reported (Friedmann 1963). One case of intraspecific brood parasitism was reported by Colwell (1986a) in Saskatchewan.

Breeding-season phenology and site fidelity:

In the central and northern Great Plains (Minnesota, Nebraska, and North Dakota), Wilson's Phalaropes arrive on the breeding grounds from mid-April to early May and depart from mid-August to early September (Roberts 1932, Howe 1972, Johnsgard 1980, Murray 1983). In Alberta, Manitoba, and Saskatchewan, Wilson's Phalaropes arrive on the breeding grounds from late April to early May and are observed until early September (Hohn 1967; Maher 1974; Reynolds et al. 1986; Colwell 1987; Colwell and Oring 1988a,b). Females arrive on the breeding grounds earlier than males (Reynolds et al. 1986, Colwell 1987), and commonly depart from breeding areas earlier than males, usually from early June to early July (Hohn 1967; Howe 1972; Colwell 1987; Colwell and Oring 1988a,b). Wilson's Phalaropes may reneest after nest failure, and females are capable of laying multiple clutches (Colwell and Jehl 1994). Polyandry was first documented in the species in Saskatchewan, where a color-banded female laid two clutches with two individual males (Colwell 1986b, Colwell 1987). Philopatry is uncommon in Wilson's Phalaropes, although males return to breeding areas in successive years more often than females (Colwell 1987, Colwell and Oring 1988b). Of 154 adult male phalaropes banded over 4 yr in Saskatchewan, 16% returned to their previous breeding area in successive years, whereas only 2% of 69 banded adult females returned (Colwell 1987).

Species' response to management:

Wilson's Phalaropes nest in idle, hayed, and grazed grasslands adjacent to wetlands (Hohn 1967, Kantrud and Higgins 1992). Burning can improve nesting habitat (Eldridge 1992). In North Dakota, Wilson's Phalaropes nested at higher densities in hayland mowed the previous year than in grazed areas (Kantrud 1981). Idle grasslands and previously grazed areas provided habitat for nesting, but areas with cattle present during the breeding season were less suitable (Renken 1983, Renken and Dinsmore 1987, Kantrud and Higgins 1992). In Alberta, Wilson's Phalaropes were present in deferred-grazed (grazed after 15 July) native pasture (Prescott et al. 1993). Nesting occurred in areas that were moderately grazed in Nebraska (Faanes and Lingle 1995) and heavily grazed in Saskatchewan (Colwell 1987). Although Wilson's Phalaropes occasionally nested in cropland (small-grain stubble) in North Dakota (Higgins 1975), native grassland was preferred over cropland and tame grassland in southern Canada and the northern United States (Owens and Myres 1973, Eldridge 1992, Kantrud and Higgins 1992). In the northern Great Plains, Wilson's Phalaropes favor CRP grassland blocks >100 ha in size (D. H. Johnson, *unpublished data*). Johnson and Schwartz (1993) reported that Wilson's Phalaropes were present in low numbers in CRP fields in the northern Great Plains (North Dakota, South Dakota, and eastern Montana). In Saskatchewan aspen parkland, Wilson's Phalaropes were observed in dense nesting cover that contained wetlands (Prescott et al. 1993, 1995).

In Wyoming, high selenium levels in lakes appeared to cause high selenium levels in the eggs ($>13 \mu\text{g/g}$) and livers ($>30 \mu\text{g/g}$) of adult Wilson's Phalaropes (See et al. 1992). One adult, dead bird had a liver selenium content of $>30 \mu\text{g/g}$, a level associated with biological risk. Mean concentrations of $>13 \mu\text{g/g}$ dry weight were associated with embryo deformities. Of six eggs collected over 2 yr, selenium concentrations ranged from 5 to $19.9 \mu\text{g/g}$ dry weight and averaged $11.7 \mu\text{g/g}$ dry weight. Irrigation over soils with a high selenium content caused leaching of selenium from the soil to the ground water. Selenium discharge from basins was related to intensity of irrigation (measured by the area of irrigated land) and the concentration of selenium in the ground water. Also in Wyoming, mortality of Wilson's Phalarope was observed after fenthion, a chemical used to control mosquitoes (Culicidae), was aerially applied at a rate of 47 g/ha to an irrigated meadow (DeWeese et al. 1983). Fenthion is a cholinesterase inhibitor, and activity of brain cholinesterase was significantly lower for 15 d postspray in Wilson's Phalaropes collected from treated areas than in Wilson's Phalaropes from control areas.

In Montana, cases of Wilson's Phalaropes fatally colliding with a power transmission line were reported (Malcolm 1982). Highest mortalities occurred during August and September during fall migration period. The power transmission line structure was constructed over a wetland that was intermittently flooded. The structure consisted of steel towers that supported six pairs of 25-mm diameter conductor wires in two layers below two static or lightning interceptor wires of 14-mm diameter. Distances from the water to the conductor wires ranged from 14 to 33 m.

Management Recommendations:

Protect wetland complexes with both seasonal and semipermanent wetlands to provide suitable habitat during both wet and dry years (Kantrud and Stewart 1984, Colwell and Oring 1988c). Wilson's Phalaropes exhibit annual variation in nest site selection, moving to deeper, more permanent wetlands in dry years (Hohn 1967, Colwell 1991).

Ensure the presence of wet-meadow areas near deeper wetlands during the breeding season (Colwell and Oring 1988c). This may make it easier for adults to move young from nests to wetlands by decreasing overland travel distance. Wilson's Phalaropes nest in upland vegetation early in the breeding season and wet-meadow vegetation later in the season (Colwell and Oring 1990).

Prevent diversion of water from saline lakes and wetlands in western staging areas (Colwell and Jehl 1994). Preserve and/or restore wetlands (Johnson 1996).

Consider shorebird needs when creating impoundments for waterfowl; provide nesting islands and beaches with gentle inclines (Colwell and Oring 1988c). Wilson's Phalaropes in Alberta, Saskatchewan, and North Dakota nested on islands or in wet-meadow zones around lakes and wetlands (Bent 1962, Hohn 1967, Kagarise 1979).

Do not disturb (e.g., drain, mow, burn, or heavily graze) nesting habitat during the breeding season, which generally extends from early May to late July (Kantrud and Higgins 1992).

Use burning to improve nesting habitat (Eldridge 1992).

Defer livestock grazing (after 15 July) in pastures that contain wetlands important to breeding Wilson's Phalaropes (Prescott et al. 1993). Idle grasslands and previously grazed areas provide habitat for nesting, but areas with cattle present during the breeding season are less suitable (Renken 1983, Renken and Dinsmore 1987, Kantrud and Higgins 1992). In Alberta, Wilson's Phalaropes were present in deferred-grazed (grazed after 15 July) native pasture (Prescott et al. 1993).

Do not construct power lines through or within 1 km of known historical high-water marks of wetlands or dry basins known to hold water intermittently (Malcolm 1982). Avoid constructing power lines through flight lines or heavily used waterbird migration routes.

Table. Wilson's Phalarope habitat characteristics.

Author(s)	Location(s)	Habitat(s) Studied*	Species-specific Habitat Characteristics
Bent 1962	Rangewide	Wetland, wet meadow	Nested in grasses of various height in wet-meadow zones around lakes and wetlands and on islands
Bomberger 1984	Nebraska	Wetland, wet meadow	Nested near wet-meadow zones around lakes and ponds; vegetation height was more important in nest-site selection than was distance from water; habitat measurements around nests were 26-32 cm average vegetation height, 46-55 cm maximum vegetation height, 18-23% bare area, 99.9% grass cover, 3876-4385 stems/m ² stem density, 0.74 cm litter depth, 4.2-4.6 m from water, 1.5 mm stem diameter, 829 g/m ² above-ground biomass, 1.7 cm interstem distance, and 32-44 ha lake surface area
Colwell 1987	Saskatchewan	Idle shortgrass, shortgrass pasture, wetland	Nested in heavily grazed uplands that had patches of western snowberry (<i>Symphoricarpos occidentalis</i>); brood rearing occurred in stands of foxtail barley (<i>Hordeum jubatum</i>)
Colwell and Oring 1990	Saskatchewan	Mixed-grass/tame pasture, wetland, wet-meadow pasture	Nested in upland grasses early in the breeding season and wet-meadow vegetation later in the breeding season; nest sites had taller, denser, and more homogeneous vegetation and less bare ground than random sites
Dinsmore and Schuster 1997	Iowa	Wetland	Nested on a small mound of vegetation near a wetland
Einemann 1991	Nebraska	Wetland	Nested near a saline wetland in a stand of foxtail barley
Eldridge 1992	Midwest	Burned, cropland, idle, idle grassland, idle seeded-	Occurred in the wet-meadow zones of permanent or semipermanent wetlands; avoided tilled cropland;

		native, hayland, pasture, wetland complex	preferred to nest in native grassland rather than planted grass; foraged in open waters at depths up to about 30 cm
Faanes and Lingle 1995	Nebraska	Cropland, idle mixed-grass, idle shortgrass, idle tallgrass, pasture, sand-sage grassland, tame hayland, wet meadow, wet- meadow pasture, wetland, woodland	Nested in prairie wetlands and wet prairie; nested in ungrazed or moderately grazed wet sedge (<i>Carex</i>) meadows
Higgins 1975	North Dakota	Burned/hayed tame, cropland, idle, idle mixed-grass, mixed-grass pasture, tame pasture, tame hayland	Nested in standing stubble and untilled uplands
Hohn 1967	Alberta	Hayland, pasture, wetland	Occupied shallow wetlands containing wet-meadow grasses and sedges; moved to larger, more permanent wetlands in dry years; needed grassy areas free of cattails (<i>Typha</i>) and sedges
Kantrud 1981	North Dakota	Mixed-grass hayland, mixed-grass pasture	Preferred hayland mowed the previous year
Kantrud and Higgins 1992	Manitoba, Montana, North Dakota, South Dakota	Burned mixed-grass, cropland, hayland, idle mixed-grass, idle tame, mixed-grass pasture	Nested in idle and grazed uplands; nested in areas with >50% litter and relatively low, sparse cover; avoided areas with 100% visual obstruction at ≥ 20 cm or effective vegetation height >46 cm; dominant nest vegetation included Kentucky bluegrass (<i>Poa pratensis</i>), needlegrass (<i>Stipa</i>), wheatgrass (<i>Agropyron</i>), sedges, Baltic rush (<i>Juncus balticus</i>), northern reedgrass (<i>Calamagrostis inexpansa</i>), and inland saltgrass (<i>Distichlis spicata</i>)
Kantrud and Stewart	North Dakota	Wetland complex	Highest densities occurred in undifferentiated tillage

1984			wetlands (wetlands with frequently tilled soils), followed by temporary, seasonal, semipermanent, fen, alkali, and permanent wetlands; occupied the peripheral low prairie and wet meadow areas of most classes of wetlands
Koenig 1984	Iowa	Wetland	Nested in wetlands of a river floodplain
Laubhan and Gammonley 2000	Colorado	Wet meadow, wetland, shrubland	Preferred seasonal wetlands and habitats dominated by Baltic rush, sedges, and grasses <40 cm tall over semipermanent wetlands, habitats dominated by cattail and softstem bulrush (<i>Schoenoplectus tabernaemontani</i>) >40 cm tall, saltgrass habitats, or upland shrub habitats
Murray 1983	North Dakota	Idle mixed-grass, wetland	Nested in wetlands of a river floodplain
Naugle 1997	South Dakota	Conservation Reserve Program (CRP; idle seeded-native, idle tame), cropland, idle mixed-grass, idle tallgrass, idle tame, mixed-grass pasture, tallgrass pasture, tame pasture, wetland	Probability of occurrence within semipermanent wetlands was related positively to the proportion of surrounding untilled uplands and number of emergent hydrophyte species (e.g., willow [<i>Salix</i> spp.]) composing $\geq 10\%$ of the vegetated wetland area; probability of occurrence was associated negatively with wetlands dominated by thick-stemmed plants (e.g., cattail and river bulrush [<i>Schoenoplectus fluviatilis</i>]); probability of occurrence within seasonal wetlands was related negatively to wetlands dominated by thick-stemmed plants
Prescott et al. 1993	Alberta	Cropland, dense nesting cover (DNC; idle seeded-native), mixed-grass pasture, parkland, tame pasture, wetland, wetland (restored)	Were present in deferred (grazed after 15 July) native pasture and DNC that contained wetlands
Prescott et al. 1995	Alberta	Cropland, DNC (idle	Highest abundances occurred in large (>8 ha), fresh or

		seeded-native, idle tame), idle mixed-grass, idle parkland, idle tame, mixed-grass pasture, parkland pasture, tame hayland, tame pasture, wetland, woodland	saline wetlands; also occurred in tame DNC
Renken 1983, Renken and Dinsmore 1987	North Dakota	DNC (idle tame), idle mixed-grass, mixed-grass pasture	Were abundant in idle mixed-grass; highest abundances occurred in a plot that was currently idle, but had been grazed the previous year; mean vegetation values for occupied areas were 67.9% grass cover, 26.4% forb cover, 99.3% litter cover, 7.5% shrub cover, 0.0% bare ground, 12 cm effective height, and 2.3 cm litter depth (percent cover of each life form was measured and calculated separately)
Roberts 1932	Minnesota	Wetland, wet meadow	Nested on the ground in damp meadows and wetlands
Stewart 1975	North Dakota	Idle, wet meadow, wetland	Nested in wet-meadow zones along shallow, fresh to alkali wetlands
Stewart and Kantrud 1965	North Dakota	Wetland	Highest densities were found on seasonal wetlands with closed stands of emergent cover, such as common spikerush (<i>Eleocharis palustris</i>), or with clumps of emergent cover interspersed with open water; highest densities also found on brackish or saline semipermanent wetlands with closed stands of emergent cover, clumps of emergent cover interspersed with open water, or with peripheral bands of emergent cover encircling expanses of open water
Weber 1978,	South Dakota	Cropland, idle mixed-grass, idle shortgrass, idle	Occurrence was associated positively with the presence of seasonal and semipermanent wetlands, stock ponds,

Weber et al. 1982		tallgrass, mixed-grass pasture, shortgrass pasture, tallgrass pasture, tame hayland, wetland, woodland	intermittent streams, area of alfalfa (<i>Medicago sativa</i>) hayland, area of surface water, and percentage of shoreline grazed; showed a preference for seasonal wetlands, although recorded frequently on semipermanent wetlands
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*In an effort to standardize terminology among studies, various descriptors were used to denote the management or type of habitat. “Idle” used as a modifier (e.g., idle tallgrass) denotes undisturbed or unmanaged (e.g., not burned, mowed, or grazed) areas. “Idle” by itself denotes unmanaged areas in which the plant species were not mentioned. Examples of “idle” habitats include weedy or fallow areas (e.g., oldfields), fencerows, grassed waterways, terraces, ditches, and road rights-of-way. “Tame” denotes introduced plant species (e.g., smooth brome [*Bromus inermis*]) that are not native to North American prairies. “Hayland” refers to any habitat that was mowed, regardless of whether the resulting cut vegetation was removed. “Burned” includes habitats that were burned intentionally or accidentally or those burned by natural forces (e.g., lightning). In situations where there are two or more descriptors (e.g., idle tame hayland), the first descriptor modifies the following descriptors. For example, idle tame hayland is habitat that is usually mowed annually but happened to be undisturbed during the year of the study.

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