SPECIES ASSESSMENT FOR THE TRUMPETER SWAN (*CYGNUS BUCCINATOR*) IN WYOMING

prepared by

AMBER TRAVSKY[1] AND DR. GARY P. BEAUVAIS[2]

[1] Real West Natural Resource Consulting, 1116 Albin Street, Laramie, WY 82072, 307-742-3506

[2] Wyoming Natural Diversity Database, University of Wyoming, Dept. 3381, 1000 E. University Ave., Laramie, WY 82071, 307-766-3023

Photo by A. Travsky (2004)

prepared for

United States Department of the Interior
Bureau of Land Management
Wyoming State Office
Cheyenne, Wyoming

October 2004

TABLE OF CONTENTS

Introduction

Weighing 10 - 15 kg and with a wingspan of 2.4m when fully grown, the trumpeter swan (*Cygnus buccinator*) is the world's largest waterfowl. Trumpeter swans are similar in appearance to other white swans, but their foreheads slope evenly to an all black bill. The more common and smaller tundra, or whistling, swan (*C. columbianus*) is smaller with a more curved upper bill, and usually has a yellow spot in front of its eye.

The trumpeter swan is a long-lived, social species, conspicuous by its large size, all-white plumage, and trumpet-like call. Although once abundant and widespread in North America, populations were greatly reduced during the European settlement era when the species was prized for its skin and feathers. Historic annual range likely encompassed most of Canada and the United States (Gale et al. 1987).

In 1989 the USDI Fish and Wildlife Service (USFWS) was petitioned to list a portion of the North American population of trumpeter swans as Threatened. In 1990 the petition was denied based on insufficient information to warrant proceeding with a status review. In 2000 the USFWS was again petitioned to list the trumpeter swan population in Yellowstone National Park as Threatened. In January 2003 the USFWS found that the petition did not adequately establish that this population (the “tri-state flock”) was a distinct population segment warranting listing. In Canada the trumpeter swan was listed as a vulnerable species in 1978 (Mackay 1978). After a status assessment conducted in the mid-1990s, the Canadian federal government moved the species to its ‘not at risk’ category (COSEWIC 2002).

Natural History

Except where indicated, the information presented below has been compiled from Banko (1960), Hansen et al. (1971), Banko and Schorger (1976), Shea (1979), and Mitchell (1994).

Morphological Description

The trumpeter swan is the largest waterfowl in the world, with adult wingspans 2.1 - 2.4 m and body weights of 10 - 15 kg. Adults are entirely white, with the head and neck often stained rufous by iron-rich waters and muds in which the birds forage. The tarsi, webbed feet with an elevated halux, as well as the bill are all black. Adult males ("cobs") range in length from 1.45 to 1.57 m; females ("pens") are slightly smaller (1.39 to 1.47 m).

Second-year swans are predominantly white but often retain a few pale gray to brown feathers on the head, neck, and body. Feet and tarsi of these young birds may be yellowish, greenish gray, or dull black. Young-of-the-year swans are a dull mousy gray with feet and tarsi a gray-pink and a dark gray-black (base) and pink (tip) bill. Newly hatched cygnets are covered in white down, with yellow feet and tarsi and an entirely pink bill.

By virtue of its large size an adult trumpeter swan is unlikely to be confused with anything but other swans. White pelicans (*Pelecanus erythrorhynchos*), whooping cranes (*Grus americana*), wood storks (*Mycteria americana*), and snow geese (*Chen caerulescens*) are all white birds that may be confused with trumpeter swans at great distances, but all have black primaries. There are two additional swans in North America: the indigenous tundra swan (*Cygnus columbianus*) and the European transplanted mute swan (*C. olor*). All three swan species are large, all-white birds.

Mute swans are easily distinguished by the bright orange bill and distinctive knob on the forehead. Trumpeter and tundra swans are similar looking species that are more difficult to differentiate. To add to the difficulty in separating the two species, trumpeters often mix with flocks of the relatively common tundra swan throughout their migration and winter range. The adult trumpeter swan is slightly larger than the adult tundra swan. The trumpeter has a straight culmen, the bill has no yellow spot, the eye is almost enclosed by black, and the white feathering on the head extends in a V shape into the dark bill.

Taxonomy and Distribution

Trumpeter swan taxonomy is shown in Figure 1; no subspecies are currently recognized. However, the trumpeter swan, whooper swan (*C. cygnus*), tundra swan, and Bewick's swan (*C. bewickii*) comprise a close-knit evolutionary complex called the northern swans (Johnsgard 1978). The relationships among these taxa are far from clear. Some have regarded the trumpeter as a subspecies of the whooper (Delacour 1959, Johnsgard 1974, Cooper 1979), whereas Banko and Schorger (1976) suggested that whooper and trumpeter swans comprise a superspecies. Barrett and Vyse (1982) examined the genetic relationships among trumpeter, tundra, trumpeter-tundra hybrid, and mute swans. Although their sample sizes were small, their analyses revealed no differences between trumpeter swans, tundra swans, and the trumpeter-tundra hybrids, suggesting a close taxonomic relationship between the species.

Meng and Parkin (1993) determined that DNA fingerprints of Bewick's, trumpeter, and whooper swans suggested a close relationship to one another. Trumpeter swans interbreed with whooper, tundra, Bewick's, and mute swans (Banko and Schorger 1976), and crosses between trumpeter and tundra swans are fertile (Mitchell 1994). Pairs of trumpeter-tundra hybrids have

successfully fledged offspring in captivity, as have pairings of trumpeter-tundra hybrids with trumpeter swans (Sladen et al. 2001).

Currently the trumpeter swan breeds in open water and marshes from central Alaska and the Yukon south into northern and eastern British Columbia. Small and disjunct breeding centers occur in Alberta, Saskatchewan, and portions of the Pacific Northwest, Rocky Mountains, and Upper Midwestern U.S. (Figure 2). Alaska contains over 85% of the world's breeding population; breeding centers outside of Alaska are very localized (Mitchell 1994). There is a resident population centered near Yellowstone National Park at the junction of Wyoming, Montana, and Idaho, and apparently a small resident group near the Black Hills of South Dakota. Pairs are known to reproduce regularly along the Green River in southwestern Wyoming. In all there are only 20 - 50 definable breeding concentrations of trumpeter swans today.

Historically trumpeter swans bred across a much larger area, encompassing much of Canada and the U.S. In the early 1900's the species was heavily harvested and thought near extinction. In 1932 only 69 birds were known to exist, but in 1954 several thousand pairs were discovered in Alaska. Now there are at least 16,000 trumpeter swans in the wild, with several populations reintroduced to sites throughout historic range.

Current winter range includes southeast Alaska and the British Columbian coast, extending south into the Puget Sound of Washington. Disjunct winter concentrations also occur in Oregon, Idaho, Nevada, and southwest Wyoming (along the Green River). As mentioned, most of the trumpeter swans in the Yellowstone population, and some near the Black Hills, are probably year-round residents. Historic winter range included most of California, portions of Arizona and New

Mexico, most of the Gulf Coast to central Florida, and the Atlantic coast as far north as ice-free inland waters persisted (Mitchell 1994).

For management purposes the trumpeter swans of North America have been assigned to three populations, based upon breeding and wintering distributions rather than known genetic differences (Barrett and Vyse 1982, USDI Fish and Wildlife Service 1984).

Pacific Coast Population (PCP)

The PCP is comprised primarily of birds that nest in Alaska and winter along the coast of Canada and the northwestern U.S. Limited observations suggest that Alaskan breeders do not often migrate or winter east of British Columbia, Washington, or Oregon (see King 1985, Bailey et al. 1990).

Rocky Mountain Population (RMP)

The RMP is comprised of birds that nest east of the PCP to the western border of Saskatchewan, and points south. Most birds in the RMP winter in the Yellowstone region of Montana, Idaho, and Wyoming (hereafter termed the tri-state area).

The RMP encompasses 3 discrete flocks: (1) Canada flock; (2) tri-state flock; and (3) restoration flock. The terminology for these groups has varied over time, having been called populations, subpopulations, segments, and flocks. Recently, the USFWS has adopted the term "flock" because there is insufficient information to determine which term is most appropriate, and "flock" is consistent with the Pacific Flyway management plan for RMP trumpeter swans (USDI Fish and Wildlife Service 2001, Pacific Flyway Council 2002). As implied, the Canada flock consists of birds that nest in Canada and winter primarily in the tri-state area. Birds in the tri-state flock nest and winter mostly in northwestern Wyoming, eastern Idaho, and southwestern Montana.

The restoration flock consists of birds derived primarily from adults and cygnets that were translocated from the tri-state flock to various refuges and wildlife management areas in attempts to establish new nesting groups (Gale et al. 1987). Primary restorations within the RMP are at Ruby Lake National Wildlife Refuge, Malheur National Wildlife Refuge, and Summer Lake Wildlife Management Area.

Interior Population (IP)

The IP is comprised of birds that nest east of the range of the RMP. The IP is the result of extensive restoration efforts, and is composed exclusively of PCP and RMP birds and eggs that were translocated to these eastern areas. Birds from the IP winter primarily in areas south of their nesting grounds.

Habitat Requirements

Breeding Habitat

Alaskan trumpeter swans require 140-154 ice-free days to complete a reproductive cycle. This requirement precludes use of otherwise suitable habitat above approximately 2,700 ft elevation; most nesting occurs below 500 ft. It is assumed that analogous time and elevation requirements hold for trumpeter swans breeding in the Wyoming region, but specific values have not yet been determined.

Across their breeding range trumpeter swans nest in clear, quiet, ponded water bodies (e.g., ponds, lakes, marshes, sloughs) with relatively static levels (i.e., no substantial seasonal fluctuation), no obvious currents or constant wave action, and shallow margins that allow considerable digging and foraging for submerged parts of aquatic plants (e.g., roots, tubers). Very small and heavily timbered wetlands are not appropriate for nesting, as open flight lanes of at least

100m are needed for takeoff and landing. Trumpeter swans avoid acidic, stagnant, or eutrophic waters (Mitchell 1994), and appear to be rather sensitive to disturbances while nesting.

Trumpeter swans build their nests on top of emergent vegetation or small islands, usually in water <1m deep. Muskrat (*Ondatra zibethicus*) and beaver (*Castor canadensis*) lodges are occasionally used as nest substrate (Alaska Department of Fish and Game 1986). In Alaska, sedges (*Carex* spp.) and horsetails (*Equisetum* spp.) dominate nesting marshes.

Non-breeding birds (typically <4 years old) usually gather in small flocks and remain together throughout the summer on water bodies not occupied by breeding pairs.

Migration Habitat

During migration trumpeter swans stopover in freshwater marshes, ponds, lakes, rivers, and brackish estuaries (Gale et al. 1987, Lockman et al. 1987, Bailey et al. 1990). They travel in family groups, and high-quality resting and feeding sites are especially critical to young birds which cannot travel as far as adults. Stopover use is limited by ice, forage availability, and disturbances.

Wintering Habitat

Good winter habitat is characterized by open water bordered by level and open terrain, such as unobstructed snowfields or meadows, which does not impair the vision or mobility of resting swans. Level terrain is especially important next to smaller water bodies because trumpeter swans need long, open air lanes for takeoff and landings.

During the mild weather of early winter swans may be widely dispersed, feeding in various water bodies, wetlands, and flooded agricultural fields. It is during mid to late winter that open

water becomes limiting. Streams and larger lakes with currents and wave action are important as they stay unfrozen during moderately cold weather; however, some source of warm water (or saline water in coastal regions) is necessary during deep cold. For this reason trumpeter swans in the tri-state area often winter at or near geothermal features (e.g., geysers, hot springs, thermal ponds). Some trumpeter swans in the RMP depend heavily on feeding in agricultural fields to survive the winter.

Preferred winter habitat in the tri-state area is open water at least 100m in major dimension, stream channels at least 15m wide, water velocity less than 45cm per second, banks with little or no shrub cover, water depth 0.6 - 1.3 m for foraging, and shallower water and sand and gravel bars for loafing and roosting (Lockman et al. 1987). Other characteristics include: slopes with ratios <1:2; soft substrates at least 5 cm deep; abundant, diverse aquatic vegetation; greater than 75% open water; water freezing only intermittently and for no longer than 2 consecutive days; no wire fences or powerlines crossing habitat or flight paths; pollutant free, especially from lead; and little or no human disturbance.

Area Requirements

Breeding

Breeding adults defend nesting territories against conspecifics and other species. Territory size varies from 1.5 - 100 ha, often with only one nesting pair per pond (Hansen et al. 1971, Holton 1982, Gale et al. 1987, Lockman et al. 1987). Larger lakes with more than one nesting pair have been reported in Montana (Banko 1960, Page 1976), Alaska, British Columbia, and the Yukon Territory (Mitchell 1994). Territory size and bird density may vary with shoreline complexity and/or forage resources.

Wintering

No winter territoriality has been reported. Winter dominance hierarchies exist, but have not been well-described or quantified (Snyder 1991). As mentioned, adequate habitat becomes limiting later in the winter as smaller water bodies begin to freeze; it is assumed that swan densities increase in suitable habitat during cold periods.

Movement and Activity Patterns

Trumpeter swans leave Pacific Coast wintering sites in late February and March and arrive on Alaskan and Yukon breeding grounds mid-March to mid-April (Jordan and Caniff 1981). Trumpeter swans in the RMP arrive on their breeding grounds in Alberta, southern Yukon, and Northwest Territories mid-April to early May. Many breeding ponds are still frozen when they arrive, but larger water bodies nearby have open leads where swans stage until ponds thaw. It is assumed this pattern is echoed by resident birds in the tri-state flock; that is, they winter and stage on larger water bodies until breeding ponds open in April and May.

As mentioned, non-breeding birds (typically <4 years old) usually gather in small flocks and remain together throughout the summer on water bodies not occupied by breeding pairs.

Adults molt in summer and are flightless for about 1 month. Females usually lose some flight feathers about the time cygnets hatch and are flightless during the critical post-hatching period. Males become flightless about the time females regain flight ability. In this manner one flightless parent remains with the cygnets during the entire brooding period.

Once the young have fledged in late September-early October large numbers of swans congregate and stage on various water bodies until winter weather forces migration. Swans typically leave breeding areas mid October to late November as water bodies freeze. They often

stopover on their way to final wintering grounds, moving to progressively larger waters as ice and forage availability dictate (Shea 1979, Lockman et al. 1987, King and Ritchie 1992).

The dominant activities of trumpeter swans on wintering grounds are feeding and resting. On the British Columbian coast feeding is strongly influenced by the cycling of tides in the estuaries. Birds feed at times during the day and night when the preferred amount of water covers their plant food. In some parts of the winter range, such as Vancouver Island, more of each 24-hour period is spent resting than feeding, probably due to relatively mild temperatures and high availability of foods rich in carbohydrates, which provide ample heat energy.

Reproduction and Survivorship

Breeding Behavior and Phenology

Swans usually mate for life; however, if one of the pair is lost the other will mate with a different individual. After selecting an appropriate water body for nesting, pairs often begin to build a new nest, or repair an existing nest, before the water is completely free of ice. There is high site fidelity among trumpeter swans; most nests are used repeatedly by the same pair, year after year. Nest repair usually involves simply adding plant material to an already substantial mound.

Starting in early May the female lays one egg about every 2 days until the clutch is complete (average 5-6 eggs; maximum 9). She incubates the eggs for 32 days; the male aggressively defends the nest during this time. The peak of the hatching period is in mid June to early July. Cygnets emerge covered in a dense pale down and remain in the nest with the female for at least 24 hours, until they are able to maintain their body temperature.

Feathers first appear at about 28 days, with cygnets being fully feathered at 9-10 weeks. Cygnets grow from about 300 gm at hatching to about 7 kg at fledging, the latter usually occurring in late September - early October at 13-15 weeks of age.

Trumpeter swans are sensitive to disturbance while nesting, and will abandon nests under some disturbance scenarios.

Population Demographics

Fecundity and Survivorship

Trumpeter swans may pair at 20 months of age, but first breeding rarely occurs until 4 to 7 years of age (Banko 1960, Monnie 1966, Lockman et al. 1987, Gale et al. 1987). Thereafter they breed at one-year intervals. Maximum life span in captivity is 32.5 years (Kortright 1943); wild trumpeter swans >24 years old have been reported (Kennard 1975).

Annual reproductive success (measured as number of young reared to fledging per the number of breeding females) ranges from 0 to 4.0 with a mean of 0.99 (Mitchell 1994). From 1968 to 1990, 3,031 broods in Alaska averaged 3.3 cygnets per brood (Conant et al. 1991). There are extreme variations in cygnet and adult survival, clutch size, nest success, and fledging rates among years (Gale at al. 1987). Cygnet survival is positively correlated with clutch and brood size, suggesting that food quality and availability strongly influences reproductive success.

Survival rates differ by age, year, and location. Annual survival rate for 1 - 2 year old birds ranges from 40-100%; for >2 year old birds it ranges from 80 to 100% (Turner and Mackay 1981, Anderson et al. 1986, Lockman et al. 1987, Lockman 1990, Bart et al. 1991).

Limiting Factors

Except for people, wild trumpeter swans have few enemies. Eagles, owls, coyotes (*Canis latrans*), and mink (*Mustela vison*) may take swans at certain times, but these instances are infrequent and usually affect very young birds or weakened adults. Diseases and parasites, alone or combined with bad weather or local food shortages, may also result in some deaths.

In contrast to historic times, direct human-caused mortality is now rather rare and typically accidental in nature, stemming mostly from ingestion of lead shot and subsequent poisoning, collisions with anthropogenic objects such as power lines and other overhead wires, and occasional misidentification by hunters.

The most serious threat to trumpeter swans is the loss of undisturbed breeding and (especially) wintering habitat to expanding human populations. Urban expansion, rural residential development, and recreation often preferentially occur in and adjacent to environments preferred by swans; namely, large, clean, calm, and productive water bodies.

The long-term viability of all 3 populations likely depends primarily on enhancement of existing, restoration of former, and creation of new wintering grounds (Pacific Flyway Council 1992, 2002). Protection and enhancement of breeding habitat is also important, but probably not as important as efforts focusing on winter habitat. Suitable breeding sites are relatively abundant and well-distributed. In contrast, suitable wintering grounds are rather scarce and concentrated to just a few areas, especially during extreme cold periods when open water is rare and undisturbed open water, with adequate food and flat and open surroundings, is even rarer.

Food Habits

Food Items

Adult trumpeter swans prefer freshwater plants, most notably wild celery (*Angelica lucida*) and pondweed (*Potamogeton* spp.) tubers, but they also eat grain, grasses, insects, snails, and other small invertebrates. During feeding experiments in Montana, adult trumpeter swans ate >20 lbs. of moist aquatic vegetation per day.

Young cygnets grow rapidly and require a high-protein diet of aquatic invertebrates during the first few weeks. After that, plants become increasingly important as food. In southcentral Alaska preferred foods include marestail (*Hippuris* spp.), horsetails (*Equisetum* spp.), sedges (*Carex* spp.), and buckbean (*Menyanthes trifoliata*) (Alaska Department of Fish and Game 1986).

On staging areas and wintering grounds in the lower U.S. trumpeter swans have learned to feed in agricultural fields on vegetables, winter wheat, and unharvested grain. Although swans benefit from these rich foods, they occasionally cause significant damage to crops.

Foraging Strategy and Flexibility

Most feeding occurs in shallow water, with adults occasionally grazing on land. In Alaska nonbreeding swans (typically <4 years old) often inhabit large lakes that lack emergent vegetation and are therefore unsuitable for breeding; this is especially true in large lakes where pondweed is common.

Cygnets feed solely in water. During their first two weeks of life cygnets generally seek invertebrates in very shallow water, 15 - 30cm deep. When in deeper water cygnets gather food brought to the surface by their parents.

Conservation

Conservation Status

Federal Endangered Species Act

The USFWS does not give any special status to trumpeter swans at this time. The species as a whole was petitioned and denied for listing in 1989. In 2002-2003 the tri-state flock was petitioned and denied for listing (USDI Fish and Wildlife Service 2003).

In Canada the trumpeter swan was listed as a vulnerable species in 1978 (Mackay 1978). After a status assessment in the mid-1990s the Canadian federal government moved the species to its "not at risk" category (COSEWIC 2002). In Alberta it is listed as "vulnerable" (Government of Alberta 2002), which means that without management and protection the species could become threatened or endangered within the province.

Trumpeter swans were listed in the IUCN Red Book during the 1960s; however, the species is not on the most recent Red List for either Canada or the U.S. (Stattersfield and Capper 2000).

USDI Bureau of Land Management

The Wyoming State Office of the USDI Bureau of Land Management (BLM) lists the trumpeter swan as a Sensitive Species. The BLM developed this designation to "ensure that any actions on public lands consider the overall welfare of these sensitive species and do not contribute to their decline." Sensitive species management will include: determining the distribution and current habitat needs of sensitive species; incorporating sensitive species in land use and activity plans; developing conservation strategies; ensuring that sensitive species are

considered in National Environmental Policy Act analyses; and prioritizing necessary conservation work (USDI Bureau of Land Management 2001).

USDA Forest Service

The USDA Forest Service lists the trumpeter swan as a Sensitive Species in both Region 2 (Colorado, Kansas, Nebraska, South Dakota, and most of Wyoming) and Region 4 (Nevada, Utah, Idaho, and western Wyoming).

State Wildlife Agencies

The Wyoming Game and Fish Department lists the trumpeter swan as NSS2 indicating a declining or restricted population in a vulnerable or declining habitat.

Heritage Ranks and Wyoming Contribution Rank

The trumpeter swan has been assigned a rank of **G4/S2** by the Wyoming Natural Diversity Database (WYNDD, University of Wyoming; Keinath et al. 2003). The **G4** rank indicates that the full species is relatively secure rangewide; **S2** indicates a moderately high risk of extinction from the state of Wyoming.

The Wyoming Contribution rank for trumpeter swan is **High**. This is based on a ranking system developed by WYNDD (Keinath and Beauvais 2003) that measures the contribution of Wyoming populations of a taxon to the rangewide persistence of that taxon, and considers several factors. For the trumpeter swan these factors include: (1) the species is a resident native in Wyoming, (2) the species has a restricted continental range, (3) the state encompasses a low percentage of that continental range, and (4) Wyoming populations are rather secure, owing to a number of breeding and wintering centers in National Parks and National Wildlife Refuges, relative to populations in other states.

Biological Conservation Issues

Abundance and Trends

The status of trumpeter swans in all of North America is officially assessed with a periodic range-wide survey (Trost et al. 2000). This survey was first conducted in 1968, and since 1975 has been conducted at 5-year intervals. Results indicate that all 3 populations combined have increased from 3,722 birds in 1968 to 23,647 birds in 2000 (Caithamer 2001), an average increase of 5.9% per year (Table 1). Respective values for the PCP (5.8%/ yr), RMP (4.8%/ yr), and IP (12.0%/ yr) suggest all populations are increasing at fairly high rates.

Despite these impressive increases over the past 3 decades, there is concern that human encroachment and development of secure breeding and especially wintering grounds is a major threat to the long-term viability of trumpeter swans (Pacific Flyway Council 1992). This holds for the PCP as well as the RMP and IP. The PCP is often assumed to be robust because of the generally wild nature of northwest Canada and Alaska; however, human development is rapidly altering productive lowlands throughout those regions.

Range Context in Wyoming

Historically trumpeter swans probably occurred throughout Wyoming, and the state formed part of the core of the species' breeding and wintering ranges. Now Wyoming represents the southernmost periphery of trumpeter swan range. The species is considered common in summer, uncommon in winter (Dorn and Dorn 1990). Most breeding and wintering records are recorded in the northwest corner of the state, in and near Grand Teton and Yellowstone National Parks; most of these birds are assumed to be yearlong residents, with some as migrating in for winter from breeding sites in Canada. Swans also regularly breed and winter along the Green River, centered

on Seedskadee National Wildlife Refuge; most of these birds are assumed to migrate into and out of this site each year (Figure 3). Breeding and wintering trumpeter swans are sporadically recorded elsewhere in the state; migrating birds are observed in many areas.

Intrinsic Vulnerability

A variety of factors contribute to a species being intrinsically vulnerable to decline and extinction, including low or variable population density, large area requirements, low fecundity, habitat specificity and site fidelity, susceptibility to hybridization, and sensitivity to disturbance and habitat alteration. Trumpeter swans exhibit all of these characters. High specificity for rather rare environments, and sensitivity to disturbances within those environments, are probably the most important characters in this context. As mentioned previously, suitable wintering habitat is rather rare and restricted in distribution, especially during very cold winters, and further loss and degradation of winter habitat is likely the main threat to trumpeter swans across their range.

Extrinsic Threats and Reasons for Decline

Excessive market hunting for food, skins, and feathers was the primary cause of the historic decline in trumpeter swans. The plumage trade peaked in the early 1800s; swan populations were dramatically reduced by the mid-1800s. Loss of secure habitat as North America was increasingly settled resulted in further declines. By 1900 trumpeter swans were extirpated from nearly all of their breeding range except for a few remote areas of Alaska and the western U.S. Passage of the Migratory Bird Treaty Act by Congress in 1918 provided some protection for swans in the U.S. However, by 1932 only 69 trumpeter swans were known to exist in the lower 48 states. This remnant population received some protection in 1935 when the U.S. government established the Red Rock Lakes National Wildlife Refuge in Montana, encompassing most of tri-state flock at that time (Banko 1960). Along with other restoration and management programs this gradually

boosted trumpeter swan populations, culminating in substantial increases documented over the last 30 years (Table 1).

Currently all 3 trumpeter swan populations (PCP, RMP, IP) are threatened by conversion, disturbance, and degradation of breeding and (especially) winter habitat by various human land uses. Activities with the greatest potential for causing future population declines, according to Mitchell (1994) and the Alaska Department of Fish and Game (1986):

- Altering aquatic vegetation and substrate (e.g., dredging, damming, siltation).
- Substantial changes to uplands adjacent to wetlands, including changes to vegetation (e.g., introduction of exotics, tree planting), landform (e.g., berm and levee construction), and other features (e.g., construction of fences, powerlines, and other flight hazards).
- Increasing fluctuations in water level, changes in drainage patterns, and long-term increases or decreases in water level.
- Increasing levels of and exposure to petroleum products and other toxic chemicals, including lead shot.
- Active harassment such as intentional hazing, chasing, and shooting.
- Passive harassment such as construction noise, vehicle noise, and boat traffic; any activity that interrupts normal behavior and causes stress and flight.
- Establishing residences and recreation sites that promote near-constant human presence (e.g., campgrounds, cabins, vacation homes) in or near breeding or wintering habitat

Protected Areas

In 1935 the U.S. government established the Red Rock Lakes Migratory Waterfowl Refuge (now National Wildlife Refuge) in the Centennial Valley of Montana "principally for the perpetuation of this species" (Banko 1960). This area encompassed much of the known remaining

nesting range for swans in the tri-state region at that time, and still serves as a critical breeding and wintering concentration for the RMP.

Since 1935 trumpeter swans have expanded their range in Wyoming and surrounding regions. Breeding and wintering sites are now known throughout northwest Wyoming, including sites within Yellowstone and Grand Teton National Parks and the National Elk Refuge. Seedskadee National Wildlife Refuge in southwest Wyoming also regularly supports breeding and wintering trumpeter swans. These 4 areas serve as the primary protected sites for the species in Wyoming.

The Bear River in Wyoming and adjacent Idaho is often mentioned as a critical region into which the current tri-state population segment can expand (e.g., Pacific Flyway Council 2002). Currently it is unknown the extent to which the newly established Cokeville Meadows National Wildlife Refuge in southwest Wyoming will serve this expansion.

Conservation Action

Existing and Future Conservation Plans

In its 1986 **North American Waterfowl Management Plan (USDI Fish and Wildlife Service 1986)** the USFWS set out a blueprint for developing public-private partnerships to conserve natural resources for the benefit of waterfowl. It was updated in 1998 (USDI Fish and Wildlife Service 1998) to include a specific objective to maintain or exceed recent rates of annual increase in all populations of trumpeter swans to achieve the autumn indexes listed in Table 2. These objectives were developed by projecting present population growth rates out to the year 2015. No trumpeter swan population currently approaches Plan objectives. The RMP and PCP are each about 35% of objective size; the IP is about 60% of objective.

The Pacific Flyway Council is a multi-jurisdictional administrative body composed of public wildlife agencies and dedicated to protecting and conserving migratory game birds in western North America. Its **Pacific Flyway Plan (Pacific Flyway Council 1992)** provides broad guidance for the conservation of RMP trumpeter swans, with the goal of restoring the RMP as a secure and primarily migratory population, sustained by naturally occurring food sources in diverse breeding and wintering sites. The most recent update, completed in 1998 (see Pacific Flyway Council 1992, 2002) sets forth 5 main objectives, plus several specific tasks and strategies for attaining those objectives, for the RMP to be achieved by 2007. The reader is directed to Pacific Flyway Council (2002) for details; below is a summary of the 5 objectives and the strategies most pertinent to Wyoming.

Objective #1 - Redistribute swans to wintering areas outside of the "core" tri-state area, reducing the number of wintering swans in the core area to <1,500. High densities in major wintering sites in the core tri-state area are degrading the quality of those sites, and thereby jeopardizing the entire RMP. Artificial feeding in some winter sites, such as Red Rock Lakes National Wildlife Refuge, may be contributing to the problem; up to 40% of the RMP may be attracted by feeding at this one site. Wyoming-relevant strategies for this objective include: relocating captive-raised and wild-caught cygnets and yearlings to areas outside the core; relocating wild-caught adults to areas outside of the core; reducing carrying capacity of some wintering sites within the core to encourage migration to non-core sites; and enhancing habitat outside of the core. All strategies recognize the upper Green and Bear Rivers as important non-core sites.

Objective #2 - Rebuild U.S. breeding flocks to at least 141 nesting pairs that winter predominately outside of the core tri-state area. For Wyoming this includes 40 adults total and 10 nesting pairs in Yellowstone National Park, and 120 adults total and 18 nesting pairs outside of Yellowstone National Park. Wyoming-relevant strategies for this objective include: enhancing and protecting breeding habitat wherever possible; assessing and reducing sources of mortality; and

relocating captive raised and wild caught cygnets and yearlings to areas outside the core. Again, all strategies recognize the upper Green and Bear Rivers as important non-core sites.

Objective #3 - Encourage growth of Canadian flocks.

Objective #4 - Manage flows to decrease winter use of the Upper Henry's Fork River by trumpeter swans, and address winter emergencies for swans due to icing.

Objective #5 - Monitor the RMP. This objective promotes continuation of the formal continent-wide surveys of breeding trumpeter swans conducted every 5 years for the past 3 decades (see Table 1). It also suggests more intensive annual monitoring of the RMP in the breeding and mid-winter periods, as well as weekly monitoring at critical sites such as Red Rock Lakes National Wildlife Refuge. Leg-banding, mortality monitoring, and habitat assessment and monitoring throughout the tri-state area are also recommended.

Information Needs

Beyond the monitoring work outlined above, research that will enhance management and conservation of trumpeter swans in Wyoming and surrounding states includes:

- Information on gene flow among subpopulations and major breeding centers.
- Information on migratory pathways and wintering sites used by pairs in major breeding centers.
- Behavioral research that quantifies the intensity and frequency of different disturbance tolerated by breeding and wintering trumpeter swans.
- Information on nutritional requirements of various age and sex classes, including differences between migratory and resident populations and the relative contributions of agricultural crops and aquatic vegetation.
- Identifying habitat features/ configurations that correlate with survival, reproductive success, and late-winter body condition.
- Identifying parameters that lead to successful relocations of captive-raised and wild-caught trumpeter swans (e.g., raising protocol, capture protocol, age at relocation, season of relocation).

Table and Figures

Table 1. Population survey results for the trumpeter swan (*Cygnus buccinator*), 1968-2000.

Region	Year						
	1968	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**
Pacific Coast Region	2,847	4,170	7,696	9,504	13,456	16,312	17,551
Rocky Mountain Region	811	799	975	1,195	1,747	2,517	3,666
Interior Region	64	116	176	209	422	927	2,430
Totals	**3,722**	**5,085**	**8,847**	**10,908**	**15,625**	**19,756**	**23,647**

Table 2. Status of and goals for trumpeter swan (*Cygnus buccinator*) populations (from USDI Fish and Wildlife Service 1998).

Population	3-Year Winter Population Average (1995-1997)	Recent Trend (1986-1997)	Winter Index Objectives
Pacific Coast	16,312	Increasing	43,200
Rocky Mountain	2,600	Increasing	6,800
Interior	1,462	Increasing	2,500

Figure 1. Currently accepted taxonomy of the trumpeter swan (*Cygnus buccinator*).

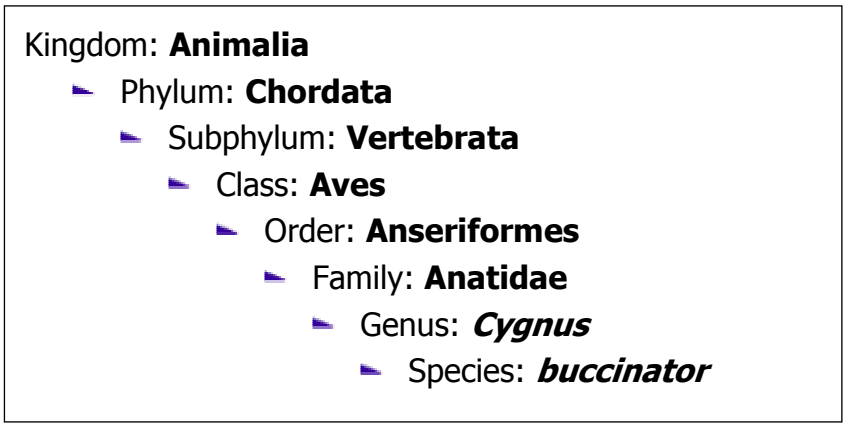


Figure 2. Current distribution of the trumpeter swan (*Cygnus buccinator*); note the 3 major populations (Pacific Coast, Rocky Mountain, and Interior).

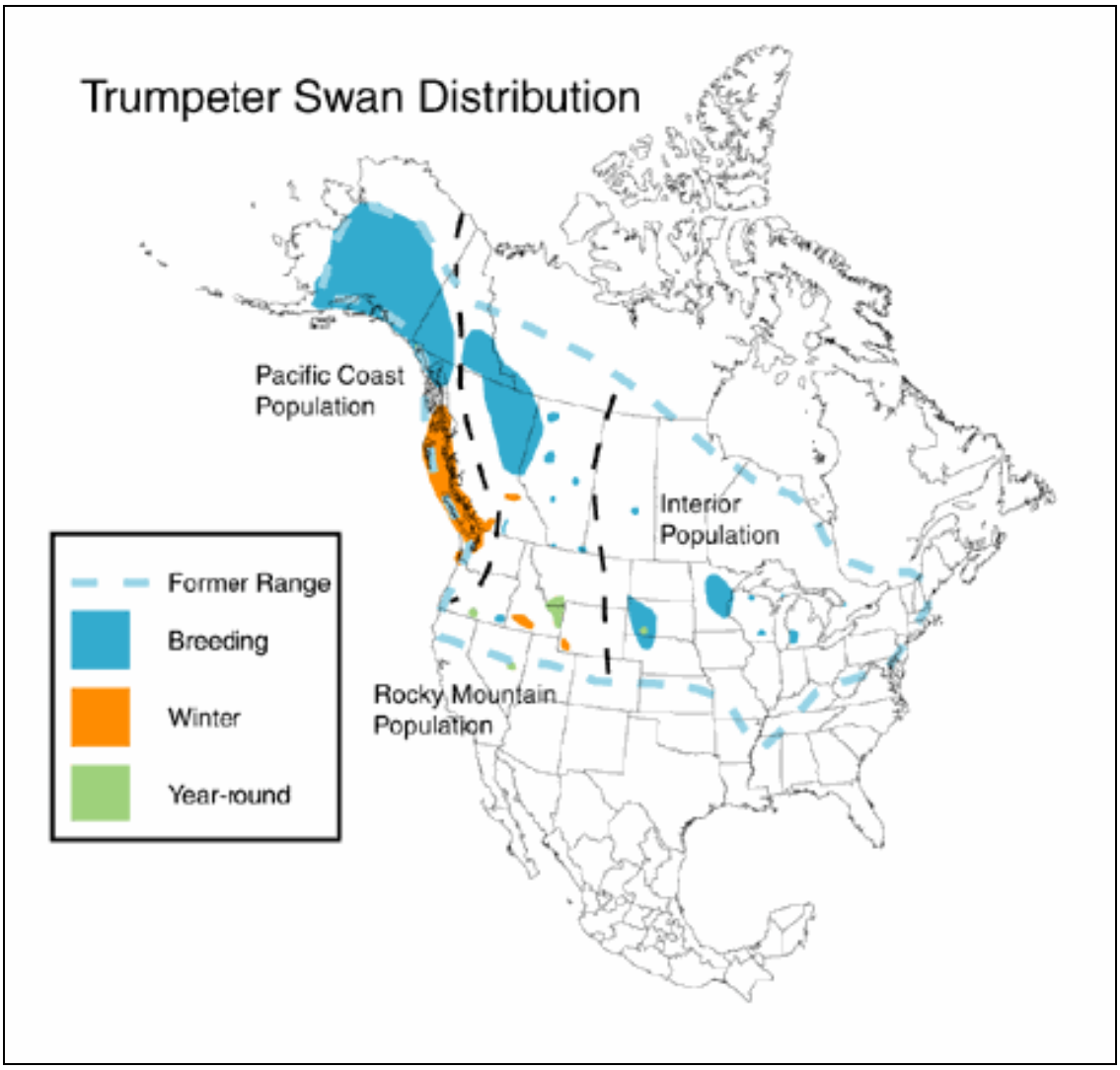
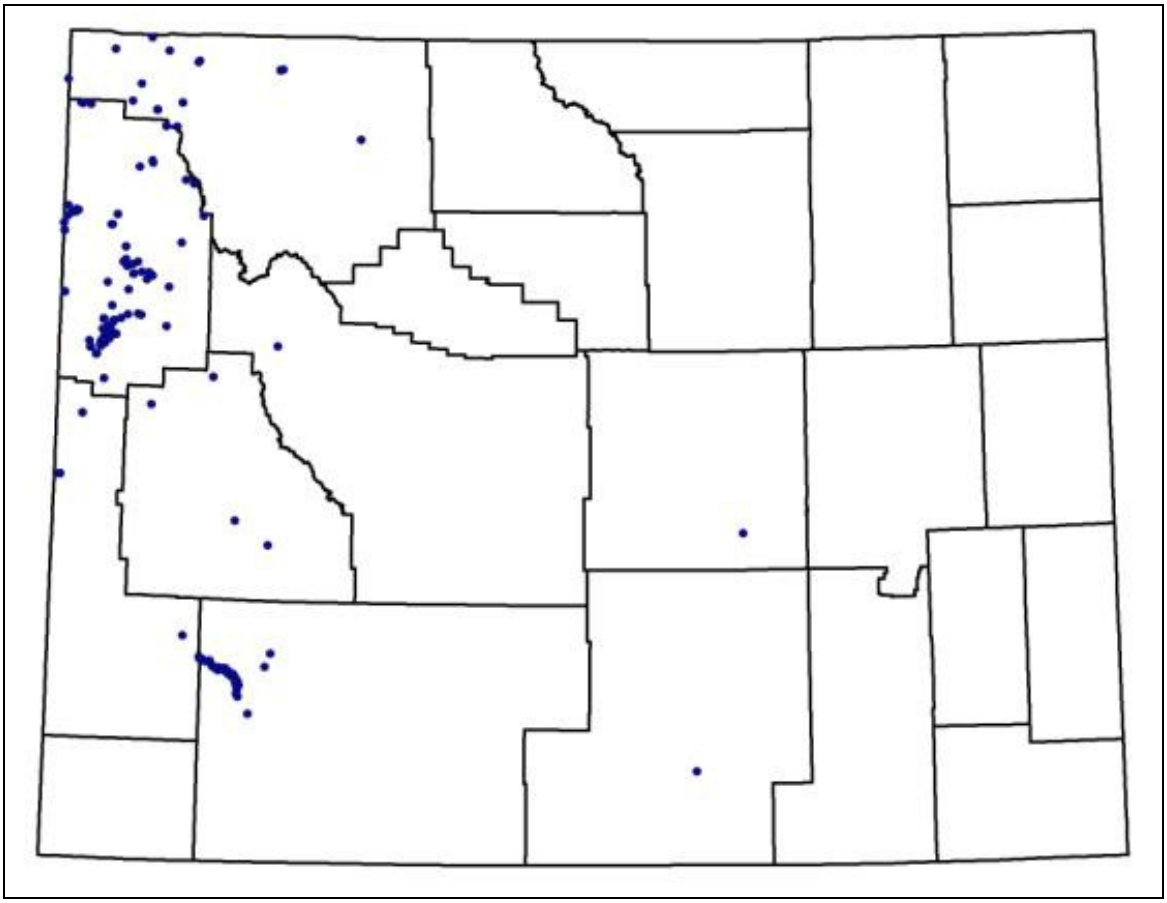


Figure 3. Trumpeter swan (*Cygnus buccinator*) breeding records in Wyoming. There are 759 records total; 71 pre-1980, 688 post-1980. Data on file at the Wyoming Natural Diversity Database (University of Wyoming, Laramie, Wyoming; download April 2004).



Literature Cited

Alaska Department of Fish and Game. 1986. Alaska habitat management guide: life histories and habitat requirements of fish and wildlife. Alaska Department of Fish and Game, Juneau, Alaska, USA.

Anderson, D.R., R.C. Herron and B. Reiswig. 1986. Estimates of annual survival rates of trumpeter swans banded 1949-82 near Red Rock Lakes National Wildlife Refuge, Montana. Journal of Wildlife Management 50:218-221.

Bailey, T.N., M.F. Porter, E.E. Bangs, W.W. Larned, R.A. Richey, and R.L. Delaney. 1990. Summer and migratory movements of tumpeter sans using the Kenai National Wildlife Refuge, Alaska. Page 91 *in* D. Compton (editor). Proceedings and Papers of the 11th Trumpeter Swan Society Conference. Trumpeter Swan Society, Maple Plain, Minnesota, USA.

Banko, W.E. 1960. The trumpeter swan: its history, habits, and population in the United States. North American Fauna No. 63. USDI Fish and Wildlife Service, Washington, DC, USA.

Banko, W.E. and A.W. Schorger. 1976. Trumpeter swan. Pages 5-71 *in* R.S. Palmer (editor). Handbook of North American birds. Volume 2 - Waterfowl, part 1. Yale University Press, New Haven, Connecticut, USA.

Barrett, V.A., and E.R. Vyse. 1982. Comparative genetics of three trumpeter swan populations. Auk 99:103-108.

Bart, J., S. Earnst and P.J. Bacon. 1991. Comparative demography of the swans: a review. Pages 15-21 i*n* J. Sears and P.J. Bacon (editors). Third International Swan Symposium, Wildfowl Supplement No. 1. International Waterfowl and Wetlands Research, Slimbridge, UK.

Caithamer, D.F. 2001. Trumpeter swan population status, 2000. USDI Fish and Wildlife Service-Division of Migratory Bird Management. Laurel, Maryland, USA.

Conant, B., J.I. Hodges, D.J. Groves and J.G. King. 1991. Alaska trumpeter swan status report. USDI Fish and Wildlife Service, Juneau, Alaska, USA.

Cooper, J.A. 1979. Trumpeter swan nesting behaviour. Wildfowl 30:55-71.

COSEWIC. 2002. Canadian species at risk, May 2002. Committee on the Status of Endangered Species in Canada.

Delacour, J. 1959. Waterfowl of the world. Volume l. Country Life Limited, London, UK.

Dorn, J.L. and R.D. Dorn. 1990. Wyoming birds. Mountain West Publishing. Cheyenne, Wyoming, USA.

Gale, R.S., E.O. Garton, and I.J. Ball. 1987. The history, ecology and management of the Rocky Mountain Population of trumpeter swans. Montana Cooperative Wildlife Research Unit, University of Montana. Missoula, Montana, USA.

Government of Alberta. 2002. Sustainable resource development: trumpeter swan. Online:

http://www3.gov.ab.ca/srd/fw/threatsp/ts_stat.html [17 Jun 2002].

Hansen, H.A., P.E.K. Shepard, J.G. King, and W.A. Troyer. 1971. The trumpeter swan in Alaska. Wildlife Monograph 26:1-83.

Holton, G. 1982. Habitat use by trumpeter swans in the Grande Prairie region of Alberta. MS thesis, University of Calgary. Calgary, Alberta, Canada.

Johnsgard, P.A. 1974. The taxonomy and relationships of the northern swans. Wildfowl 25:155-161.

Johnsgard, P.A. 1978. The triumphant trumpeter. Natural History 77:72-77.

Jordan, M. and R. Caniff. 1981. *Cygnus buccinator* in Skagit Valley, Washington, USA. Pages 327-334 *in* G.V.T. Matthews and M. Smart (editors). Second International Swan Symposium. International Waterfowl and Wetlands Research. Slimbridge, UK.

Keinath, D.A. and G.P. Beauvais. 2003. Wyoming animal element ranking guidelines. Wyoming Natural Diversity Database, University of Wyoming. Laramie, Wyoming, USA.

Keinath, D., B. Heidel, and G.P. Beauvais. 2003. Wyoming plant and animal species of concern. Wyoming Natural Diversity Database, University of Wyoming. Laramie, Wyoming, USA.

Kennard, J. 1975. Longevity records of North American birds. Bird Banding 46:55-59.

King, R.J. 1985. Trumpeter swan (*Cygnus buccinator*) movements from the Tanana Valley, Alaska. USDI Fish and Wildlife Service. Fairbanks, Alaska, USA.

King, J.G. and B. Ritchie. 1992. Flying with the swans through Alaska's great mountains. Pages 165-168 *in* C.D. Mitchell, J.R. Balcomb, and J.E. Bornely (editors). Proceedings and Papers of the 13th Trumpeter Swan Society Conference. Trumpeter Swan Society, Maple Plain, Minnesota, USA.

Kortright, F.H. 1943. The ducks, geese, and swans of North America. American Wildlife Institute. Washington, DC, USA.

Lockman, D.C. 1990. Trumpeter swan mortality in Wyoming. Pages 12-13 *in* D. Compton (editor). Proceedings and Papers of the 13th Trumpeter Swan Society Conference. Trumpeter Swan Society, Maple Plain, Minnesota, USA.

Lockman, D.C., R. Wood, H. Burgess, R. Burgess, and H. Smith. 1987. Rocky Mountain trumpeter swan population - Wyoming flock 1982-1986. Wyoming Game and Fish Department. Cheyenne, Wyoming, USA.

Mackay, R.H. 1978. Status report on trumpeter swan in Canada, 1978. *In* Status reports on endangered wildlife in Canada. Volume 1. Committee On the Status of Endangered Wildlife In Canada. Canadian Wildlife Service, Ottawa, Canada.

Meng A. and D.T. Parkin. 1993. Genetic differentiation in natural populations of swans revealed by DNA fingerprinting. Acta Zooligica Sinica 39:209-216.

Mitchell, C.D. 1994. Trumpeter swan (*Cygnus buccinator*). No. 105 *in* A. Poole and F. Gill (editors). The birds of North America. The Academy of Natural Sciences (Washington, DC, USA) and The American Ornithologists' Union (Philadelphia, Pennsylvania, USA).

Monnie, J.B. 1966. Reintroduction of the trumpeter swan to its former prairie breeding range. Journal of Wildlife Management 30:691-696.

Pacific Flyway Council. 1992. Pacific flyway management plan for the Rocky Mountain Population of trumpeter swans. Pacific Flyway Council and USDI Fish and Wildlife Service.

Pacific Flyway Council. 2002. Pacific flyway implementation plan for the Rocky Mountain Population of trumpeter swans. Online: http://pacificflyway.gov/Abstracts.asp#rmts [July 2002]

Page, R.D. 1976. The ecology of the trumpeter swan on Red Rock Lakes National Wildlife Refuge, Montana. Ph.D. dissertation, University of Montana. Missoula, Montana, USA.

Shea, R.E. 1979. The ecology of trumpeter swans in Yellowstone National Park and vicinity. MS thesis, University of Montana. Missoula, Montana, USA.

Sladen, W.L., G. Shire and R. Cannif. 2001. Hybridization in the northern swans [poster]. Fourth International Swan Symposium / Eighteenth Trumpeter Swan Society Conference. Warrenton, Virginia, USA.

Snyder, J.W. 1991. The wintering and foraging ecology of the trumpeter swan, Harriman State Park of Idaho. MS thesis. Idaho State University, Pocatello, Idaho, USA.

Stattersfield, A.J. and D.R. Capper (editors). 2000. Threatened birds of the world. Lynx Edicions and BirdLife International. Barcelona (Spain) and Cambridge (UK).

Trost, R.E., J.E. Cornely and J.B. Bortner. 2000. U.S. Fish and Wildlife Service perspective on RMP trumpeter swan restoration. Pages 60-66 *in* R.E. Shea, M.H. Linck, and H.K. Nelson (editors). Bulletin of The Trumpeter Swan Society 29.

Turner, B. and R. H. Mackay. 1981. The population dynamics of trumpeter swans of Grande Prairie. Canadian Wildlife Service. Edmonton, Alberta, Canada.

USDI Bureau of Land Management. 2001. Instruction memorandum no. WY-2001-040, sensitive species policy and list. USDI Bureau of Land Management. Cheyenne, Wyoming, USA.

USDI Fish and Wildlife Service. 1984. North American management plan for trumpeter swans. Office of Migratory Bird Management. Washington, DC, USA.

USDI Fish and Wildlife Service. 1986. North American waterfowl management plan. USDI Fish and Wildlife Service. Washington, DC, USA.

USDI Fish and Wildlife Service. 1998. North American Waterfowl Management Plan Update. USDI Fish and Wildlife Service. Washington, DC, USA.

USDI Fish and Wildlife Service. 2001. Environmental assessment: proposal to establish operational/ experimental general swan hunting seasons in the Pacific Flyway. USDI Fish and Wildlife Service. Washington, DC, USA.

USDI Fish and Wildlife Service. 2003. Endangered and Threatened wildlife and plants; 90-Day finding for a petition to list the tri-state area flock of trumpeter swans as Threatened. Federal Register 68(18)/ 28 January 2003.