

UPLAND SANDPIPER ASSESSMENT

Prepared by:

Andrew P. Weik

April 5, 2000

Update and final revisions by:

Thomas P. Hodgman

October 27, 2006

MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE

WILDLIFE DIVISION

WILDLIFE RESOURCE ASSESSMENT SECTION

BIRD GROUP

TABLE OF CONTENTS

INTRODUCTION.....	3
NATURAL HISTORY.....	4
Description.....	4
Vocalizations	6
Distribution.....	6
Taxonomy.....	11
Habitat and Diet.....	11
Breeding Ecology	12
Survival and Longevity	17
Migration.....	17
Wintering	18
MANAGEMENT	19
Regulatory Authority	19
Past Goals and Objectives	20
Past and Current Management.....	20
HABITAT ASSESSMENT	24
Past Habitat.....	24
Current Habitat	25
Habitat Projection	28
POPULATION ASSESSMENT	29
Past Populations.....	29
Current Population.....	30
Population Projection.....	31
Limiting Factors	31
USE AND DEMAND ASSESSMENT	32
SUMMARY AND CONCLUSIONS	34
LITERATURE CITED	35

INTRODUCTION

Since 1968, the Maine Department of Inland Fisheries and Wildlife (MDIFW) has developed and refined wildlife species assessments to formulate management goals, objectives, and strategic plans. Assessments are based upon available information and the judgments of professional wildlife biologists responsible for individual species or groups of species. This document represents the first planning effort undertaken by MDIFW for upland sandpipers, a species designated as Threatened in Maine.

Assessments provide the background for species planning initiatives. A “Natural History” section reviews biological characteristics of the species useful to understanding its status. The “Management” section recaps previous actions, strategic plans, relevant rules, and regulatory authority. Historic, current, and projected future conditions for the species are discussed individually for “Habitat,” “Population,” and “Use and Demand” analyses. The major points of an assessment appear in “Summary and Conclusions.”

Owing to the relative scarcity of upland sandpipers in the east and limited information about them, this assessment draws heavily on research from other regions, particularly from the midwest and prairie states. However, upland sandpipers in Maine and other eastern states and provinces have unique habitat associations relative to species’ “norms” elsewhere across their broad range. This assessment summarizes the population status and natural history of upland sandpipers breeding in Maine.

I gratefully acknowledge Barry Van Dusen for permission to use his line drawing of an upland sandpiper (Figure 1).

NATURAL HISTORY

Description

The upland sandpiper, *Bartramia longicauda* (Bechstein), was formerly known as the upland plover (and variously as Bartramian sandpiper, grass plover, prairie pigeon, and quailie (Knight 1908)). Taxonomically classified as a shorebird, this species inhabits upland grasslands and barrens. Upland sandpipers are neotropical migrants, spending the nonbreeding season in South America.

Among the shorebirds, it is medium sized. Its long thin neck, short bill, small head with prominent dark eye, and long tail are diagnostic characteristics (Figure 1). Length from tip of bill to end of tail is 28-33 cm; weight is 170-200 g; and wingspan is 53-58 cm (converted to metric from Forbush 1929). Legs are yellow and the slightly down-curved bill (2.7-3.0 cm) is yellow with dark upper mandible. Females are slightly larger than males, and may be distinguished during nesting season with 85% accuracy by measuring wing chord and tail length (Peterson 1983).

Plumage of adults is scaly brown dorsally, grading to white ventrally. The crown is dark with a buffy white medial stripe. The throat is white, while the neck and breast have a buff wash and are heavily streaked brown. The belly and vent are white, with brown chevrons lining the lower breast and flanks. The tail extends beyond the tips of folded wings. Plumage of juveniles is similar to that of adults, but with a heavier buff wash of the neck and breast, and less distinct flank markings (Forbush 1929, Hayman et al. 1986).

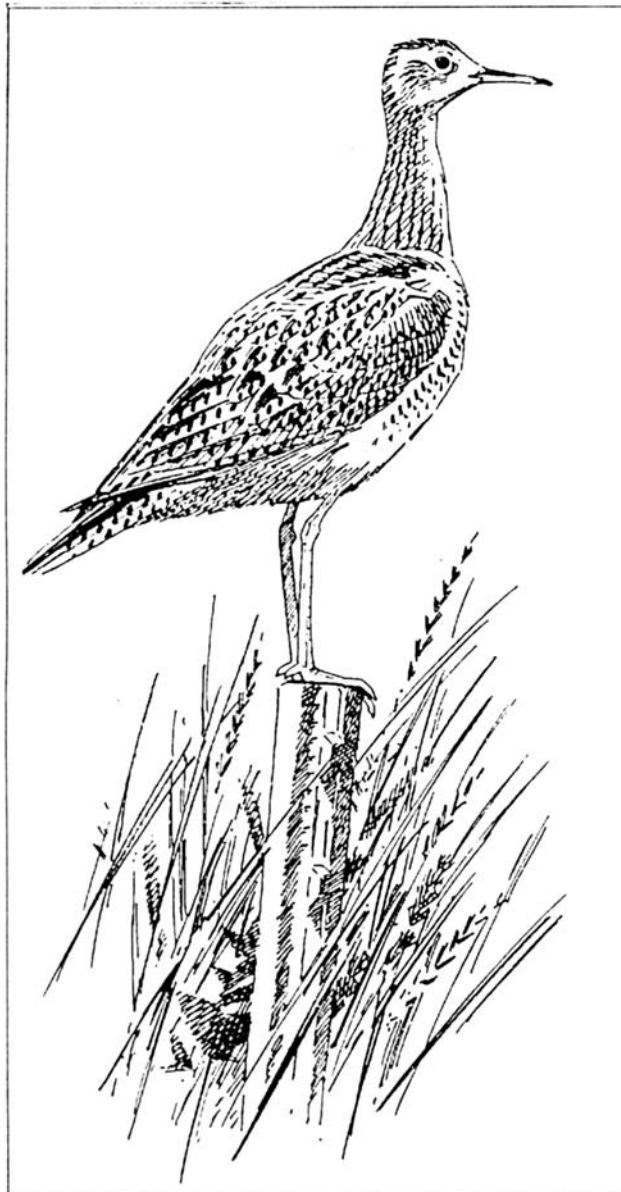


Figure 1. Upland sandpiper, adult. Artwork by Barry Van Dusen, reproduced with permission from the artist

In flight, the wings are long and pointed. Distal portions of wings (i.e. primary flight feathers) appear dark, while basal portions are lighter brown. Under sides of wings are white with fine, dark barring. The rump is dark, and white margins of the rump and tail may be visible (Forbush 1929, Hayman et al. 1986). Upland sandpipers often hold wings extended over the back during landing.

Vocalizations

Upland sandpipers often can be heard when they can't be seen. At least 4 vocalizations have been described:

Alarm call - "quip-ip-ip-ip-ip" (Bent 1929) - is often associated with nest or young.

Song - "whe-e-e-e-e-e-e-e-e-e-o-o-o-o-o-o-o-o-o" (Knight 1908) - is a prolonged, rolling whistle that rises, then falls. It is given on the breeding grounds in courtship flight or from ground or elevated perches.

Trill call - "tre-e-e-e-e-e, tre-e-e-e-e-e-e-e-e-p" (Bent 1929) - is given during flight, while running, or perching. It is used both on breeding grounds and during migration.

Call - "qua-a-ily" (Bent 1929) - from which came its nickname "quailie", is used both on the breeding grounds and during migration.

Distribution

The upland sandpiper breeds in North America in central Alaska and northern Yukon, southern Northwest Territories, northern British Columbia, Alberta, southern Saskatchewan and Manitoba to the Great Lakes; east through southern Ontario and

Quebec to the Maritime provinces (Erskine 1992); south to Virginia, Ohio, Indiana, Illinois, Missouri, northern Texas, Colorado, Idaho, eastern Oregon and eastern Washington (Bent 1929, Forbush 1929, American Ornithologists' Union 1983, van den Driessche et al. 1994). The highest nesting densities are in the northern prairie states (e.g., ND, SD), Saskatchewan, and Manitoba. The species' presence in the British Isles and continental Europe has been considered "casual or accidental" (American Ornithologists' Union 1983).

Relative to the prairies, eastern Canada and the northeastern U.S. support a small proportion of North America's breeding upland sandpipers. Surveys conducted throughout New York and the New England states in 1997 yielded a conservative estimate of 328 territorial pairs, of which 45% (i.e., 148 pairs) were in Maine (Figures 2 and 3) (Shriver et al. 1998, Weik 1999a). Fewer than 50 pairs breed in the Maritimes (Erskine 1992). During surveys in Quebec from 1984-1989, upland sandpipers were reported on 12.6% (311 of 2464) of 10 km X 10 km atlas blocks (Yank and Breton 1996), the majority of which are in the Saint Lawrence Plain and Ottawa Valley.

Within Maine, upland sandpipers have been reported historically from 79 sites in 13 counties (Table 1) (Knight 1908, Palmer 1949, MDIFW data). However, surveys since 1989 documented the species at 73 sites encompassing 11 counties. Two-thirds of recently occupied (i.e., since 1989) sites were reported from Washington and Hancock Counties (Weik 1999a).

Upland sandpipers winter in the Pampas region of Argentina, Uruguay, Paraguay, and southern Brazil (Bent 1929, Forbush 1929, Hayman et al. 1986, White

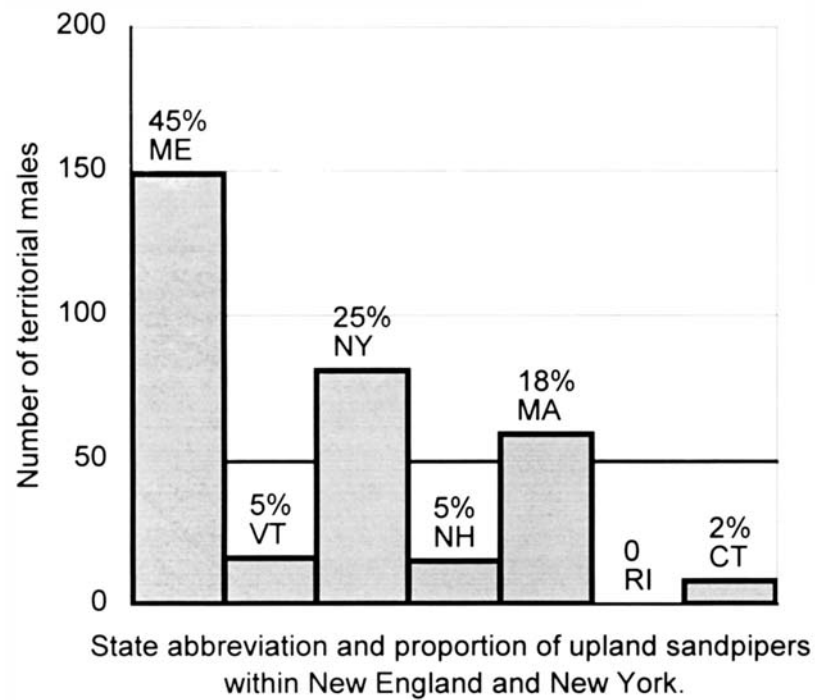


Figure 2. Distribution of upland sandpipers among 6 New England states and New York, by state, surveyed during June-July 1997. Data courtesy of Maine Department of Inland Fisheries and Wildlife and Massachusetts Audubon Society.



Figure 3. Occurrence of upland sandpiper during 1997 surveys in New York and New England. Data courtesy of Maine Department of Inland Fisheries and Wildlife and Massachusetts Audubon Society.

Table 1. Historic status and number of modern (post 1989) summer (breeding season) records for upland sandpipers among 16 counties in Maine.

County	Historic Status ¹	No. of records since 1989
Androscoggin	"common summer resident"	1
Aroostook	"common"	7
Cumberland	"common summer resident"	2
Franklin	"common summer resident"	0
Hancock	"common summer resident"	8
Kennebec	"common summer resident"	3
Knox	"occurs"	2
Lincoln	no record	0
Oxford	no record	0
Penobscot	"common summer resident"	3
Piscataquis	"common summer resident"	0
Sagadahoc	no record	0
Somerset	"common summer resident"	3
Waldo	"common"	1
Washington	"common summer resident"	41
York	"common summer resident"	2
		—
		Total: 73

¹ Based on Knight (1897, *in* Palmer 1949)

1988). Lesser numbers winter in eastern Venezuela and Surinam (Haverschmidt 1966, White 1988).

Taxonomy

Upland sandpiper is the only species of the Genus *Bartramia*, in the Family Scolopacidae. The species is included in the curlew Tribe Numeniini. No subspecies have been recognized (American Ornithologists' Union 1983).

Habitat and Diet

Upland sandpipers require large areas of grasslands for breeding. Their principal habitat is the shortgrass prairies of the northern plains states and prairie provinces (Higgins and Kirsch 1975, Kirsch and Higgins 1976, Bowen and Kruse 1993). Upland sandpipers also inhabit a variety of grasslands including hay fields, lightly grazed livestock pastures (Ailes 1976, Bowen 1976, Bowen and Kruse 1993) and other agricultural fields (White 1983), grass portions of airfields (Osborne and Peterson 1984, Vickery et al. 1994), as well as low, shrub-dominated habitats such like lowbush blueberry (*Vaccinium oxycoccus*) barrens, and recently were discovered using large peatlands in Quebec (Calme and Haddad 1996) and Maine (P. deMaynadier pers. commun., Weik and Purtell 2000). In grassland and barren sites (largely commercial blueberry barrens) in southern and eastern Maine, Vickery et al. (1994) found upland sandpipers were uncommon on sites <50 ha and reached a 50% incidence on sites of about 200 ha.

Upland sandpipers consume a wide variety of invertebrate life. Grasshoppers, crickets, and weevils are important foods as are adult and larval forms of several species of leaf-beetles, click beetles, moths, a variety of Diptera, Hymenoptera, Hemiptera, centipedes, millipedes, spiders, snails, and earthworms (Houston and Bowen 2001). Aughey (1878) found an average of 37 locusts and 16 other insects in upland sandpipers (n = 22) collected in Nebraska. Buss and Hawkins (1939) summarized the following early work on the food habits of upland sandpipers: Howell (1907) found various species of weevils (Curculioninae) in 48 upland sandpipers collected in Texas. McAtee and Beal (1912) examined 163 stomachs collected from unspecified locations and habitats in North America and reported approximately 97% of the contents consisted of animal matter; the remaining 3% consisted of seeds of various grasses and forbs.

In Maine, blueberry barrens, upland sandpipers are suspected to feed on several agricultural pests, including grasshoppers (*Melanoplus* spp., *Camnula* sp.), crickets, and caterpillars of the blueberry spanworm (*Itame argillacearia*). However, no research has been conducted on the food habits of upland sandpipers occupying blueberry fields and there are no data on whether the species consumes blueberries.

Breeding Ecology

Upland sandpipers are monogamous, and are thought to arrive on their breeding grounds already paired (Buss and Hawkins 1939, Higgins and Kirsch 1975, Ailes 1976). They sometimes nest colonially, but also may nest as isolated pairs (Buss and Hawkins

1939, Bowen 1976). Upland sandpipers arrive on their breeding grounds in Maine in late April in York County to mid-May in Aroostook County.

The courtship behavior, presumably of males, includes a flight display in which one or more (presumably) males fly with short bursts of rapid wing beats alternating between long gliding stretches, in a circular or elliptical path approximately 0.5-2.0 km in diameter, as high as several hundred feet (~200 m) above the grassland-barren. This flight may be accompanied by a prolonged, rolling whistled song, which rises then falls, or by a trill call. Both vocalizations also may be given from ground or elevated perches. The mobility and intermingling of courting sandpipers causes difficulty for observers trying to accurately estimate numbers of breeding pairs.

Limited data on return rates of marked adults suggest that upland sandpipers exhibit low site fidelity. Although, Ailes (1976) found that 33% of banded adults (n=15) returned to the same breeding site in southern Wisconsin the year after initial capture, Bowen (1976), in Kansas, recaptured only 15% of birds banded as adults (n=20) on their breeding grounds the following year. Further, birds banded as juveniles, were not resighted on their natal grasslands in subsequent years in Kansas (n=39; Bowen 1976), and only 2 of 60 in Wisconsin (Ailes 1976). Age at first breeding is unknown (Houston and Bowen 2001).

Nest consists of a shallow scrape (<5 cm deep) roughly 11 cm in diameter, most often lined with vegetation. Both male and female build the nest often creating several scrapes before choosing one to complete. Houston and Bowen (2001) provide a detailed description of nest and the nest-building process.

Upland sandpipers select dense patches of vegetation for nesting. In a study of nest site characteristics of ground-nesting birds in the prairie pothole region of North and South Dakota, Montana, and Manitoba, most upland sandpiper nests had 100% visual obstruction at less than 15 cm horizontal distance (Kantrud and Higgins 1992). Nests are usually placed among grasses and forbs, and sometimes shrubs, 10 to 40 cm tall (Kantrud and Higgins 1992, Buhnerkempe and Westemeier 1988, Ailes 1976, Kirsch and Higgins 1976).

Nest site selection by upland sandpipers in blueberry fields, the major habitat for upland sandpipers in Maine, has not been studied. Biennial pruning (some combination of mowing, burning, and herbicide application) is practiced on commercial blueberry fields before and during the early stages of the growing season. Vegetative cover in pruned, nonbearing-year fields may not offer adequate nest concealment during the early nesting season, and thus, biennial pruning may influence selection of nesting habitat.

Nest densities vary considerably across sites and years. Nest densities in North Dakota were 8-22 pairs/100 ha (Bowen and Kruse 1993), and 8-17 pairs/100 ha (Kirsch and Higgins 1976). In South Dakota, nest density was 5 pairs/100 ha (Lokemoen and Duebbert 1974), and in Wisconsin, Buss and Hawkins (1939) estimated a nest density of 25-75 pairs/100 ha. There are no nest density estimates for upland sandpipers in Maine; however, Vickery (1993) calculated pair densities of 0.4-1.2 pairs/10 ha (i.e., 4-12 pairs/100 ha) for upland sandpipers at Kennebunk Plains in York County. Factors that limit nest density (e.g., food availability, condition of nesting cover, territoriality) are poorly understood.

Eggs average 45 x 32.5 mm, are oval and less pointed than those of most shorebirds, are pale buff in color and are evenly marked with dark spots Bent (1929). Clutch size is typically 4 eggs (range 3-5 eggs) (Bent 1929, Ailes 1976). Complete clutches found during studies in North Dakota (Higgins and Kirsch 1975; n=189) and in Wisconsin (Buss and Hawkins 1939; n=47) all contained 4 eggs. The time interval between laying of successive eggs ranges from 24-49 hours (Higgins and Kirsch 1975, Ailes 1976).

Incubation begins with the laying of the last egg, and continues for 21-27 days (Buss and Hawkins 1939, Higgins and Kirsch 1975, Ailes 1976). Both adults share incubation duties, with the male doing the larger portion as hatch approaches. Pipping and hatching may span 18-72 hours (Buss and Hawkins 1939); in North Dakota 58% of clutches (n=12) hatched 24-48 hours after the first egg pipped (Higgins and Kirsch 1975).

Nesting success (% of nests in which ≥ 1 egg hatch) by upland sandpipers is high relative to that of other ground nesting birds. Upland sandpipers had “apparent” (i.e. not counting undetected nest losses) nesting success of 66% (n=47) in Wisconsin (Buss and Hawkins 1939), 65% (n=178) in North Dakota (Kirsch and Higgins 1976), 59% (n=27) in Kansas (Bowen 1976), and 50% (n=24 nests) in Illinois (Buhnerkempe and Westemeier 1988). Kantrud and Higgins (1992) used a statistical method that accounts for nests destroyed before they can be detected (Johnson 1991), to calculate 48% nesting success (n=617) for upland sandpipers in North and South Dakota, Montana, and Manitoba during 1963-1991; this estimate corresponds to an apparent nesting

success of 67%. Nesting success by upland sandpipers in Maine, where they occupy a relatively unique cover type (i.e., blueberry barrens), has not been studied.

Hatching success (% of eggs that hatch) among successful nests also is high. Hatching success ranged from 91% (n=32 eggs) in Illinois (Buhnerkempe and Westemeier 1988), to 94% (n=400) in North Dakota (Higgins and Kirsch 1975), to 97% (n=101) in Wisconsin (Buss and Hawkins 1939). There are no estimates of hatching success for upland sandpipers nesting in Maine.

Renesting by upland sandpipers that have lost the first clutch has not been documented, but is suggested by a second peak of hatching (Buss and Hawkins 1939, Higgins and Kirsch 1975, Ailes 1976). During 1997-1999, broods (n=15) in Aroostook, Washington, and York counties, Maine, hatched as early as 15 June and as late as 10 July (A. Weik, MDIFW, unpublished data).

The young are precocial (Houston and Bowen 2001), leave the nest within 24 hours of hatching, and are typically attended to by one parent, usually the male. Parents may act aggressively toward other upland sandpipers that approach within close proximity of a young brood; however, distress cries of young and adults resulting from an interspecific encounter may elicit strong mobbing behavior by other adults (A. Weik, MDIFW, unpubl. observations). Newly hatched young weigh approximately 14-17 g and attain near-adult weight of approximately 140 g in 30-34 days (Buss and Hawkins 1939, Ailes 1976). Young are capable of sustained flight by 30-34 days old, at which time, they are abandoned by the parents. Upland sandpiper broods disperse and may join mixed-age flocks in August, and begin their southern migration by early September.

Survival and Longevity

Survival rates for upland sandpipers of any age have not been estimated. During 1914-1998, 1160 individuals were banded and 11 bands have been recovered (USGS 1999). The longevity record for upland sandpipers is 8 years and 11 months as determined from banding (Houston and Bowen 2001).

Migration

Migration by upland sandpipers seems to be relatively protracted. White (1988) found that records of South American specimens spanned August through May, indicating that the migration period lasts 3-4 months in the spring and in the fall. Some birds may migrate rapidly from breeding grounds to wintering sites in southern South America, while others may linger in Central America and northern South America, and actually spend as little as 2 months on the wintering grounds (White 1988). Significant stopover sites have not been identified.

During fall migration, upland sandpipers pass through interior North America, Central America and the Caribbean, and South America east of the Andes Mountains (A.O.U. 1983, White 1988). The migration path of upland sandpipers from the Northeast is not known.

During spring, upland sandpipers migrate north through Central America. According to Bent (1929), some birds cross from Yucatan to Cuba and Florida, and migrate up the Atlantic seaboard.

Wintering

The principal wintering grounds are largely confined to grasslands in the Pampas region of Argentina and Uruguay, although numbers of birds observed since 1920 have been low (Wetmore 1926, White 1988). White (1988) noted a shift in the distribution of winter records around 1930. After 1930, upland sandpiper numbers apparently declined in Uruguay and in the province of Buenos Aires, Argentina, and increased to the north and west of Buenos Aires. Habitat loss and widespread pesticide use are thought to be largely responsible for the low numbers of wintering birds observed and their change in distribution, but this is not well documented (White 1988); hunting and predation are considered of little significance. Wintering birds are rare elsewhere, although Haverschmidt (1966) reported small flocks regularly wintering in Surinam. Winter habitat used by upland sandpipers is similar to that commonly used during the breeding season in North America: short- and tall-grass sites in livestock pastures and rangeland (White 1988).

MANAGEMENT

Regulatory Authority

The first law to regulate take of upland sandpipers in Maine was passed by the Maine Legislature in 1880. Chapter 50, “an act for the protection of Game and Birds” (Section 12) prohibited the killing, possession (except alive), or attempted sale of any “plover”, between 1 May and 1 September (upland sandpipers were known as upland plovers until well into the 1900’s). The penalty for infractions of this law was “not less than five nor more than ten dollars for each bird...”. Chapter 50 also prohibited the take or destruction of nests, eggs, or unfledged young, except for the purpose of preserving as specimens (Section 15; penalty of \$1 to \$10 per nest, egg, or bird), and the transportation of plovers (among others) during the closed season for that species (Section 16; penalty of \$5 per bird). As of 2004, the intentional take of an Upland Sandpiper constitutes a Class D crime. However, take by means of a negligent act is considered a Class E crime.

Upland sandpipers in Maine also are protected by the Maine Endangered Species Act. Upland sandpipers were classified as Threatened by the Maine Legislature in 1997. The Maine Department of Inland Fisheries and Wildlife is responsible for enforcing prohibitions of take and harassment under this state statute. In 1988, the Maine Legislature amended the Endangered Species Act to authorize MDIFW to designate Essential Habitat that is critical to the conservation of Endangered or Threatened species, and to develop guidelines for the protection of Essential Habitat. Any project which occurs partially or wholly within a designated Essential Habitat, and is

permitted, licensed, funded, or carried out by a state agency or municipal government, must be approved by MDIFW before project activities can take place. However, Essential Habitat has not been designated for upland sandpipers.

Within federal jurisdiction, upland sandpipers are protected from take and harassment by the Migratory Bird Treaty Act of 1918. Enforcement responsibility for this lies with the U.S. Fish and Wildlife Service.

Past Goals and Objectives

There are no past goals and objectives for managing this species.

Past and Current Management

Upland sandpipers have benefited from habitat management for grasshopper sparrows, a state Endangered species, at 3 of 4 sites in southern Maine: Brunswick Naval Air Station (BNAS) in Cumberland County; Kennebunk Plains Wildlife Management Area (KPWMA) in York County; and Sanford Municipal Airport (SMA) in York County. Vegetation management for grasshopper sparrows includes periodic mowing or burning to promote bunchgrasses and forbs, while discouraging encroachment by woody vegetation. Suggested vegetation management at these sites includes the curtailment of mowing in designated areas between 1 May and 31 August. Managers of BNAS and SMA have employed periodic (every 1 to 3 years) mowing, while controlled burns have been used to maintain habitat conditions at KPWMA. Numbers of upland sandpipers at the 4 grasshopper sparrow breeding sites in southern

Maine also have been monitored during annual monitoring efforts for grasshopper sparrows (Weik 1999b).

MDIFW has tracked upland sandpiper breeding season occurrences in the Natural Heritage Database since 1996. In 1989, Pierce and Melvin (1991) surveyed grassland birds on 37 blueberry barrens and airports, and reported presence of upland sandpipers in relation to habitat characteristics. In 1996, MDIFW began preliminary field surveys for upland sandpipers in Somerset, Penobscot, Hancock, and Washington Counties (Weik 1996).

During 1997-1999, MDIFW collaborated with Massachusetts Audubon Society and Maine Chapter of The Nature Conservancy in a field survey of grassland breeding birds throughout Maine, as well as in the other New England states and New York (Shriver et al. 1998, Weik 1999a, Weik and Purtell 2000). The coordinated region-wide effort revealed the importance of Maine to the conservation of upland sandpipers in the region (Figures 2 and 3). In particular, the blueberry barrens of Washington County seem to be at the core of this species range in the northeastern U.S. (Figure 3).

The North American Breeding Bird Survey (BBS) is an important tool for monitoring population trends of many birds across the continent (Sauer et al. 1996). Short of a true census, it is useful to know whether the population is stable, rising, or falling. Unfortunately, the BBS does not sample upland sandpiper habitats intensively enough in Maine to adequately monitor their population trends. Weik and Purtell (2000) modeled several population monitoring alternatives for upland sandpipers in an attempt to develop a statistically valid strategy to monitor trends in Maine. They considered a monitoring program adequate if it could detect an annual population trend of $\geq 3\%$ with

90% certainty. An annual 3% negative trend equates to a population reduction of 26% in 10 years, or 46% in 20 years. Of the 7 alternatives modeled for upland sandpipers (Table 2), only the strategy of 30 sites surveyed once per year over a 15 year period met this criterion. Over a 10-year period, surveying 3 times per year (on 22 sites) yields nearly-adequate results (power = 0.86). A monitoring program for upland sandpipers in which 22-30 sites are surveyed 3 times per year for 10 years, and once annually thereafter, will detect a 3% annual trend with power >0.85. Any refinements in methodology that reduce the coefficient of variation among upland sandpiper counts would enhance the power of the monitoring program to detect trends, which would permit a less intensive or less extensive monitoring effort (Weik and Purtell 2000).

There have been no studies of life history, productivity, or demographics of upland sandpipers in Maine, New England, or eastern Canada. The lack of this vital information hampers informed management of this species in eastern habitats.

Table 2. Power of various monitoring strategies to detect trends in an upland sandpiper (*Bartramia longicauda*) population surveyed at *22 blueberry fields and barrens in eastern Maine. Power estimates were generated in program MONITOR version 6.3 (Copyright 1995, James P. Gibbs).

Population Trend (%)	5 counts per year for 5 years*	1 count per year for 10 years*	2 counts/yr for 10 yrs*	3 counts/yr for 10 yrs*	1 count/yr for 15 yrs*	1 count biennially over 20 years*	1 count/yr on 30 plots	
							for 10 yrs	for 15 yrs
-10	0.96	0.97	0.99	1.00	1.00	1.00	0.99	1.00
-9	0.96	0.95	0.99	1.00	1.00	1.00	0.98	1.00
-8	0.92	0.93	0.99	1.00	1.00	1.00	0.98	1.00
-7	0.88	0.91	0.99	1.00	0.99	0.99	0.96	1.00
-6	0.80	0.87	0.98	0.99	0.99	0.99	0.95	1.00
-5	0.75	0.83	0.94	0.97	0.96	0.97	0.89	0.99
-4	0.66	0.71	0.88	0.92	0.93	0.94	0.77	0.97
-3	0.56	0.62	0.75	0.86	0.85	0.86	0.67	0.91
-2	0.43	0.52	0.61	0.68	0.70	0.74	0.51	0.74
-1	0.34	0.41	0.39	0.47	0.48	0.49	0.39	0.48
0	0.32	0.28	0.31	0.31	0.30	0.34	0.28	0.25
+1	0.42	0.39	0.43	0.48	0.49	0.57	0.34	0.56
+2	0.47	0.54	0.68	0.81	0.84	0.86	0.59	0.91
+3	0.63	0.72	0.91	0.97	0.97	1.00	0.81	1.00
+4	0.72	0.89	0.96	0.99	1.00	1.00	0.92	1.00
+5	0.83	0.96	1.00	1.00	1.00	1.00	0.99	1.00
+6	0.91	0.99	1.00	1.00	1.00	1.00	1.00	1.00
+7	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00
+8	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
+9	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
+10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

*MONITOR inputs: 22 plots monitored; number of counts/plot/survey variable; plot counts and plot variances from Table 2 in Weik and Purtell (2000); plots weighted by plot magnitudes; number of surveys (years) variable; occasions of surveys in time = annual or biennial; linear population model; variation in trends among plots = 0; significance level for trend detection = 0.1; 2-tailed test for significant trends; whole number rounding of counts; trend coverage = complete; 500 iterations performed.

HABITAT ASSESSMENT

Past Habitat

Upland sandpipers generally are associated with grasslands, often in the form of prairie, hay meadow, livestock pasture, and in Maine, lowbush blueberry barrens. Historically, upland sandpipers in Maine typically used hay fields and pastures (Forbush 1929, Knight 1908, Palmer 1949). Grasslands and barrens in the Northeast are not strictly an artifact of European settlement (see Askins 1999 for a thorough analysis). Agricultural clearings by Native Americans have influenced the landscape and were prominent in what is now New England long before the arrival of Europeans (Day 1954, Russell 1980). Early explorers (e.g., Champlain ca. 1604 and Weymouth ca. 1614) described meadows, fields, and regenerating hardwood scrub in lowlands from southern New England through central Maine (Day 1954, Russell 1980). Winne (1997) provided evidence that fire was important in the maintenance, and likely, the creation of the fire-adapted grassland-pine barren community of the Pineo Ridge barrens in western Washington County, which predated European settlement by at least several hundred years (Winne 1997). The Epping Plain, near Pineo Ridge, was described by a land surveyor in 1796 as “a plain two or three miles in diameter very poor and barren. The soil is perfectly barren and covered with a short kind of heath and no wood. It has the appearance of having been burned” (A. Baring *in* Fischer 1954). Currently, both the Pineo Ridge barrens and the Epping Plain are managed largely for commercial blueberry production, and upland sandpipers inhabit both sites during the breeding season.

The amount of open land increased through the 1800s as colonists cleared forests for farming. By 1880, one-third of the state was in farmland (Day 1954). Most land clearing occurred in southern and central Maine, areas of 13 counties in which Knight (1897, *in* Palmer 1949) reported upland sandpipers as a “common” summer resident. During the 1880s and into the early 20th century, many farms were abandoned and land began to revert to forest. Peak abundance of upland sandpiper habitat in Maine probably coincided with the peak in farm area during the latter half of the 19th century.

Farmland, and probably more importantly for upland sandpipers, the amount of pasture have decreased steadily since 1930, when nearly one-fourth of the state was in agriculture (Table 3). Approximately 7% of the state was in agriculture in 1982, and by 1997 only 6.1% of the state was classified as farmland (Bureau of Census 1999). From 1880 to 1997, area of pasture decreased by 96% (Bureau of Census 1999).

In addition to the decrease in quantity of farmland, particularly pasture and hay, there likely has been a decrease in the quality of these cover types as potential habitat for upland sandpipers. Improvements in technology during the past 30 years have enabled farmers to harvest hay crops earlier, before nesting birds have completed incubation or young are sufficiently mobile to escape machinery, and thus production of young likely has been reduced.

Current Habitat

In Maine, upland sandpipers primarily use managed or reverting blueberry barrens, and also use grass portions of runways at several airfields. Breeding season use of hay

Table 3. Area¹ (in thousands of acres) in selected agricultural land uses (1880-1997) that provide habitat for upland sandpipers in Maine.

Agricultural Use	1997	1987	1982	1930	1880
Land in farms	1211.6	N/A	1468.7	4639.9	6552.6
% of state total	6.1	N/A	7.4	24.3	33.1
Cropland used only for pasture	65.1	N/A	86.7	499.5	1,620.8
Land in wild and tame hay	148.4	N/A	161.9	N/A	N/A
Harvested blueberry land:					
State total	23.7	21.2	N/A	N/A	N/A
Hancock & Washington Counties	20.5	17.6	N/A	N/A	N/A

¹Data from 1997 Census of Agriculture (Bureau of Census 1999).

fields and pastures is uncommon, but annually occurs on at least two traditional sites. The first breeding season occurrence of upland sandpipers on a peatland in Maine was documented in 1999 (Weik and Purtell 2000). As of 1998, upland sandpipers occupied 7 airports and one state-owned wildlife management area (Kennebunk Plains).

Despite a long-term decline in farm area in Maine, recent expansion of wild blueberry cultivation may have provided upland sandpipers with additional habitat. From 1987 to 1997, area of blueberry fields harvested increased 10.6% statewide; the increase in area of harvested blueberry fields within Washington and Hancock Counties, where upland sandpipers are most abundant, was 14.2% during this period (Bureau of Census 1999). Further, the quality of some blueberry barrens as upland sandpiper habitat may improve, as many existing blueberry fields have been enlarged by clearing adjacent forest in recent (1996-1999) years (A. Weik, MDIFW, personal observation); upland sandpipers are area-sensitive, and are more likely to occur in areas >200 ha (Vickery et al. 1994, Weik 1999a).

Estimated areas of managed and reverting blueberry fields, and grassed airfields provide an index to potential upland sandpiper habitat, although it is unlikely that many of the smaller (<50 ha) sites are suitable. Estimated areas of hay meadows and livestock pastures, cover types formerly important to this species in Maine, would drastically overstate the amount of habitat available to upland sandpipers.

In 1997 there were 23,693 acres of commercial lowbush blueberry barrens harvested in Maine, 86% of which were in Hancock and Washington Counties (Bureau of Census 1999). These figures reflect approximately half of the commercial blueberry lands, as lowbush blueberries are managed to produce a crop biennially. Blueberry management is intensive typified by biennial burning (and often mowing) to stimulate

flowering and fruit production the following year. Furthermore, controlling grass eases harvest and reduces competition for blueberry plants and thus grasses are often controlled with herbicides. Vickery et al. (1999) found no difference in density of nesting Upland Sandpipers at Kennebunk Plains on plots receiving 0, 1 or 2 treatments of hexazinone (although other species were negatively effected). Burning, though essential in blueberry production, does not appear to greatly influence density of nesting upland sandpipers (Vickery et al. 1999). Long-term absence of fire would certainly be detrimental in allowing establishment of tall shrubs.

Habitat Projection

As of 2003, approximately 74,500 ha of lowbush blueberry were managed in North America (Strik 2006). From 1992 to 2003, area managed for lowbush blueberry in the U.S. increased by 6% with Maine responsible for 97% of the lowbush blueberry land in the U.S. (Strik 2006). A 10 - 20% increase in the amount of land managed for lowbush blueberry is expected by 2013 (Strik 2006). An increase in production in both Canada and the U.S. continued for the past 2 decades until poor weather in 2004 and 2005 reduced harvests in Maine (Yarborough 2006). The increasing trend in production continued unabated throughout this period in Canada (Yarborough 2006).

Improvements in vegetation management at airfields could increase the quality of these sites for upland sandpipers. The nonforested “footprint” of airfields was increased in 2000 to meet FAA rules for improved public safety. Furthermore, Maine Dept. of Transportation expressed a willingness to develop best management practices for airfield maintenance (C. Todd, MDIFW, pers. comm.). Despite these efforts, the number of airports with suitable habitat is not predicted to change in the next 10 years.

POPULATION ASSESSMENT

Past Population

The abundance, or even existence, of upland sandpipers and several other common grassland birds in the Northeast before colonization and forest clearing by Europeans is unclear. The first ornithologists to systematically identify and record birds along the east coast of North America documented upland sandpipers and other grassland birds. However, this took place approximately 100 years after much land in the east already had been cleared. So, it is possible that some birds invaded newly-cleared eastern grasslands from the Midwest long before they were first documented (Askins 1999).

During the late 1800s, Knight (1897, *in* Palmer 1949) indicated that upland sandpipers could be found in all 16 Maine counties: a “common summer resident” in 13 counties, “common” in Waldo and Aroostook Counties, and also present in Knox County. Several authors reported a rapid decrease in upland sandpipers across their range from Maine to the Midwest during the 1890s, the result of over-gunning by market hunters (Forbush 1929, Buss and Hawkins 1939, Palmer 1949). Within just several years, Knight (1908) wrote: “Though this species formerly occurred commonly during the migrations and was not rare as a summer resident of various parts of the State, it is now decidedly less common and the number of breeding birds which occur in the State are very few.”

Palmer (1949) reported that records of upland sandpipers in the State were few until after 1920. Numbers apparently “increased slowly” and the species reestablished

itself on sites in Cumberland, Androscoggin, Kennebec, and Penobscot Counties (Palmer 1949). Weik (1999a) found upland sandpipers during the breeding season in 9 counties. The species has been confirmed breeding in 20 atlas blocks (i.e., 1 block = area encompassed by a single 7.5' topographic quadrangle) during the Maine Breeding Bird Atlas (Adamus 1987). However, definitive evidence of population trend is not available as no upland sandpipers were reported from any BBS route in Maine during 1999-2005.

Current Population

Upland sandpiper populations are notoriously difficult to estimate accurately. They may nest colonially or as isolated pairs (Houston and Bowen 2001). Several pairs may use one large grassland or barren, or one pair may use several smaller, disjunct sites in close proximity to one another. Courtship flights can be difficult to interpret due to the high altitude and large area sometimes covered by displaying birds. Incomplete understanding of upland sandpiper behavior, coupled with limited access to breeding habitat by observers, have precluded an accurate estimate of their population size.

Surveys by MDIFW to date (Pierce and Melvin 1991; Weik 1996, 1999a; Weik and Purtell 2000) have provided information on species occurrence, distribution, and relative abundance. Weik (1997) conservatively estimated 148 pairs of upland sandpipers among 59 grasslands, barrens, and airports over 9 counties; Pierce and Melvin (1991) recorded at least 12 individuals on 5 additional sites in Hancock and Kennebec Counties. Three additional breeding season observations of upland sandpipers were recorded in 1999 (Weik and Purtell 2000). The total number of

breeding pairs of upland sandpipers in Maine during the 1990s was likely in excess of 160 pairs, although the exact number is unknown and undoubtedly varies annually.

Population Projection

It would be reasonable to expect that Maine's population of upland sandpipers will fluctuate with changes in quantity and quality of habitat, as well as in response to varying survival and productivity. However, it is impossible to predict future populations without reliable information on current population size, survival rates, and productivity (number of young that reach flight age / breeding pair). Until a program to monitor Maine's population is instituted, it will be impossible to determine population trend, because BBS routes simply do not intersect enough suitable habitat.

Limiting Factors

Limiting factors to population growth for upland sandpipers breeding in Maine are not well understood. Upland sandpipers, which require large area mosaics of grassland and berrrens for reproduction, are likely limited by the amount of habitat suitable for breeding. Other potential limiting factors include mortality among adults on breeding grounds, wintering grounds, or during migration; mortality of eggs or nests (e.g., factors affecting fertility and nest attendance of adults, and nest predation); mortality of young on the breeding grounds; habitat quantity and quality on migration stop-over sites and on the wintering grounds; and availability and quality of food on the breeding grounds, during migration, and on the wintering grounds.

USE AND DEMAND ASSESSMENT

Historically, upland sandpipers were prized and much sought after for their meat. It is probable that over-gunning by market hunters during the 1890s led to a rapid decrease in upland sandpipers across their range from Maine to the Midwest (Forbush 1929, Buss and Hawkins 1939, Palmer 1949). Forbush (1929), wrote of upland sandpipers: “The tale of the destruction of this lovely bird is a sad one. Harmless and eminently useful, it nevertheless is one of the most luscious morsels to delight the epicurean palate, and so the greed of man has almost swept it from the earth. The market demanded it and got it.”

Several authors (Knight 1908, McAtee and Beal 1912) commented on upland sandpipers’ usefulness to agriculture alluded to by Forbush (1929) in the preceding paragraph. Knight (1908) wrote: “It seems highly probable that the species in question is one of the most beneficial birds we have. They frequent uplands and fields and feed almost entirely on grasshoppers and crickets in late summer, consuming millions of them. They also eat various other species of insects and larvae”. Although no research has been conducted on food habits in the East, upland sandpipers in Maine blueberry fields are suspected to feed on several agricultural pests, including grasshoppers, crickets, and caterpillars of the blueberry spanworm.

Upland sandpipers have long been appreciated for aesthetic qualities, and appear in popular literature as harbingers of spring (Forbush 1929, Spiller 1935, Leopold 1949). Aldo Leopold (1949), wrote of the upland sandpiper: “When dandelions have set the mark of May on Wisconsin pastures, it is time to listen for the final proof of

spring. Sit down on a tussock, cock your ears at the sky, dial out the bedlam of meadowlarks and redwings, and soon you may hear it: the flight-song of the upland plover, just now back from the Argentine”.

Wildlife observation, particularly birding, provides tremendous recreational opportunity and adds to the quality of life of many residents and visitors of Maine. Approximately 454,000 people spent 2.9 million days on trips to watch wildlife in Maine during 1996 (USDI 1996). Upland sandpiper is a species of special interest to birders in the State (Pierson et al. 1996). An estimated 46% of Maine residents 16 years old and older participated in wildlife watching, where the enjoyment of wildlife was the primary purpose of the activity (USDI 1996); of Maine residents who actively watched wildlife, 98% indicated bird watching was a focus.

Wildlife watching, including bird watching, adds considerably to Maine's economy. Direct expenditures related to wildlife watching by residents totaled over \$98 million in 1996, and nonresidents spent approximately \$122 million on goods and services to watch wildlife in Maine (USDI 1996). However, the number of Mainers who traveled >1 mile away from home to watch wildlife during 1996 declined 35% since 1991, and wildlife watching related expenditures by Mainers were down 30% during the same period. The decline in wildlife watching participation among Mainers is consistent with a national trend during the same time period (1991-1996). However, nonresidents continue to come to Maine to watch wildlife; during 1996, nonresidents watching wildlife in Maine numbered 321,000 remaining unchanged from the 1991 survey, and their related expenditures were unchanged as well.

SUMMARY AND CONCLUSIONS

Upland sandpipers require large grasslands and barrens, cover types in Maine that have depended on human land use activities or wild fire since prehistoric times. The species was a common summer resident in most counties of the State during the latter half of the 19th century, a time when farmland area peaked, but unregulated market hunting caused widespread declines by 1900. Upland sandpipers gained federal protection in 1918 with enactment of the Migratory Bird Treaty Act. Since 1920, upland sandpipers have slowly increased and reoccupied former sites, even as farmland has declined.

Recent region-wide surveys have shown that the core of the species range in New York and New England, is the blueberry barrens of Hancock and Washington Counties; airfields throughout Maine, also provide important habitat. A lack of basic natural history information for upland sandpipers in Maine (especially in barrens) has precluded a thorough understanding of limiting factors, and limits our ability to accurately estimate population size. Although habitat (managed blueberry barrens) is projected to increase in coming years, trends in the upland sandpiper population will be impossible to detect without additional monitoring. Management of upland sandpipers, and especially monitoring their populations, must be linked to conservation of other grassland dependant species (e.g., grasshopper sparrow). Until comprehensive monitoring and habitat management take place, upland sandpipers and other residents of Maine's grasslands and barrens will maintain a precarious existence.

LITERATURE CITED

- Adamus, P. R. 1987. Atlas of breeding birds in Maine, 1978-1983. Maine Dept. of Inland Fisheries and Wildlife, Augusta. 366pp.
- Ailes, I. W. 1976. Ecology of the upland sandpiper in central Wisconsin. M.S. Thesis. Univ. of Wisconsin, Stevens Point. 63pp.
- American Ornithologists' Union. 1983. Checklist of North American Birds, 6th Ed. Allen Press Inc., Lawrence, Kansas. 877pp.
- Askins, R. A. 1999. History of grassland birds in eastern North America. Stud. Avian Biol. 19:60-71.
- Aughey, S. 1878. Notes on the nature of the food of birds of Nebraska. U.S. Entomological Commission, 1st rpt., Appendix II, Hayden Survey of Territories, unclassified publ. No. 14
- Bent, A. C. 1929. Life histories of North American shore birds. Part 2. Smithsonian Inst., U.S. Natl. Mus. Bull. 146. 412pp.
- Bowen, B. S. and A. D. Kruse. 1993. Effects of grazing on nesting by upland sandpipers in southcentral North Dakota. J. Wildl. Manage. 57:291-301.
- Bowen, D. E. 1976. Coloniality, reproductive success, and habitat interactions in upland sandpipers (*Bartramia longicauda*). M.S. Thesis. Kansas St. Univ. Manhattan. 127pp.
- Buhnerkempe, J. E. and R. L. Westemeier. 1988. Breeding biology and habitat selection of upland sandpipers on prairie-chicken sanctuaries in Illinois. Transactions of the Illinois State Academy of Sciences 81:153-162.
- Bureau of Census. 1999. 1997 Census of agriculture. Vol. 1 Geographic area series. Part 19. Maine: state and county data. U.S. Dep. of Comm., Washington, D.C.
- Buss, I. O., and A. S. Hawkins. 1939. The upland plover at Faville Grove, Wisconsin. Wilson Bull. 51:202-220.
- Calme, S., and S. Haddad. 1996. Peatlands: a new habitat for the upland sandpiper, *Bartramia longicauda*, in eastern Canada. Can. Field-Nat. 110:326-330.
- Day, C. A. 1954. A history of Maine agriculture, 1604-1860. Univ. Press, Orono, Maine. 318pp.

- Erskine, A. J. 1992. Atlas of the breeding birds of the Maritime Provinces. Nimbus Publishing Limited and Nova Scotia Museum, Halifax. 270pp.
- Fischer, R. A. 1954. Calendar of the letters of Alexander Baring, 1795-1801. Manuscript Div., Library of Congress, Washington, D.C.
- Forbush, E. H. 1929. Birds of Massachusetts and other New England states. Part 1: waterbirds, marsh birds and shore birds. Massachusetts Dep. Agric., Boston. 486pp.
- Gibbs, J. P. 1995. Monitor: user's manual. Dept. of Biology, Yale University, New Haven, Connecticut.
- Haverschmidt, F. 1966. The migration and wintering of the Upland Plover in Surinam. Wilson Bull. 78:319-320.
- Hayman, P., J. Marchant, and T. Prater. 1986. Shorebirds: an identification guide to the waders of the World. Houghton Mifflin Co., Boston. 412pp.
- Higgins, K. F., and L. M. Kirsch. 1975. Some aspects of the breeding biology of the upland sandpiper in North Dakota. Wilson Bull. 87:96-101.
- Houston, C. S. and D. E. Bowen, Jr. 2001. Upland Sandpiper (*Bartramia longicauda*). In The Birds of North America, No. 580. (A. Poole and F. Gill, eds.) The Birds of North America, Inc., Philadelphia, PA.
- Howell, A. H. 1907. The relation of birds to the cottonboll weevil. U.S. Biol. Survey Bull. 29:20.
- Johnson, D. H. 1991. Further comments on estimating nest success. Ibis 133:205-207.
- Kantrud, H. A. and K. F. Higgins. 1992. Nest and nest site characteristics of some ground-nesting, non-passerine birds of northern grasslands. Prairie Nat. 24:67-84.
- Kirsch, L. M. and K. F. Higgins. 1976. Upland sandpiper nesting and management in North Dakota. Wildl. Soc. Bull. 4:16-22.
- Knight, O. W. 1897. A list of the birds of Maine showing their distribution by Counties and their status in each County. Univ. of Maine, Dept. of Nat. Hist., Bull. 3:1-184.
- _____. 1908. The birds of Maine. Charles H. Glass and Co., Bangor, Maine. 693pp.
- Leopold, A. 1949. A sand county almanac. Sierra Club/Ballantine Book. 295pp.

- Lokemoen, J. T. and H. F. Duebbert. 1974. Summer birds for a North Dakota prairie. S. D. Conserv. Digest 41:18-21.
- McAtee, W. L., and F. E. L. Beal. 1912. Some common game, aquatic and rapacious birds in relation to man. U.S. Dep. Agric., Farmer's Bull. No. 497:15-16.
- Osborne, D. R. and A. T. Peterson. 1984. Decline of the upland sandpiper (*Bartramia longicauda*) in Ohio: an endangered species. Ohio J. Sci. 84:8-10.
- Palmer, R. S. 1949. Maine birds. Bull. Mus. Comp. Zool., Vol. 102, Harvard College, Cambridge, Massachusetts. 656pp.
- Peterson, A. T. 1983. Techniques for aging and sexing upland sandpipers (*Bartramia longicauda*). Wader Study Group Bull. 39:60.
- Pierce, S. P. and S. M. Melvin. 1991. Assessment of barrens/grassland birds and habitats in Maine. Unpublished Report of the Maine Department of Inland Fisheries and Wildlife, Endangered and Nongame Wildlife Program, Bangor, ME. 20pp.
- Pierson, E. C., J. E. Pierson, and P. D. Vickery. 1996. A birder's guide to Maine. Down East Books, Camden, Maine. 400pp.
- Russell, H. S. 1980. Indian New England before the Mayflower. University Press of New England, Hanover, New Hampshire. 284pp.
- Sauer, J. R., B. G. Peterjohn, S. Schartz, and J. E. Hines. 1996. The North American breeding bird survey home page. Version 95.1. Patuxent Wildlife Research Center, Laurel, MD.
- Shriver, W. G., A. L. Jones, and P. D. Vickery. 1998. Project #96-177 Grassland Bird Program - Northeast Grassland Bird Survey, 1997. Massachusetts Audubon Society unpubl. progress report to National Fish & Wildlife Foundation. 22pp.
- Spiller, B. L. 1935. Grouse feathers. The Derrydale Press, New York. 207pp.
- Strik, B. 2006. Blueberry production and research trends in North America. Acta Horticulturae (ISHS) 715: 173-184. http://www.actahort.org/books/715/715_25.htm
- U.S.D.I. 1996. 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. U.S. Department of Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Bureau of the Census. Washington D.C.
- U.S.G.S. 1999. Patuxent Wildlife Research Center, Bird Banding Laboratory website: <http://www.pwrc.usgs.gov/bbl/>

- van den Driessche, R., S. D. McConnell, and T. D. Hooper. 1994. First confirmed breeding record for the upland sandpiper, *Bartramia longicauda*, in British Columbia. *Can. Field-Nat.* 108:89-91.
- _____. 1993. Habitat selection of grassland birds in Maine. PhD dissertation. University of Maine, Orono. 123pp.
- _____, M. L. Hunter, Jr., and S. M. Melvin. 1994. Effects of habitat area on the distribution of grassland birds in Maine. *Cons. Biol.* 8:1087-1094.
- _____, _____, and J. V. Wells. 1999. Effects of fire and herbicide treatment on habitat selection in grassland birds in southern Maine. *Stud. Avian Biol.* 19:149-159.
- Weik, A. P. 1996. Preliminary field survey for upland sandpipers, 1996. Unpublished report of the Maine Department of Inland Fisheries and Wildlife, Bangor, ME. 4pp.
- _____. 1997. Conservation of grassland birds in Maine: field survey of breeding birds - 1997 progress report. Unpublished report of the Maine Department of Inland Fisheries and Wildlife, Bangor, ME. 3pp.
- _____. 1999a. Conservation of grassland birds in Maine: field survey of breeding birds (1997-1998). Unpublished report of the Maine Department of Inland Fisheries and Wildlife, Bangor, ME. 49pp.
- _____. 1999b. 1999 annual report: grasshopper sparrow breeding bird census. Unpublished report of the Maine Department of Inland Fisheries and Wildlife, Bangor, ME. 4pp.
- _____, and R. Purtell. 2000. Grassland birds. *Pages 88-98 in A survey of rare, threatened, and endangered fauna in Maine: East Coastal and Eastern Interior Regions (1999).* A. Weik, P. deMaynadier, and T. Hodgman, eds. Unpublished report of the Maine Department of Inland Fisheries and Wildlife, Bangor, ME.
- Wetmore, A. 1926. The birds of Argentina, Paraguay, Uruguay, and Chile. *U.S. Nat. Museum Bull.*, 133 (p. 146).
- White, R. P. 1983. Distribution and habitat preference of the upland sandpiper (*Bartramia longicauda*) in Wisconsin. *Am. Birds* 37:16-22.
- _____. 1988. Wintering grounds and migration patterns of the upland sandpiper. *Am. Birds* 42:1247-1253.
- Winne, J. C. 1997. History of Vegetation and Fire on the Pineo Ridge Grassland Barrens of Washington County, Maine. Pp. 25-52 *in Grasslands of Northeastern North America: ecology and conservation of native and agricultural landscapes.*

P.D. Vickery and P.W. Dunwiddie, eds. Massachusetts Audubon Society, Lincoln, MA.

Yank, R., and L. Breton. 1996. Upland sandpiper. *Pages 482-483 in* Gauthier, J., and Y. Aubry eds. 1996. *The breeding birds of Quebec: Atlas of the breeding birds of southern Quebec*. Association quebecoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montreal. 1302pp.

Yarborough, D. E. 2006. Wild Blueberry Newsletter. University of Maine Cooperative Extension. 3pp. <http://wildblueberries.maine.edu/Newsletters/April2006.htm>