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AVIAN COMMUNITY STATUS IN THE CHILLY SLOUGH WETLAND CONSERVATION AREA, EAST CENTRAL IDAHO 1997 – 2001

by

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SUMMARY

The Chilly Slough Wetland Conservation Area (CSWCA) protects almost 2,000 acres of a 5,000-acre high-desert wetland in the Thousand Springs Valley, the largest wetland in east-central Idaho. Managed jointly by the Challis Field Office of the Bureau of Land Management (BLM) and the Upper Snake River Regional Office of the Idaho Department of Fish and Game, primary management concerns are protecting the wetland for waterfowl and neotropical migratory birds. From 1997 through 2001, systematic surveys of birds in the CSWCA assessed bird species composition, bird habitat affiliations, breeding bird abundance, and waterfowl brood production. Seventy-two bird species in 21 families were observed using the CSWCA from 1997 to 2001 during the spring – fall period. Peregrine falcon, formerly an endangered species, was observed using the wetland in summer 1999 and 2001. Trumpeter swan, a species considered critically imperiled in Idaho, used the CSWCA during spring migrations. Forty-one species of birds were observed during breeding bird surveys counted from points along transects. Annual water levels in Thousand Springs Creek fluctuated in concert with annual March – July precipitation. Breeding bird densities were correlated with March – July precipitation ($r = 0.97$). About 40 species nest in the CSWCA in most years including at least 13 species of waterfowl. The ratio of waterfowl young to adults also was correlated with March – July precipitation ($r = 0.95$). The baseline data obtained in this 5-year monitoring effort exemplifies the value of the protection of large portions of the Chilly Slough wetland. Management of the CSWCA should focus on maintenance of existing protection (e.g., livestock exclusion, ACEC and RNA designations), acquisition of additional wetland with the view of maintaining water level dynamics (i.e., protection of the source springs in the North Unit), and continued monitoring of biodiversity. A potential major threat to the CSWCA is the invasion and dominance of exotic plants. Continued, less rigorous avian monitoring of the CSWCA is recommended.

Introduction

Chilly Slough, a large, spring-fed, high-desert wetland, may be the most species-rich area in east-central Idaho. Besides supporting nesting and migratory waterfowl, the wetland provides diverse habitats for resident and neotropical migratory birds, for large and small mammals, for a thriving fishery of rainbow and brook trout, and for reptiles and at least one amphibian species.

Cooperatively funded by the North American Wetlands Council, Ducks Unlimited, Inc., The Nature Conservancy, Rocky Mountain Elk Foundation, Idaho Department of Fish and Game, the U.S. Fish and Wildlife Service, and the BLM, the 1,940-ac Chilly Slough Wetland Conservation Area was established to "protect, restore, and enhance wetland values and functions." The BLM designated portions of the wetland as an Area of Critical Environmental Concern (ACEC; 1,165 ac), with a portion of that as a Research Natural Area (RNA; 233 ac). Waterfowl and neotropical migratory birds are particular management concerns.

In 1997, I began systematic avian surveys within the boundaries of the CSWCA. These surveys included spring and fall migratory birds, birds breeding in the wetland, and waterfowl brood counts. The surveys continued from 1997 through 2001 (Yeo 1998, 1999, 2000a). This report summarizes the results of the five years of survey.

The objective of the avian surveys was to implement a simple and efficient monitoring program that would establish a record of avian communities that use the CSWCA, both as a reference for future managers and as indicators of the success of land management. Specifically, I had the following objectives:

- Identify bird species using the CSWCA during spring and fall migrations, and during the breeding/nesting season.
- Enumerate waterfowl productivity within the CSWCA.
- Detect trends of abundance for individual avian species.
- Identify habitat affiliations for individual avian species.
- Identify the effects of CSWCA management on bird use and abundance.

Acknowledgements
This project was supported by BLM Challenge Cost Share funding through the Challis Field Office. Jerry Gregson, BLM wildlife biologist, suggested the project, and his involvement and support over the years contributed to its success. Jette Morache assisted with field surveys. Area ranchers allowed passage across their lands to isolated portions of the CSWCA.

Study Area

The CSWCA encompasses the heart of a 5,000-acre wetland in the Thousand Springs Valley of east-central Idaho, about 35 miles south of Challis (**FIGURE 1**). The valley is bordered to the east by the highest mountains in Idaho, the Lost River Range (including Mt. Borah, the highest peak in Idaho at 12,662 feet), and the Boulder Mountains to the west. Elevations vary only about 40 feet across the length and width of the CSWCA, from about 6,320 feet at the northern end to about 6,280 feet at the southern end. Many springs contribute to the wetland with Thousand Springs Creek beginning from a concentration of springs at the north end of the valley, and draining to the south through the middle of the wetland into the Big Lost River. Over the past decade, 1,940 acres of the wetland have been withdrawn from livestock grazing, separated into three principal units – North Unit, Middle Unit, and South Unit (**FIGURE 1**).

Hummocky sedge and grass fens dominate the CSWCA with cattail and bulrush marshes most common in the South Unit. Willows are restricted to a few isolated individuals in the North Unit and a small openly growing patch at Whiskey Springs in the South Unit. The wetland plant communities occur along subtle hydrological gradients, sometimes separated only by a few inches in elevation (Bursik 1994). I categorized the vegetation into three mixed scrub-shrub wetland types, five emergent wetland types, two upland vegetation types, and an aquatic vegetation type that includes lotic and lentic communities dominated by aquatic plants (Yeo 2000b). These categories include several recognized wetland community types (Bursik 1994, Jankovsky-Jones 1999, Yeo 2000b). However, for ease of recognition in the field, avian habitat affiliations were assigned to six vegetation types: sagebrush upland, greasewood, grass hummock wetland, sedge hummock wetland, cattail/bulrush marsh, and aquatic (which includes open lentic and lotic habitat).

Waters in the CSWCA are alkaline and low in solutes (**TABLE 1**). Lowest alkalinity appears to be in some of the source springs in the North Unit with higher alkalinity in open water marshes. Concentration of dissolved solids (conductivity) increased from spring sources to open water marsh. Water temperatures were warmer in open water compared to spring sources. With the low gradient, the stream channel is sluggish, and except in some spring-fed pools near Whiskey Springs, much of the water surface freezes during the coldest winter days. Throughout most of the winter, however, open water remains available on at least some sections of the stream channel.

TABLE 1. Water quality measures, Chilly Slough Wetland Conservation Area.

Date	Location	Water Temperature (F)	pH	Conductivity (*u*S/cm)
June 7, 1996	North Unit, spring pools	48	8.8	19
June 7, 1996	North Unit, marsh	77	9.0	31
July 13, 1997	South Unit, marsh	70	9.3	35
October 9, 1998	South Unit, marsh	50	9.0	25

Summers typically are warm and dry; maximum temperatures in July average 82° F and July precipitation averages < 1" at the Chilly Barton Flats weather station, located about three miles south of the CSWCA (Western Regional Climate Center). Growing season precipitation (March – July) was less than the 50-year average during three of the five years of surveys (**FIGURE 2**). Precipitation during 1998 was substantially greater than the 50-year average with subsequent years declining in total growing season precipitation, with the lowest precipitation in 2001.

Water levels within the wetland fluctuated seasonally with a consistent pattern of lowest levels in the South Unit in April, and peak levels during August (**FIGURE 3**). Some of the water recharge for the wetland comes from irrigation run-off on adjacent private agricultural lands (Jerry Gregson, BLM, personal communication). However, over the five years of record, water levels followed annual patterns of growing season precipitation with highest levels in 1998, and declining in subsequent years.

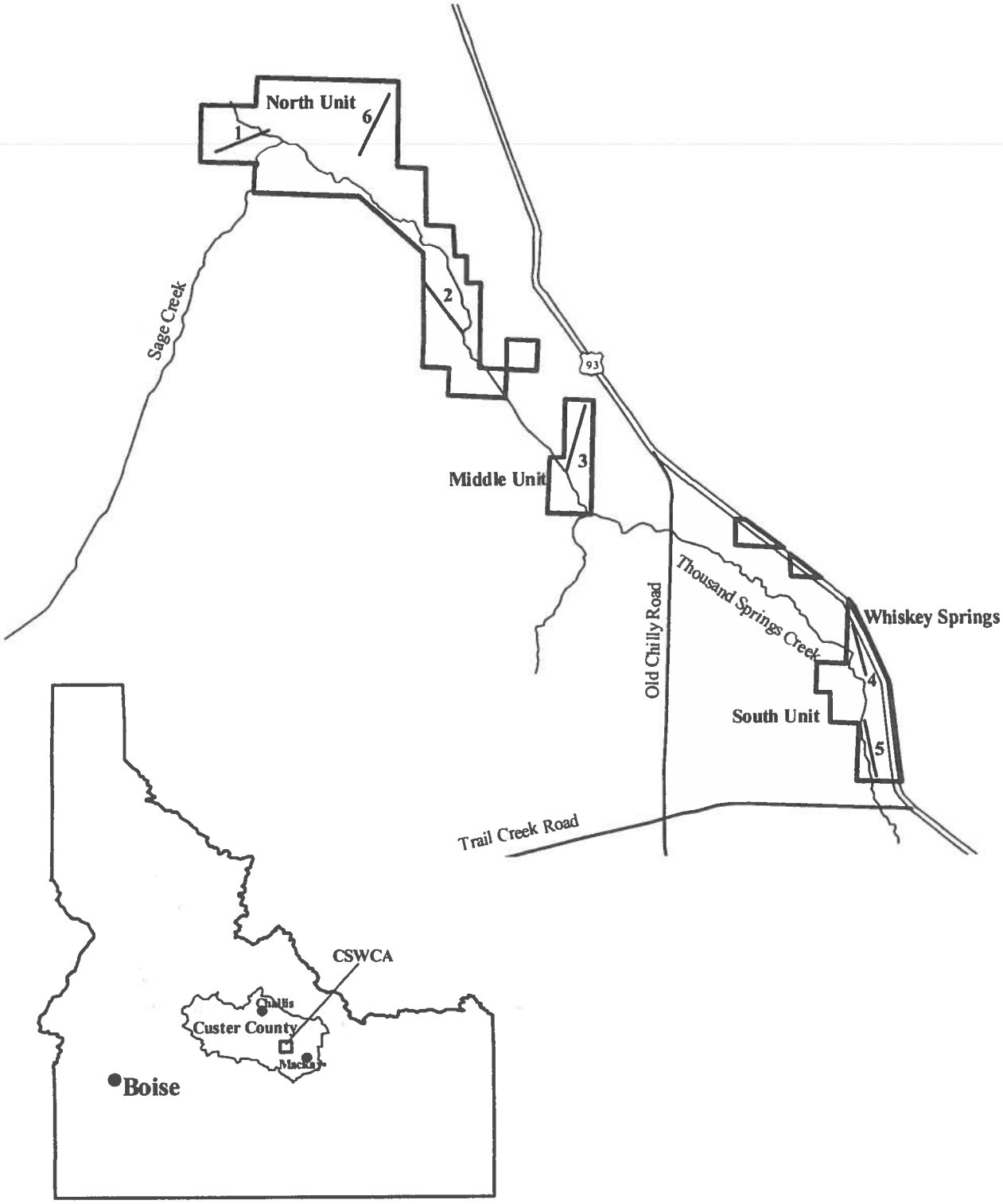

FIGURE 1. Chilly Slough Wetland Conservation Area (CSWCA) location, unit boundaries, and locations of breeding bird point-count transects.

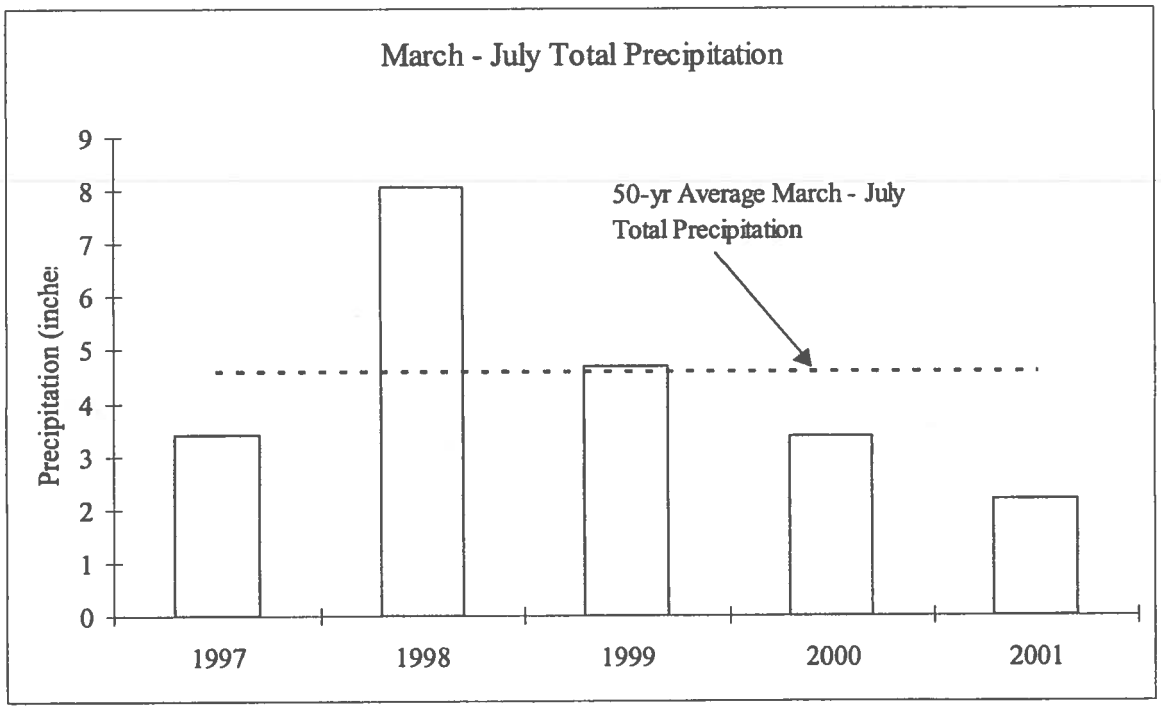

FIGURE 2. Growing season (March – July) precipitation compared to the long-term average growing season precipitation for 1997 – 2001, Chilly Barton Flats weather station.

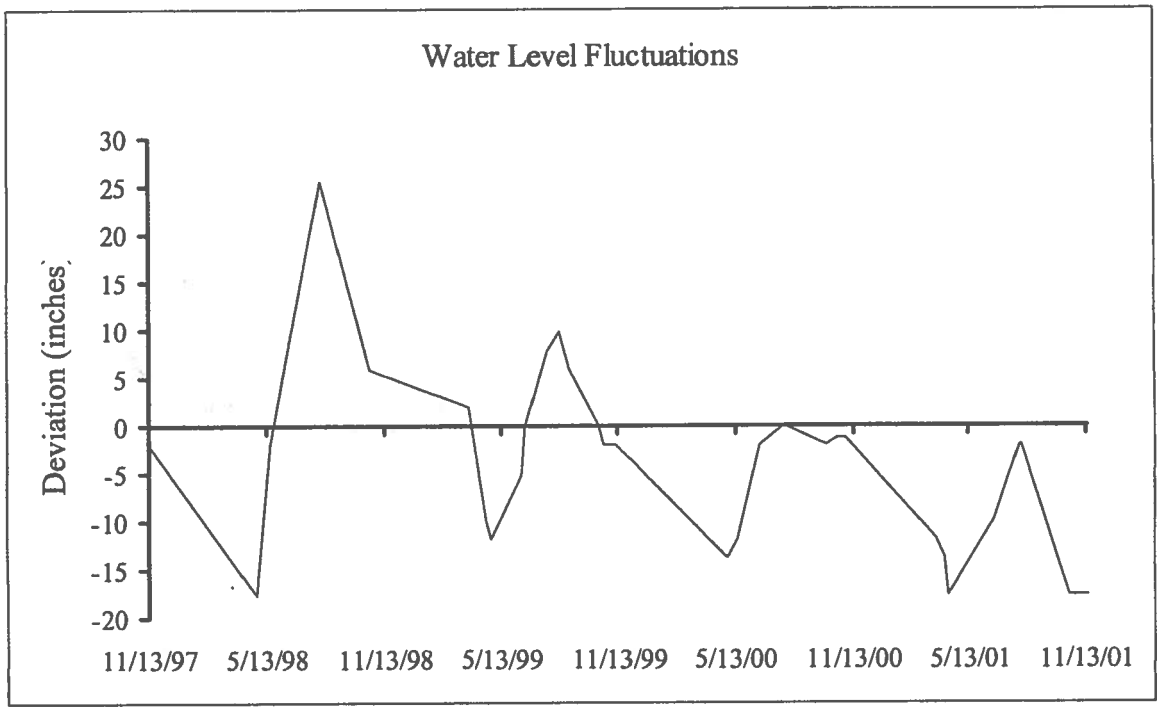

FIGURE 3. Seasonal fluctuations in water level (compared to a median depth of 22 inches) in Thousand Springs Creek in the South Unit, Chilly Slough Wetland Conservation Area.

Methods

Species Occurrence
I compiled a list of bird species detected from 1997 through 2001. I compared these species with confirmed or probable breeders in the region (Stephens and Sturts 1998), and those species observed in the region (Roberts 1992, Roberts and Gregson 1994). Species expected to occur in the CSWCA during summer was based on the suitability of available nesting and foraging habitat (Ehrlich et al. 1988, Roberts 1992).

Breeding Bird Census
Point counts (Bibby et al. 1992, Ralph et al. 1993, 1995) along transects were conducted in mid-June, likely the middle of the breeding season in the CSWCA, to estimate the abundance of breeding birds. In 1997, I established five permanent 0.6-mile (1 km) long transects dispersed throughout the CSWCA, and that bisected the diversity of vegetation types (**FIGURE 1**). New lands were acquired in the northeastern portion of the North Unit in late 1998, so I added an additional transect in 1999 to sample those lands. Transects were located so that they were accessible, and so there were readily identifiable landmarks to locate the beginning of each transect (starting points and azimuths of each transect are listed in **APPENDIX 1**). Each transec was surveyed once each year, and surveyed within three hours after sunrise. Surveys were not conducted when weather dampened bird activity or impaired the ability to detect birds, i.e., winds > 10 mph, or with fog or intense precipitation.

Birds seen or heard within a five-minute period were counted at each of five points on each transect, each point 820 feet (250 m) apart. Birds detected within 164 feet (50 m) were noted separately from those detected beyond that distance. The time each observation period began, the species detected, the number of individuals of each species, sex and age when possible, habitat affiliation of each observation, and behavior were noted.

Density for each species with sufficient observations was calculated following Bibby et al. (1992:91):

$$\text{Density} = \log_e (n/n_2) \times n/m(\pi r^2)$$

where
n is the total number of birds counted
n_2 is the number of birds counted beyond the 164 foot fixed radius
m is the total number of point counts
r is the fixed radius; 164 feet (50 m)

This calculation attempts to account for uncounted individuals that result from detection differences among species and habitats. The form of the equation gives a plausible detection curve (Bibby et al. 1992) but may not be appropriate for all species. In some instances, no individuals for a species were observed beyond the fixed radius. In these instances, species density was calculated based on the area circumscribed by the fixed radius (2 ac). In addition, for some species in some years, birds were detected only beyond the fixed radius. Densities can't be calculated for these observations. Annual variations in breeding bird densities were

compared with regional trends using the North American Breeding Bird Survey (Sauer et al. 2001). The total number of individuals observed, species richness, and density of all species combined were compared among years for breeding birds (Nur et al. 1999).

Waterfowl Productivity

To estimate annual waterfowl productivity, I canoed the cattail/bulrush marsh in the South Unit during mid-summer (late July & early August). In 2000 and 2001, I also canoed about three miles of Thousand Springs Creek in the North Unit beginning at the northern boundary. All birds seen were recorded to species (if possible), and the number of associated young counted. Fledglings of any species were recorded, as were nests with eggs. I drove or walked a one-mile transect that overlooked the marshes of the South Unit during the same period as an additional assessment of waterfowl brood production. This route was along or paralleled a two-track road running from the southern boundary of the South Unit to the visitor pullout from Highway 93 near Whiskey Springs. The highest count for each species was used as the productivity estimate.

Migratory Season Birds

During spring (March – May) and during fall (October – November), I counted birds using the CSWCA along the one-mile transect in the South Unit. I also walked other areas of the CSWCA and noted all birds observed. I made particular efforts to observe open water areas within the CSWCA to increase chances of finding migratory waterfowl during spring and fall.

Results

Species Occurrence

Since 1997, I've recorded 72 bird species in 21 families using the conservation area (**TABLE 2**). Twenty species of waterfowl, 19 species of obligate neotropical migrants (nearly all members of species migrate to tropics; Saab and Groves 1992), and 15 species of facultative neotropical migrants (some individuals of species migrate to tropics) were encountered within the boundaries of the CSWCA. Peregrine falcons, formerly listed as endangered by the U.S. Fish and Wildlife Service and considered critically imperiled statewide (Roberts and Gregson 1994, Groves et al. 1997), were observed in the CSWCA in two years. These are the first sightings of wild peregrine falcons using the CSWCA since they were released to the area in 1988. Trumpeter swans, a critically imperiled statewide species, used the CSWCA in 1999 and 2001 during spring migrations. An observation of an eared grebe is the first record of that species presence in the wetland.

Barnes (1994) summarized bird-sighting records for the two decades before 1994 and his own surveys conducted in 1994, and reported 133 bird species using the Chilly Slough wetland and surrounding Thousand Springs valley (**APPENDIX 2**). I documented 5 species not previously recorded for the area: eared grebe, Swainson's hawk, peregrine falcon, spotted towhee, and chipping sparrow. Barnes (1994:Table 2) listed 61 species that I didn't observe between 1997 – 2001. However, many of the species he lists are unlikely to use the CSWCA because their preferred habitats are lacking, e.g., flycatchers, woodpeckers, many warblers (Ehrlich et al. 1988). These species likely were observed outside the CSWCA in the riparian corridor of cottonwood and willows along the Big Lost River, and around ranches in hayfields, irrigated pastures, and buildings. Other species may be occasional visitors. Snow geese and greater white-fronted geese migrate through the region. During periods when these two species were observed in the region, I didn't observe them using the CSWCA. Other species that Barnes lists may be misidentifications, e.g., grasshopper sparrow or accidentals outside their usual range.

It seems that the CSWCA is supporting the range of species likely to inhabit the wetland. Observations of great blue heron have been uncommon in the CSWCA until 2001. Jerry Gregson found a dead heron in the North Unit in May 1986, and he and Hadley Roberts saw a single heron near Whiskey Springs in April 1987. I didn't observe herons in the CSWCA until April 2001 when I observed 4 within the boundaries of the CSWCA. I continued to observe herons, generally 1-2 at a time throughout the remainder of summer 2001. Great blue heron are considered common in the region (Roberts 1992) with obvious rookeries along the Salmon River near Challis (personal observation), and along the Big Lost River north of Mackay Reservoir (Bart Gamett, biologist, Lost River Ranger District, personal communication).

Other species that might use the CSWCA because of the available habitat and because they are confirmed or probable breeders in the region (Stephens and Sturts 1998) are considered rare in the region (Roberts 1992). Common poorwill have not been reported for the CSWCA although the sagebrush vegetation surrounding the wetlands should provide habitat. Common poorwill may be present though not recorded because they are most easily observed along dirt roads after dark (Roberts 1992), a time typically not surveyed. Swainson's hawks were reported for the first time using the CSWCA in 2001. This was a pair hunting over the North Unit in mid-summer.

Swainson's hawks are confirmed breeders in the region (Stephens and Sturts 1998) but again are considered rare (Roberts 1992). No nesting by this species has been confirmed in the Chilly Slough area or anywhere north of Chilly Slough in central Idaho (Stephens and Sturts 1998, Jerry Gregson, BLM, personal communication). The sagebrush steppe foothills and limestone cliffs surrounding the CSWCA should provide suitable nesting and hunting habitat for Swainson's hawks, as well as ferruginous hawks (which have not been reported for the area). Lark buntings were reported in irrigated meadows adjacent to the CSWCA (Jankovsky-Jones 1999), and are probable breeders in the region (Stephens and Sturts 1998). Roberts (1992) reports only two sightings of lark bunting in central Idaho. The western edge of their summer range is central Montana and Wyoming (National Geographic Society 1987, Stokes and Stokes 1996,), although recent publications indicate that their range can extend into southeastern Idaho (Stephens and Sturts 1998, Sibley 2000, Alsop 2001, Sauer et al. 2001).

Habitat Affiliations

The habitats that species were observed using during the five years of observation are listed in **TABLE 2**. Marsh wren, sora, American coot, and common yellowthroat were limited to cattail/bulrush marsh. Yellow-headed blackbird and red-winged blackbird were observed most often in cattail/bulrush marsh but occasionally were observed in other wetland habitats. Observations of vesper sparrow, Brewer's sparrow, and sage thrasher were restricted to sagebrush and adjacent greasewood vegetation. Savannah sparrow, one of the most common species in the CSWCA, typically was found in grass and sedge vegetation but occasionally also in greasewood.

Two abandoned homestead cabins within the CSWCA were stabilized in 2000, one in the North Unit and one at Whiskey Springs in the South Unit. Stabilization included screening openings to prevent access by wildlife to the buildings. Cliff swallows, commonly the most abundant bird in the CSWCA, use the buildings for nesting and roosting. Other birds, such as rock doves and owls, also probably use the buildings for nesting and roosting. Management to preserve the buildings may limit nesting by these species. Bird nesting boxes probably are responsible for the presence of mountain bluebirds in the CSWCA. Swallows, particularly tree swallows, and European starlings also were seen to use bird nesting boxes.

Some waterfowl, e.g., northern pintail, American wigeon, and mallard, use upland habitat far from water for nesting, and these species were observed in upland vegetation of sagebrush and greasewood during the point-count surveys. Other waterfowl commonly nest away from water in nearby wetland meadow habitat but rarely were observed there. Sandhill crane were most commonly observed in sedge and grassland wetland vegetation but also were found nesting in cattail marsh.

Breeding Bird Abundance

Point counts of birds during the breeding season generally increased over the five years of surveys from 213 individuals in 1997 to 355 individuals in 2001 (**TABLE 3**). Total bird densities tracked growing season precipitation (**FIGURE 4**). Bird density ranged from a low of about 6 birds/ac in 2001, the driest year, to about 9.6 birds/ac in 1998, the wettest year (Pearson's correlation coefficient, $r = 0.97$). Species richness fluctuated from a low of 23 species observed in 1997 to a high of 31 species observed in 1998. Overall, 41 species were observed on

the breeding bird point-count transects from 1997 through 2001 (**TABLE 4**). Of these, 16 species were observed in each of the five years. Cliff swallow, marsh wren, savannah sparrow, and red-winged blackbird had the highest densities during the five years although each species didn't have high densities in every year. A few species abundance remained similar during the five years (e.g., northern harrier, long-billed curlew, common snipe, horned lark, and mountain bluebird), whereas other species estimates of abundance were very different between years (e.g., sandhill crane, marsh wren, yellow-headed blackbird). Marked differences in year-to-year abundance are common for many birds.

Although cliff swallows may be the most abundant species in the CSWCA (most commonly observed as a single flock around nests in the North Unit, so this may be misleading), there were few observations of any swallows in 1999. This coincides with the highest number of European starlings observed in the five years of survey. European starling would compete for nest boxes with tree swallows as well as with mountain bluebirds, which had lower density in 1999 than in 1998. Yet, numbers of tree swallows and cliff swallows increased again in 2001, and total number of mountain bluebirds remained stable from 1998 through 2001. Starlings have been rare before and after 1999.

Densities of some birds dependent on cattails for nesting were less in 1999 than in 1998 (i.e., marsh wren and red-winged blackbird), or shifted to other areas of the CSWCA (i.e. yellow-headed blackbird). In mid June 1999, I discovered that from 50-75% of the residual cattail reeds in the South Unit had been removed as if with a scythe. A fierce hailstorm likely caused the damage. Most yellow-headed blackbirds were observed in the South Unit in 1997 and 1998 (98% and 87%, respectively) whereas in 1999, only 14% of yellow-headed blackbirds were observed in the South Unit with most (68%) found in the Middle Unit in small patches of cattails along Thousand Springs Creek. Red-winged blackbird and marsh wren numbers have increased since 1999.

During the 1980 – 2000 period, population trends for several species inhabiting the CSWCA have shown population declines in the physiographic region ("Dissected Rocky Mountains"; map in Butcher 1990) encompassing the wetland (Sauer et al. 2001): killdeer, Brewer's sparrow, red-winged blackbird, horned lark, and vesper sparrow. Killdeer, Brewer's sparrow, horned lark, and vesper sparrow densities were generally low with few individuals counted in any year. Red-winged blackbird densities in the CSWCA declined from a high in 1997 of 1.33 birds/ac to about 0.11 birds/ac in 2001. However, total birds counted during 1997 and 2001 were similar suggesting that changes in distribution affected density estimates. Red-winged blackbirds, although possibly the most numerous landbird in North America, are a frequent victim of cowbird parasitism (although cowbirds are rarely observed in the marsh). Marsh wrens are common in the marsh, particularly in the South Unit cattail/bulrush vegetation, and they often puncture or steal red-winged blackbird eggs (Ehrlich et al. 1988). Yellow-headed blackbirds, whose numbers have fluctuated greatly over the past five years, exclude marsh wrens from their territories.

A few species using the CSWCA had positive population trends in the region for the 1980 – 2000 period: tree swallow, sandhill crane, and cliff swallow (Sauer et al. 2001). Sandhill crane density in the CSWCA remained similar from 1997 through 2000 with a large upswing in 2001

(**TABLE 4**). Total number of sandhill crane observed on the breeding bird point-count transects declined from 1997 to 1999 then increased in 2000 and again in 2001. Tree swallow density increased over the five years of surveys. Cliff swallow densities were generally some of the highest in the CSWCA but density estimates more likely reflect the location of a large nesting colony of cliff swallows at the start of transect 1 than high densities dispersed throughout the CSWCA. Cliff swallows typically were only occasionally observed on the other point-count transects.

Reproduction

Of the 72 species I've observed using the CSWCA, I estimate that about 40 regularly nest within the boundaries of the CSWCA. Mallard, teal (cinnamon and blue-winged, although cinnamon appears more numerous), northern shoveler, gadwall, American wigeon, lesser scaup, and American coot were generally consistent waterfowl breeders in the CSWCA (**TABLE 5**). In every year, there are unidentified young without attendant adults, which may indicate additional breeding waterfowl species. Canada geese also nest consistently within the CSWCA although I've not seen broods over the five years of survey. The highest count of waterfowl young was in 2000, the lowest in 1997. However, the annual ratio of the number of young waterfowl counted to adult waterfowl counted was correlated with annual growing season precipitation (**FIGURE 5**). There were more young per adult in 1998 the wettest of the five years of surveys, and fewest young per adult during 2001 the driest year (Pearson's correlation coefficient, $r = 0.95$).

Although I saw mallard adults in 1998, I saw no ducklings with these adults although unidentified ducklings may have been mallards. In mid-July, 1998, I encountered a female mallard sitting on a nest with 8 eggs near the boiling springs at Whiskey Springs. I observed 6 soras and 1 chick during mid-August 1998. This is the first record of sora breeding in the CSWCA of which I'm aware, although its been suspected for some time.

Many birds obviously nest and raise broods in the CSWCA. Canada geese begin nesting by late March into April, and although I haven't observed broods using the CSWCA, the presence of nests with eggs clearly demonstrates that geese are breeding here. I've encountered sandhill crane pairs with chicks on nests of cattails in the South Unit, and observed adults with as many as 6 young feeding during June in the Middle Unit. During summer 2000, at least 3 northern harrier fledglings were observed begging food from 2 adults in the South Unit. Moreover, in mid-summer 2001, 6 short-eared owls were observed clustered on a fence in the North Unit. Therefore, I assume at least 4 of them were fledglings. In all years, both tree swallows and mountain bluebirds have been observed using nest boxes located throughout the wetland. In addition, as previously mentioned, there's a nesting colony of cliff swallows on an abandoned homestead cabin in the North Unit. Generally, 50+ cliff swallows have been observed there in June in most years. Marsh wren nests are common within the cattail marsh although male marsh wrens may construct a dozen or more nests each year with only a few used for nesting (Ehrlich et al. 1988). While walking through greasewood and sedge fen, I've encountered mallard, common snipe, and long-billed curlew on nests with eggs throughout the CSWCA.

Migration

Forty-four bird species were observed in the CSWCA during spring (March through early May) from 1997 through 2001 (**TABLE 6**). Ten species were observed each spring in all years: Canada goose, mallard, cinnamon teal, northern harrier, American coot, sandhill crane, killdeer, marsh wren, mountain bluebird, and red-winged blackbird. All are regular breeders in the CSWCA. Swans (tundra and a lesser number of trumpeter) and common goldeneye were observed in large numbers in 1999 and 2001 but not at all in other years.

Of the 29 bird species using the CSWCA during fall (October – November), only mallard and northern harrier were observed in each of the five years of fall observations (**TABLE 7**). Mallard and American coot were present in both spring and fall from 1997 – 2000, and generally were numerous. Tundra and trumpeter swans use the CSWCA during spring, and possibly during fall although I haven't observed them using the CSWCA in fall over the five years. I did see both species of swans at a reservoir about 6 miles south of Challis ("Ingrams' Warm Springs Reservoir") during fall in several years which indicates that swans migrate through the area in fall. Similarly, snow geese and northern white-fronted geese migrate through the area but were not observed at the CSWCA at times they were known to be in the area. Both species have been reported using the CSWCA (Barnes 1994). Northern harrier, marsh wren, mountain bluebird, vesper sparrow, and western meadowlark may linger sometimes well into November prior to migration.

The CSWCA doesn't seem to harbor as many migrating waterfowl species, particularly during fall, as are known to migrate through the region. For example, on November 8, 2001, I observed only mallard using the CSWCA. Yet, only an hour later on the Ingrams' Warm Springs Reservoir, I observed American coot, mallard, pied-billed grebe, ruddy duck, American wigeon, bufflehead, lesser scaup, gadwall, and common merganser. I've also seen western grebe at the Ingram Reservoir, a species not reported for the CSWCA. The Ingram Reservoir is surrounded by low-growing sedges and can be readily viewed from the highway whereas much of the CSWCA is hidden from easy viewing. So almost certainly there are more species using the CSWCA than are observed.

TABLE 2. Summary of bird species detected, their habitat affiliations, and their management status within the Chilly Slough Wetland Conservation Area during 1997 – 2001.

SPECIES	HABITAT	STATUS [1]
Grebes		
Pied-billed Grebe	cattail marsh	
Eared Grebe	cattail marsh	
Herons and Bitterns		
American Bittern	sedge	
Great Blue Heron	cattail marsh, sedge	
Swans, Geese, and Ducks		
Tundra Swan	cattail marsh	
Trumpeter Swan	cattail marsh	S1
Canada Goose	sedge, cattail marsh, aquatic	
Green-winged Teal	cattail marsh	
Mallard	grass, sedge, cattail marsh, aquatic	
Northern Pintail	greasewood, cattail marsh	
Blue-winged Teal	cattail marsh	
Cinnamon Teal	cattail marsh	
Northern Shoveler	cattail marsh	
Gadwall	sedge, cattail marsh	
American Wigeon	cattail marsh	
Canvasback	cattail marsh	
Redhead	cattail marsh	
Lesser Scaup	sedge, cattail marsh	
Common Goldeneye	cattail marsh	
Common Merganser	aquatic	
Bufflehead	cattail marsh	
Ruddy Duck	bulrush marsh, aquatic	
Hawks and Eagles		
Northern Harrier	sagebrush, grass, sedge, cattail marsh	n
Swainson's Hawk	sedge	N
Red-tailed Hawk	greasewood	n
Rough-legged Hawk	sagebrush	
Golden Eagle	sedge, cattail marsh	
Falcons		
American Kestrel	sedge	n
Peregrine Falcon	cattail marsh	E, S1,n
Rails and Coots		
Sora	cattail marsh	
American Coot	cattail marsh	
Cranes		
Sandhill Crane	grass, sedge, cattail marsh	
Plovers		
Killdeer	sagebrush, greasewood, grass, sedge	n

TABLE 2. continued

SPECIES	HABITAT	STATUS [1]
Sandpipers and Phalaropes		
Willet	greasewood, grass, sedge, cattail marsh	
Long-billed Curlew	sedge, cattail marsh	N
Common Snipe	grass, sedge, cattail marsh	
Wilson's Phalarope	sedge, cattail marsh	
Gulls and Terns		
Ring-billed Gull	aquatic	
Doves		
Rock Dove	sagebrush, greasewood, grass	
Mourning Dove	sagebrush	n
Owls		
Great Horned Owl	greasewood	
Short-eared Owl	sedge	n
Goatsuckers		
Common Nighthawk	cattail marsh, sedge	N
Larks		
Horned Lark	grass	n
Swallows		
Tree Swallow	greasewood, grass, cattail marsh	N
Violet-green Swallow	sagebrush, greasewood, sedge, cattail marsh	N
Northern Rough-winged Swallow	cattail marsh	N
Cliff Swallow	sagebrush, greasewood, grass, sedge, cattail marsh	N
Barn Swallow	grass, sedge	N
Magpies and Crows		
Black-billed Magpie	sagebrush, greasewood, grass	
American Crow	greasewood	
Wrens		
Marsh Wren	cattail marsh	n
Thrushes		
Mountain Bluebird	sagebrush, greasewood, grass, cattail marsh	n
American Robin	willow	
Thrashers		
Sage Thrasher	sagebrush, greasewood	N
Starlings		
European Starling	grass	
Wood Warblers, Sparrows, and Blackbirds		
Yellow-rumped Warbler	greasewood	n

TABLE 2. continued

SPECIES	HABITAT	STATUS [1]
Common Yellowthroat	cattail marsh	N
Spotted Towhee	greasewood	n
Chipping Sparrow	sedge	N
Brewer's Sparrow	sagebrush	N
Vesper Sparrow	sagebrush, greasewood	N
Sage Sparrow	sagebrush, greasewood, grass, sedge	N
Savannah Sparrow	sagebrush, greasewood, grass, sedge	N
Song Sparrow	greasewood	
Lincoln's Sparrow	sagebrush, greasewood	N
White-crowned Sparrow	greasewood	N
Red-winged Blackbird	greasewood, sedge, willow, cattail marsh	n
Western Meadowlark	sagebrush, greasewood, grass, sedge	n
Yellow-headed Blackbird	sedge, cattail marsh	N
Brewer's Blackbird	greasewood, grass, sedge, cattail marsh	n
Brown-headed Cowbird	greasewood	N

[1] E = endangered, S1 = critically imperiled statewide, N = neotropical migrant (entire population migrates south of U.S.), n = neotropical migrant (part of population migrates south of U.S.)

TABLE 3. Breeding bird summary statistics for the CSWCA during June, 1997 – 2001.

	1997	1998	1999	2000	2001
Total Individuals Observed[1]	213	340	279	339	355
Species Richness[2]	23	31	28	28	29
Density of All Birds/Acre[3]	7.34	9.55	7.33	6.43	5.97

[1] Total number of birds observed on point-count transects.
[2] Number of species (S) observed on point-count transects.
[3] Calculated following Bibby et al. (1992:91; see Methods).

TABLE 4. Breeding bird counts (n) and density estimates (birds/ac) on point-count transects within the CSWCA, 1997 – 2001.

	1997		1998		1999		2000		2001	
Species	**n**	**density**	**n**	**density**	**n**	**density**	**n**	**density**	**n**	**density**
Mallard	6	0.09	2	NA[1]	7	0.15	3	0.02	13	0.26
Nothern Pintail	2	0.04	3	NA	0	0.00	0	0.00	0	0.00
Gadwall	0	0.00	3	NA	6	NA	0	0.00	5	0.08
American Wigeon	3	0.06	0	0.00	0	0.00	1	NA	0	0.00
Redhead	0	0.00	2	0.04	0	0.00	0	0.00	3	0.05
Lesser Scaup	0	0.00	2	0.04	5	NA	2	NA	0	0.00
Cinnamon Teal	0	0.00	0	0.00	3	NA	0	0.00	1	0.02
Northern Harrier	2	0.03	7	0.02	5	0.08	6	0.07	6	0.04
American Kestrel	0	0.00	1	NA	0	0.00	1	NA	2	NA
Sora	0	0.00	0	0.00	0	0.00	2	NA	1	NA
Sandhill Crane	17	0.09	16	0.07	12	0.06	23	0.06	30	0.36
Killdeer	4	0.11	7	0.18	4	0.05	0	0.00	6	0.18
Willet	0	0.00	10	0.21	16	0.27	5	0.08	10	0.16
Long-billed Curlew	1	0.02	8	0.16	10	0.12	6	0.02	9	0.17
Common Snipe	8	0.16	9	0.05	12	0.14	11	0.09	10	0.02
Wilson's Phalarope	7	0.14	4	0.11	0	0.00	0	0.00	3	0.02
Rock Dove	4	0.08	5	0.10	12	0.21	1	NA	0	0.00
Mourning Dove	0	0.00	1	0.00	0	0.00	0	0.00	0	0.00
Great Horned Owl	0	0.00	0	0.00	0	0.00	1	NA	0	0.00
Short-eared Owl	0	0.00	2	0.03	0	0.00	4	NA	5	0.02
Horned Lark	1	NA	3	0.06	2	0.03	3	NA	3	0.05
Tree Swallow	0	0.00	7	0.14	9	0.15	7	0.23	16	0.27
Violet-green Swallow	4	0.08	8	0.11	1	NA	1	0.02	1	0.00
Northern Rough-winged Swallow	0	0.00	1	0.02	0	0.00	0	0.00	0	0.00
Cliff Swallow	68	5.91	65	1.34	4	0.07	67	1.15	40	1.43
Barn Swallow	1	0.02	7	0.14	0	0.00	0	0.00	0	0.00
American Crow	1	NA	0	0.00	0	0.00	0	0.00	0	0.00
European Starling	0	0.00	0	0.00	10	0.17	0	0.00	1	0.00
Marsh Wren	5	0.10	41	1.19	19	0.28	22	1.17	25	0.44
Mountain Bluebird	3	0.07	12	0.61	10	0.40	9	0.15	10	0.28
American Robin	0	0.00	0	0.00	1	NA	0	0.00	0	0.00
Sage Thrasher	1	0.02	5	0.10	3	0.02	4	0.05	6	0.04
Common Yellowthroat	0	0.00	2	0.04	3	0.05	0	0.00	1	0.02
Savannah Sparrow	20	0.66	28	0.58	42	2.70	52	2.09	54	1.40
Red-winged Blackbird	36	1.33	37	0.86	20	0.65	7	0.02	39	0.11
Western Meadow Lark	7	0.18	12	0.22	19	0.73	16	0.46	13	0.11

TABLE 4. continued

Species	1997		1998		1999		2000		2001	
	n	density	n	density	n	density	n	density	n	density
Yellow-headed Blackbird	7	0.02	15	0.10	28	0.55	51	NA	11	0.04
Brewer's Blackbird	5	0.10	15	0.84	12	0.23	23	0.42	25	0.32
Brewer's Sparrow	0	0.00	0	0.00	1	0.02	2	NA	6	0.04
Vesper Sparrow	0	0.00	0	0.00	3	0.05	8	0.19	0	0.00
Sage Sparrow	0	0.00	0	0.00	0	0.00	1	0.02	0	0.00

[1] NA = Not Applicable; density could not be calculated because no birds were observed within the point-count plot. See Methods.

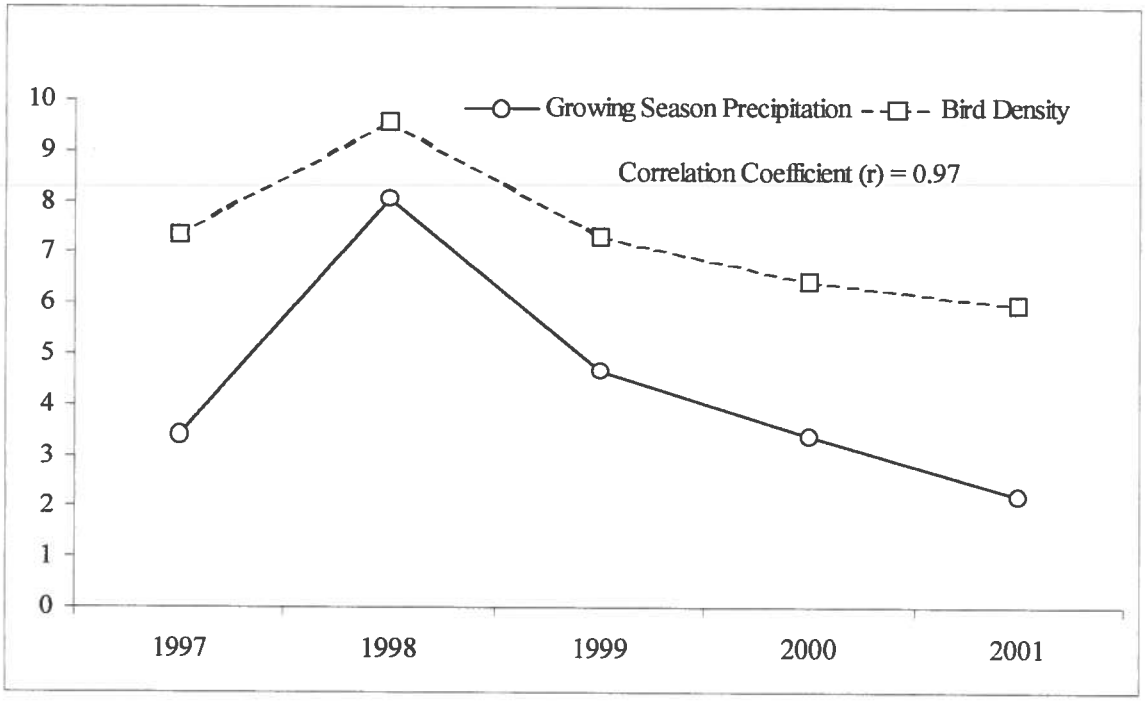

FIGURE 4. Breeding bird density (birds/acre) in the CSWCA compared with growing season precipitation (March – July, inches) at Chilly Barton Flats weather station.

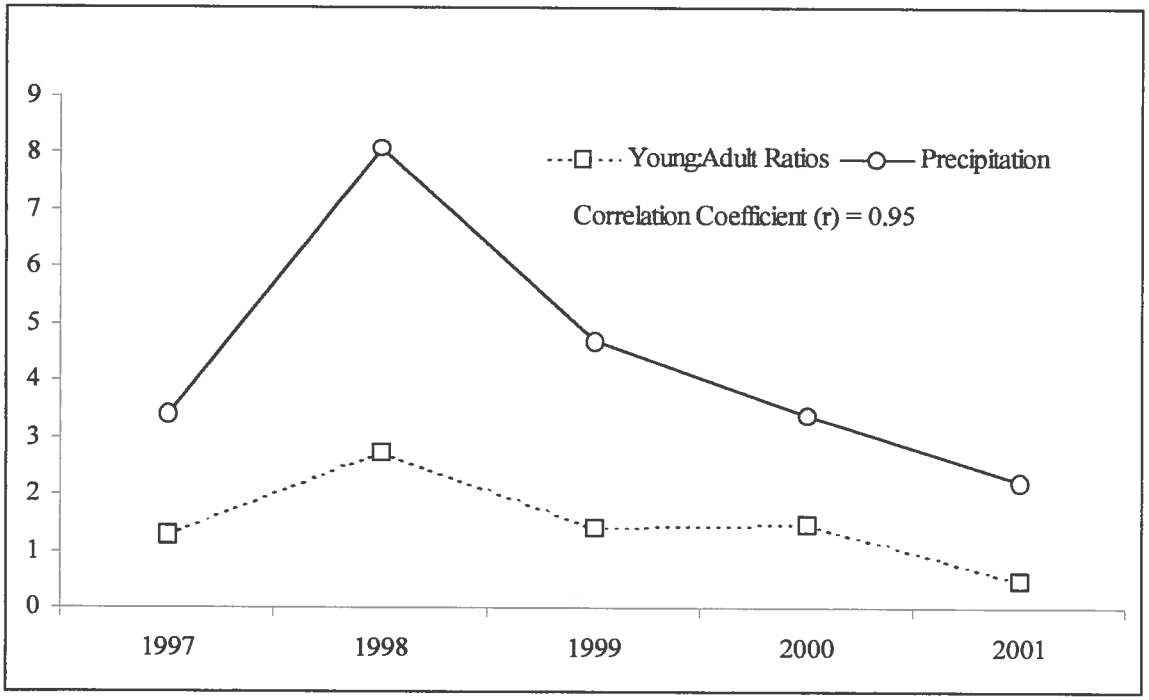

FIGURE 5. Annual variation in the ratio of the number of young:adult waterfowl in the CSWCA compared to growing season precipitation (March – July, inches) at the Chilly Barton Flats weather station.

TABLE 5. Waterfowl brood counts in the CSWCA during mid-summer, 1997-2001.

	1997		1998		1999		2000		2001	
Species	**Adult**	**Young**	**Adult**	**Young**	**Adult**	**Young**	**Adult**	**Young**	**Adult**	**Young**
Pie-billed Grebe				3		1	4	11		
Eared Grebe	2						2			
Canada Goose[a]										
Mallard	4	3	12		9	13	23	18	35	3
Northern Pintail					4	11	1	[b]		
Teal[c]			5	3	6	15	19	11	13	12
Northern Shoveler	2		1		3		20	1	8	8
Gadwall					1		1	6	7	7
American Wigeon			1		4	15	4	5	6	4
Redhead			2	29	4					
Lesser Scaup	2		3	39	4	15	8	58	3	8
Common Goldeneye					4					
Ruddy Duck					1		3	3		
Sora			6	1	5		4		3	
American Coot			4	11	9		12	11	15	4
Unidentified Ducks		10	1	9	9	14	1	20	7	24
Dead Ducks								6[d]		2

[a] Canada Geese begin nesting early (~ April); I've encountered nests with eggs, abandoned nests with eggs, but I've not seen young geese using the CSWCA.
[b] Two adult Northern Pintails with 3 young were in the South Unit in early October 2000.
[c] Includes both Blue-winged and Cinnamon Teal.
[d] Apparently uninjured, floating in a side pond in the South Unit. All appeared the same age (> 2 weeks old) and in good condition. Probably they were Gadwalls. The two found in 2001 were American Coots.

TABLE 6. Spring (March – early May) bird counts in the CSWCA, 1998 – 2001. Counts represent the highest single count for a particular species in each year.

Species	1998	1999	2000	2001
Pied-billed Grebe	1			
Great Blue Heron				4
Tundra Swan		25		59
Trumpeter Swan		14		4
Canada Goose	11	7	20	17
Green-winged Teal	2			12
Mallard	10	12	10	49
Northern Pintail	2			9
Blue-winged Teal			4	
Cinnamon Teal	3	14	30	7
Northern Shoveler	5	2	2	
Gadwall	2	4		2
American Wigeon		7	4	5
Canvasback		2		
Redhead	8	8		
Common Goldeneye		53		29
Common Merganser				1
Bufflehead	4			
Northern Harrier	6	3	4	4
Red-tailed Hawk				1
American Kestrel	2		3	
American Coot	9	58	20	9
Sandhill Crane	1	8	6	10
Killdeer	1	2	1	2
Willet	2	2	5	
Long-billed Curlew			1	1
Wilson's Phalarope			4	
Unknown Sandpiper			1	
Rock Dove		5		
Tree Swallow			13	
Violet-green Swallow	2			
Black-billed Magpie	1			
Marsh Wren	19	3	17	12
Mountain Bluebird	4	4	3	3
Sage Thrasher	1			1
European Starling				1
Yellow-rumped Warbler			1	
Spotted Towhee			1	
Vesper Sparrow	2		1	
Lincoln's Sparrow				2
White-crowned Sparrow		1		

TABLE 6. continued

Species	1998	1999	2000	2001
Red-winged Blackbird	8	19	9	12
Western Meadowlark	4	1		2
Yellow-headed Blackbird	6	3		

TABLE 7. Fall (October – November) bird counts in the CSWCA, 1997 – 2001. Counts represent the highest single count for a particular species.

Species	1997	1998	1999	2000	2001
American Bittern			1		
Canada Goose		4	12		
Green-winged Teal		5	3		
Mallard	64	35	142	35	43
Northern Pintail	5		9	5	1
Blue-winged Teal		2	1	3	
Cinnamon Teal			8	5	7
Northern Shoveler		11	1	1	2
Gadwall		2		16	
American Wigeon	2		4	2	
Redhead			6		
Lesser Scaup		20		2	2
Common Goldeneye		3		2	
Northern Harrier	2	1	3	3	2
Rough-legged Hawk	2			2	
Golden Eagle		1		1	1
American Coot	4	60	29	9	
Ring-billed Gull				1	
Rock Dove		2			
Horned Lark				2	
Black-billed Magpie		1		2	1
Marsh Wren		2	7	5	4
Mountain Bluebird		9	3		1
Sage Thrasher					1
Chipping Sparrow					2
Vesper Sparrow		3		5	
Song Sparrow					1
Red-winged Blackbird				3	
Western Meadowlark		2			

Discussion

Given its location and the vegetation types represented, the CSWCA is supporting all the species of birds that can reasonably be expected for the area based on recent range maps of bird distributions (e.g., Sibley 2000, Alsop 2001, Sauer et al. 2001), breeding records (Stephens and Sturts 1998), and local long-term observations (Roberts 1992). The multiple observations of peregrine falcon and trumpeter swan using the CSWCA coupled with the rich variety of bird species found there exemplify the value of protecting large portions of the Chilly Slough wetland. Management of the CSWCA should focus on maintenance of existing protection (e.g., livestock exclusion, ACEC and RNA designations), acquisition of additional wetland with the view of maintaining water level dynamics (i.e., protection of the source springs in the North Unit), and continued monitoring of biodiversity. A potential major threat to the CSWCA is the invasion and dominance of exotic plants (Fredrickson and Laubhan 1994, Jankovsky-Jones 1999).

The data suggest the importance of growing season precipitation to bird species richness and productivity in the CSWCA. Growing season precipitation was correlated with annual peaks in water levels in Thousand Springs Creek, annual densities of breeding birds in the CSWCA, and annual ratios of the number of ducklings to adult waterfowl. Whether the importance of precipitation is for its affect on water level dynamics, or on vegetative productivity with consequent benefits to birds or both, or on other aspects of the ecology of the wetland is unknown. The five years of water level measures obtained in this study seem related to the dynamics of the wetland avian community but five years of annual data is too short a period to reliably judge ecological relationships. The hydrology of the CSWCA was profoundly affected by the 1983 Mt. Borah earthquake at least in the short-term, and the long-term hydrologic dynamics are undocumented (Jankovsky-Jones 1999).

Marked differences in year-to-year abundance is common for many birds. Variation can result from natural stochastic variation in population numbers, from the effects of environment on populations (as suggested by the relationship of bird abundance and productivity with growing season precipitation in the CSWCA), and from estimation error. There are ambiguities inherent in bird surveys that require considerable effort to overcome (e.g., Barker and Sauer 1995, Johnson 1995, Pendleton 1995). Differential detection probabilities among species, habitats, and seasons can contribute substantially to the observed variance of bird numbers and species richness. Some birds are more likely to be observed at a distance rather than nearby, (e.g., sandhill cranes, common snipe). Birds inhabiting cattails (e.g., marsh wren, common yellowthroat) are more difficult to detect and enumerate than birds inhabiting sedge fen (e.g., long-billed curlew, savannah sparrow). Some birds are behaviorally more conspicuous (e.g., the territorial calls of sage thrasher, the mating flight displays of common snipe). Variation in observer ability also can affect detection rates (Kepler and Scott 1981, Ralph et al. 1993). Comparison between the initial years of the survey (1997 and 1998) and the subsequent years may be confounded by my improving experience identifying some birds in the wetland (e.g., common yellowthroat, savannah sparrow). In addition, some birds may be counted more than once. Some birds seen at > 50 m may become birds recorded at < 50 m at subsequent points (e.g., northern harrier), even though the distance between points was large (0.16 miles/0.25 km).

The primary purpose of the five years of survey was to establish baseline data of birds inhabiting the CSWCA using repeatable, standardized methods. Identification of birds using the CSWCA, species richness, and estimates of bird abundance are useful information for managers. With the existing baseline of information, additions to the list of species using the CSWCA can be obtained with less rigorous methods, e.g., with incidental sightings gathered on standardized wildlife sighting forms or with organized birding days benefiting from the inclusion of local birders (Johnson 1999). I recommend that the point-count surveys on the existing permanent transects be continued at intervals in the future. Reliable estimates of bird abundance may be less important than estimates of avian community composition and species richness. Avian community composition and species richness can be robustly estimated despite not all birds or species being consistently detected (Nichols et al. 1998). Moreover, these data can be used to assess the effects of management on the CSWCA.

To assess the effect of future management on portions of the CSWCA, the monitoring effort could be augmented with additional samples comparing the area(s) to be affected with those that are not (Johnson 1999). The baseline data reported here can be used to (1) select sites that are similar for treatment and control comparisons, (2) understand the variation in species richness or bird abundance for calculation of needed sample size, and (3) estimate the treatment effect as part of the sample.

Acquisition of lands to the CSWCA, and maintenance of fences to exclude livestock should result in changes (particularly to grasslands, sedge fen, and alkaline communities), that can affect birds. Grassland birds, such as savannah sparrow, may increase in density as the current data indicates. Long-billed curlews, which prefer short-stature grasslands for breeding and feeding, also may increase in density. However, we should not be surprised if some species experience population declines or species richness declines because of protection of the CSWCA. The habitats may become increasingly uniform within the CSWCA as the duration of protection increases thus reducing habitat diversity. Only through a continued monitoring effort can managers assess changes in biodiversity, and judge the effectiveness of management actions and the long-term value of the CSWCA.

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APPENDIX 1. Breeding bird point-count transect locations, azimuths, and starting points in the CSWCA. All UTM coordinates are in Zone 12.

Transect	Azimuth	Transect Starting Point	Easting	Northing
1	70°	North Unit, begin on east side of shack	263160	4892375
2	140°	North Unit, begin 50 paces along azimuth from NW fence corner	266100	4890455
3	192°	Middle Unit, begin at relic planter/seeder	268455	4888750
4	160°	South Unit, begin at southernmost roofless shack	272125	4885780
5	336°	South Unit, begin 50 paces north of southern boundary fence	272540	4883430
6	210°	North Unit, begin 250 paces along azimuth from NE fence corner	265727	4893342

APPENDIX 2. List of birds of Chilly Slough summarized by Barnes (1994; Table 2). Only birds identified to species are listed.

Grebes
- Red-necked Grebe
- Pied-billed Grebe

Herons and Ibises
- American Bittern
- Black-crowned Night-heron
- Great Blue Heron
- White-faced Ibis

Swans, Geese, and Ducks
- Tundra Swan
- Trumpeter Swan
- Canada Goose
- Greater White-fronted Goose
- Green-winged Teal
- Mallard
- Northern Pintail
- Blue-winged Teal
- Cinnamon Teal
- Northern Shoveler
- Gadwall
- American Wigeon
- Canvasback
- Redhead
- Ring-necked Duck
- Lesser Scaup
- Common Goldeneye
- Barrow's Goldeneye
- Bufflehead
- Common Merganser
- Ruddy Duck

Vultures
- Turkey Vulture

Hawks and Eagles
- Norther Harrier
- Sharp-shinned Hawk
- Cooper's Hawk
- Red-tailed Hawk
- Rough-legged Hawk
- Golden Eagle

Falcons
- American Kestrel
- Merlin
- Prairie Falcon

Quail and Grouse
- Sage Grouse

Rails and Coots
- Virginia Rail
- Sora
- American Coot

Cranes
- Sandhill Crane

Plovers
- Killdeer

Stilts and Avocets
- American Avocet
- Black-necked Stilt

Sandpipers and Phalaropes
- Marbled Godwit
- Long-billed Dowitcher
- Greater Yellowlegs
- Lesser Yellowlegs
- Solitary Sandpiper
- Willet
- Spotted Sandpiper
- Long-billed Curlew
- Semipalmated Sandpiper
- Western Sandpiper
- Least Sandpiper
- Baird's Sandpiper
- Pectoral Sandpiper
- Common Snipe
- Wilson's Phalarope
- Red-necked Phalarope

Gulls and Terns
- Franklin's Gull
- Ring-billed Gull
- California Gull

Doves
- Rock Dove
- Mourning Dove

Owls
- Great Horned Owl
- Short-eared Owl

Nighthawks
- Common Nighthawk

APPENDIX 2. continued

Hummingbirds
- Rufous Hummingbird

Kingfishers
- Belted Kingfisher

Woodpeckers
- Red-naped Sapsucker
- Northern Flicker

Flycatchers
- Say's Phoebe
- Western Kingbird
- Eastern Kingbird

Larks
- Horned Lark

Swallows
- Tree Swallow
- Violet-green Swallow
- Bank Swallow
- Northern Rough-winged Swallow
- Cliff Swallow
- Barn Swallow

Crows and Ravens
- Black-billed Magpie
- American Crow
- Common Raven

Chickadees
- Black-capped Chickadee

Nuthatches
- White-breasted Nuthatch

Wrens
- Rock Wren
- Marsh Wren

Kinglets and Thrushes
- Ruby-crowned Kinglet
- Mountain Bluebird
- Townsend's Solitaire
- American Robin

Thrashers
- Gray Catbird
- Sage Thrasher

Pipits
- American Pipit

Shrikes
- Northern Shrike
- Loggerhead Shrike

Starlings
- European Starling

Vireos
- Warbling Vireo

Warblers, Sparrows, and Blackbirds
- Orange-crowned warbler
- Yellow Warbler
- Yellow-rumped Warbler
- MacGillivray's Warbler
- Common Yellowthroat
- Wilson's Warbler
- Green-tailed Towhee
- American Tree Sparrow
- Brewer's Sparrow
- Vesper Sparrow
- Lark Sparrow
- Sage Sparrow
- Savannah Sparrow
- Grasshopper Sparrow
- Fox Sparrow
- Song Sparrow
- Lincoln's Sparrow
- White-crowned Sparrow
- Dark-eyed Junco
- Snow Bunting
- Bobolink
- Red-winged Blackbird
- Western Meadowlark
- Yellow-headed Blackbird
- Brewer's Blackbird
- Brown-headed Cowbird

Finches
- Gray-crowned Rosy-finch
- Black Rosy-finch
- Cassin's Finch
- Pine Siskin
- American Goldfinch

Weaver Finches
- House Sparrow

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