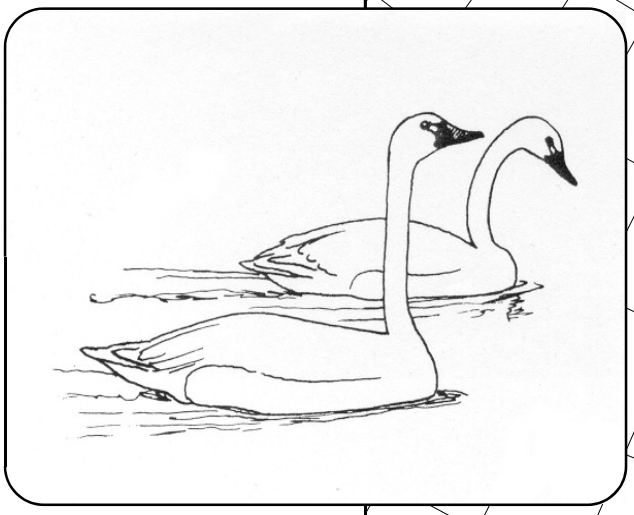
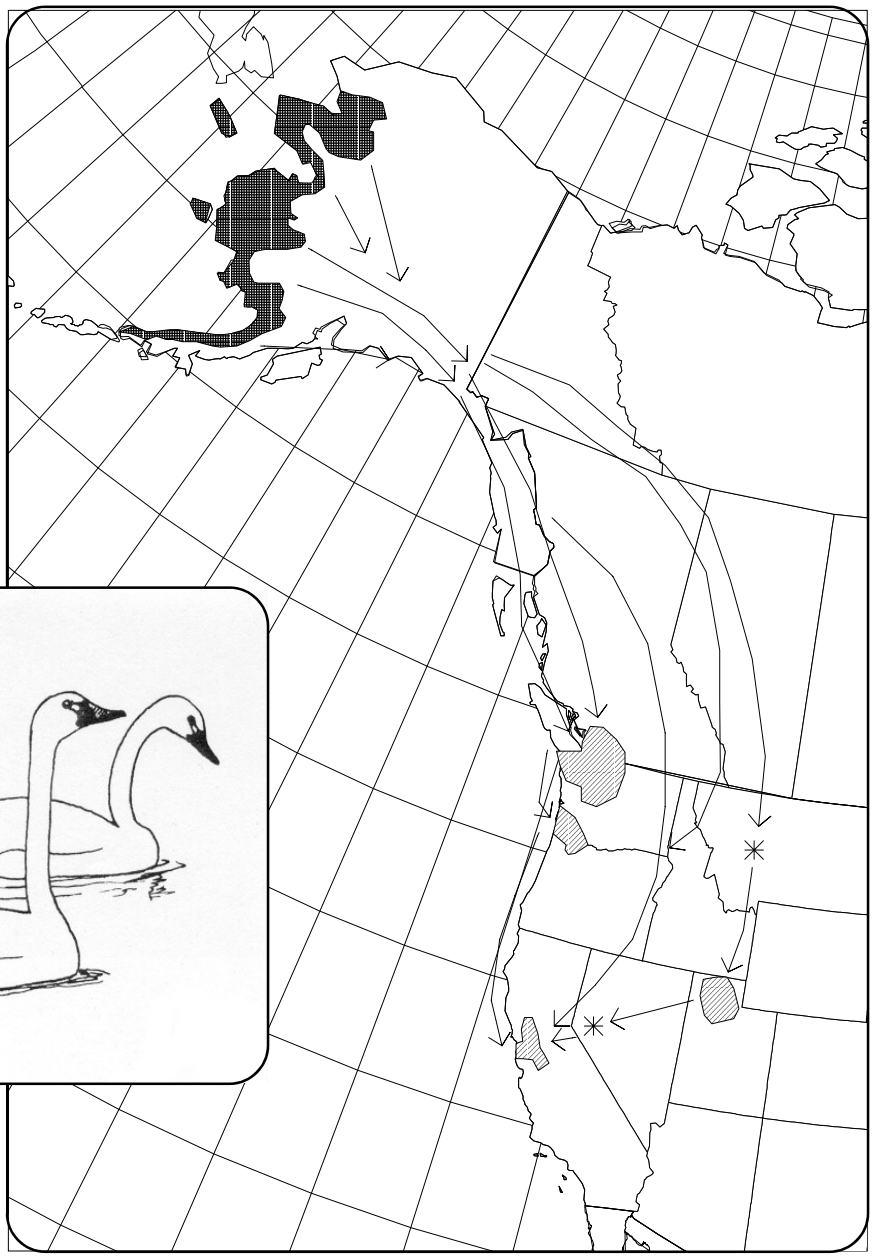
Pacific Flyway Management Plan for the

Western Population of Tundra Swans





PACIFIC FLYWAY MANAGEMENT PLAN

FOR

THE WESTERN POPULATION OF TUNDRA SWANS

Prepared for the:

Pacific Flyway Council
U.S. Fish and Wildlife Service
Canadian Wildlife Service

by the

Pacific Flyway Study Committee
Tundra Swan Subcommittee

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Approved by: _____ _____
Chair, Pacific Flyway Council Date

_____

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This management plan is one of a series of cooperatively developed plans for managing the various species of migratory birds of the Pacific Flyway. Inquiries about this plan may be directed to member states of the Pacific Flyway Council or to the Pacific Flyway Representative, U.S. Fish and Wildlife Service, 911 N.E. 11th Ave., Portland, OR 97232.

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PACIFIC FLYWAY MANAGEMENT PLAN FOR THE WESTERN POPULATION OF TUNDRA SWANS

I. INTRODUCTION

The purpose of this plan is to establish guidelines for the cooperative management of the Western Population (WP) of tundra swans (*Cygnus c. columbianus*). This document is a revision of the original flyway management plan for this population (Pacific Flyway Council 1983). It also incorporates revised provisions for harvest management that were formerly found in the separate 1989 Hunt Plan (Pacific Flyway Council 1989). Management of Eastern Population (EP) tundra swans, which migrates from northern Alaska across all four waterfowl flyways, is treated in a separate continental plan (Ad Hoc Eastern Population Tundra Swan Committee 1998).

The American Ornithologist's Union (1982) changed the common name of this species from *whistling* swan to *tundra* swan. North American tundra swans are delineated into two populations, based upon their largely separate breeding and wintering distributions (Figure 1). The Western Population breeds in western and northwestern Alaska and winters in the western United States and coastal British Columbia. The Eastern Population breeds from northern Alaska across the Canadian Arctic and winters on the Atlantic coast.

The number of WP swans recorded on the Pacific Flyway Midwinter Waterfowl Surveys has averaged about 55,300 birds over the long term (1949-2000) and 80,600 over the past 10 years (Appendix A). WP winter indices doubled during the 1950s, increased by 50% in the 1970s and 1980s, and began a steady significant increase in the 1990s (Figure 2). The population reached an all-time high of 122,521 swans in 1997 and nearly as many in 1999 (Appendix A). Historically, EP swans have been more numerous than WP swans, and began to increase significantly in the mid-1970s. The EP grew by 55% between the mid-1950s and the late 1990s and peaked at over 110,000 in 1992. Since then the EP has averaged about 90,000 swans and seems relatively stable or gradually declining. Overall, the combined number of EP and WP swans increased at an average annual rate of about 2.1% during the period 1955-89 (Serie and Bartonek 1991) and now comprise a record number of over 210,000 tundra swans in North America.

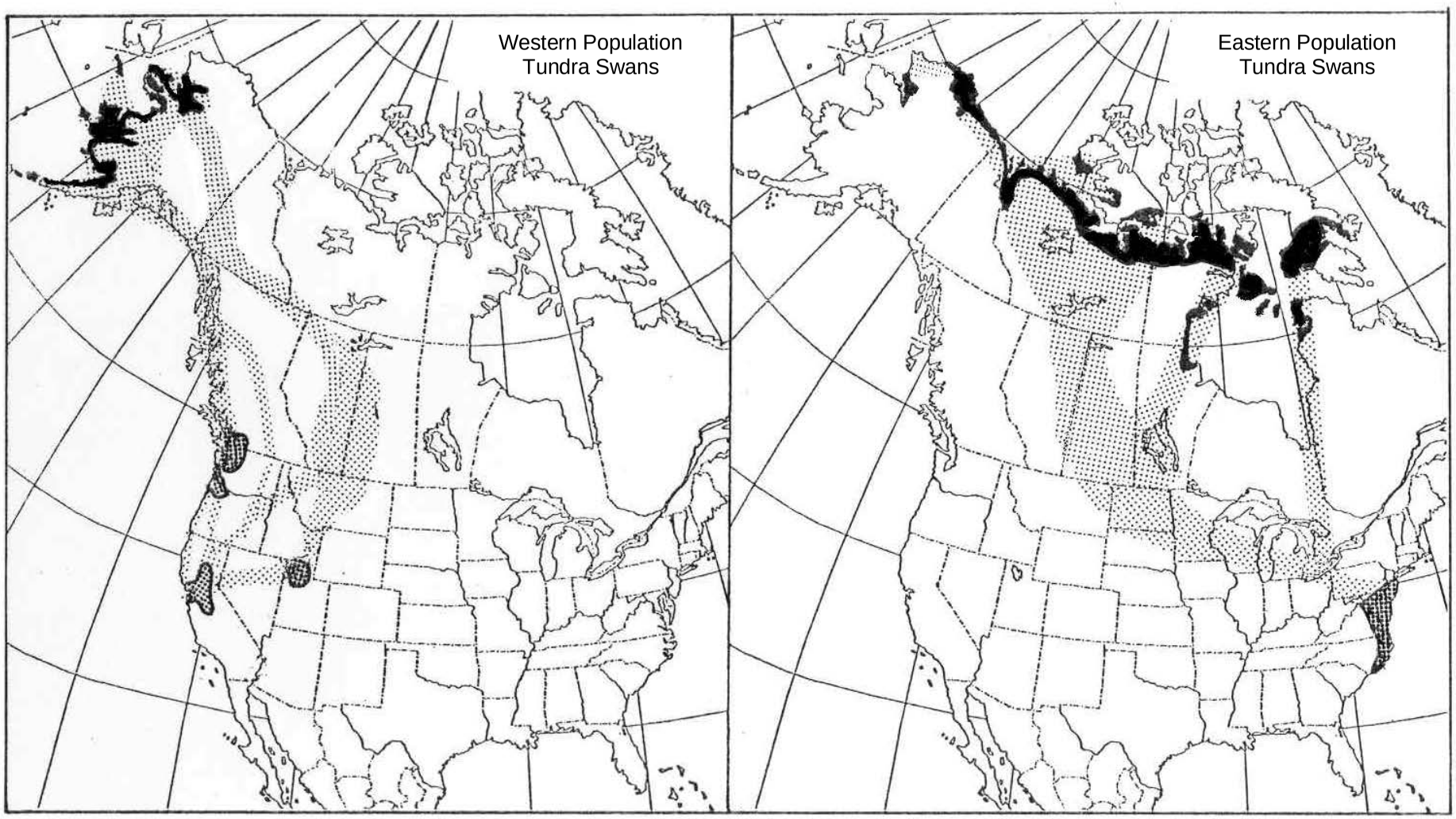

FIGURE 1. Range maps of Eastern and Western Populations of tundra swans.

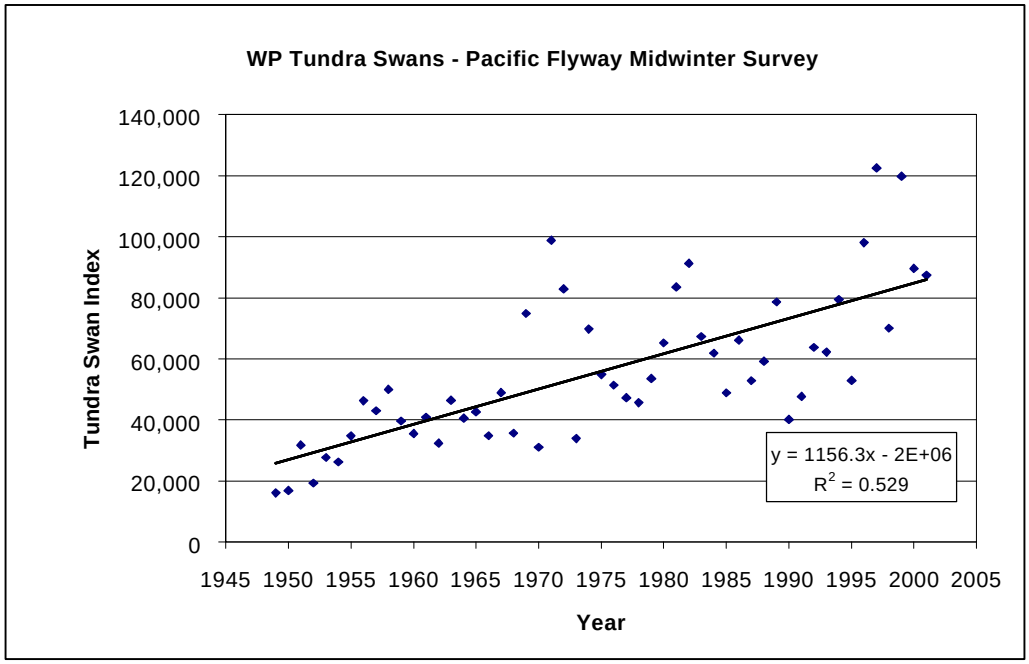

FIGURE 2. Population index of Western Population tundra swans measured by Pacific Flyway Midwinter Surveys 1949 - 2001.

II. GOAL AND OBJECTIVES

The goal of this plan is to ensure the maintenance of the Western Population of tundra swans at a size and distribution that will provide for all their benefits to society.

Objectives of this plan are to:

A. Maintain a population of at least 60,000 swans to provide suitable public benefits; this objective level is consistent with the WP tundra swan goal of the North American Waterfowl Management Plan (1998 Update) and average winter index since swan hunting was initiated in 1962. Hunting will be suspended if the population index falls below a minimum level of 40,000. These objective levels are measured as 3-year average indices from the Midwinter Waterfowl Survey. If the WP swan population increases to a size that causes habitat degradation, results in significant disease losses or poses threats to public health or safety, strategies to stabilize or reduce the population will be implemented.

B. Maintain current patterns of distribution throughout the WP tundra swan range;

C. Provide breeding, migration, and wintering habitats of sufficient quantity and quality to maintain the desired numbers and distribution of swans; and

D. Provide for aesthetic, educational, and scientific uses of swans.

E. Provide for sustainable sport and subsistence harvests of WP swans.

III. STATUS

Numbers and Distribution

Breeding Areas.

Tundra swans nest on lowlands along much of North America's subarctic and arctic coasts. Alaska's tundra swans belong to both the WP and EP populations. Swans from the North Slope constitute about 4% of tundra swans in Alaska, but they are EP birds that winter mainly in the Atlantic Flyway. WP individuals and family groups from northwest Alaska occasionally consort with EP swans or change flyways (Jensen 1971; Sladen 1973; Limpert et al. 1991; Moermond and Spindler 1997). Swans from the Seward Peninsula and Kotzebue Sound region, which collectively represent about 6% of Alaska tundra swans, are mostly WP swans. The WP swan breeding range (Figure 1) also includes Unimak Island in the easternmost Aleutian Islands, Kodiak Island, and the coast and islands of the eastern Bering Sea. Wilk (1988) estimated that 4000-4600 tundra swans inhabit the northern Alaska Peninsula. The majority of WP swans (76%) nest on the Yukon-Kuskokwim (Y-K) Delta.

WP swans have been counted since 1964 throughout much of their range in Alaska on strata 8-11 of the annual Alaska-Yukon Breeding Waterfowl Survey, conducted from late May through early June (King 1972). Indices of single + paired swans and total swans have increased each decade (Figure 3, Appendix B), consistent with the trend in midwinter counts. During the 1991-2000 period, an average of 115,700 tundra swans was estimated to be within the surveyed breeding areas (Conant et al. 2000, Appendix B), with perhaps another 4,000 to 5,000 tundra swans being in unsurveyed areas. Over the past 10 years, single and paired swans (potential breeding birds) averaged 61% of all observations, while the remaining 39% were in flocks containing both non- and failed-breeders (Figure 3).

Migration Routes

Knowledge of WP swan migrations has improved substantially because of neck-collaring (Sladen 1973; Limpert et al. 1991; Moermond and Spindler 1997) and radio telemetry (Spindler and Hall 1991; Ely et al. 1997) studies, but descriptions of some parts of migration routes and staging areas are incomplete.

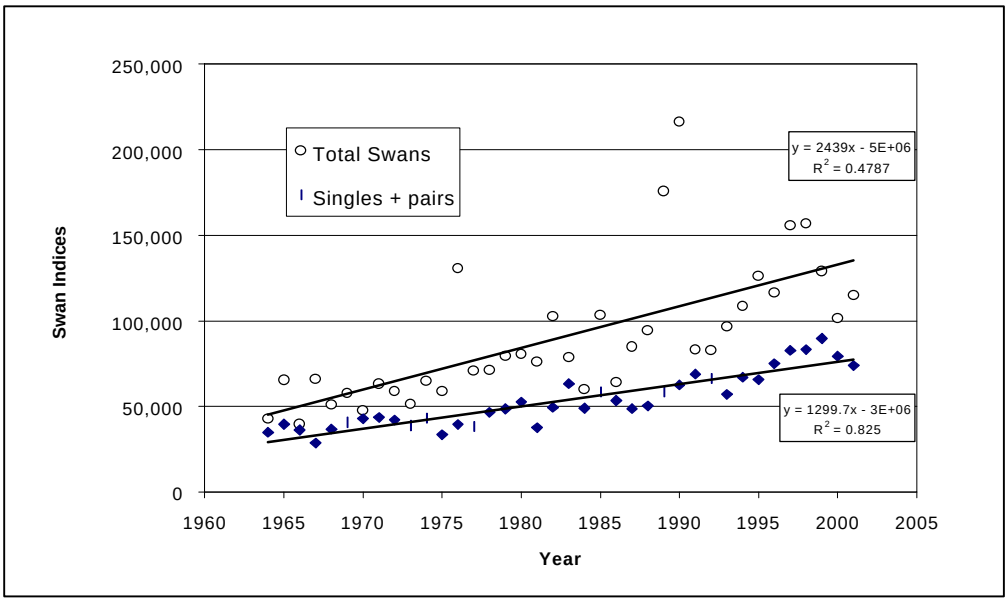

Figure 3. Indices of singles + pairs and total swans on strata 8-11 of the Alaska-Yukon Waterfowl Breeding Population Survey 1964-2001.

There are both interior and coastal corridors followed by WP swans migrating between Alaskan breeding grounds and wintering grounds further south in the Pacific Flyway. Most WP swans from western and northwestern Alaska use interior routes for migration, and the remainder migrates solely along the coast (Figure 1).

Tundra swans depart northwest Alaska breeding grounds in late September, moving southeast up the Tanana River Valley (Spindler and Hall 1991; Moermond and Spindler 1997). On a similar schedule, some swans from the Y-K Delta stopped briefly in Cook Inlet, then moved east on an inland route north of the Wrangell Mountains, also to the Tanana Valley (Ely et al. 1997). Swans cross into the Yukon during the first two weeks of October (Cooper and Ritchie 1988).

Coastal migrants, perhaps mostly from Bristol Bay and the Alaska Peninsula (Ely et al. 1997) travel through southcentral Alaska, with some stopping briefly in Cook Inlet and the Copper River Delta. They fly into southeastern Alaska where they split to follow coastal and interior routes. The larger group probably continues eastward into Alberta where it is joined by other Alaskan swans that have migrated through the interior and EP tundra swans from the Arctic Coast and Mackenzie River drainage. The smaller of the two groups that split in southeastern Alaska follows a coastal route with flocks terminating their migration and wintering from British Columbia southward to California.

Swans migrating from southern Alberta are believed to follow two primary corridors. One corridor leads to Freezeout Lake, Montana, then southward to the marshes of northern Utah and northwestern Nevada. Peaks in fall migration occur in late October

in Montana, mid- to late November in Utah and mid- to late December in Nevada. The migration is more protracted in Utah and Nevada than in Montana. Early freezing and storms usually decrease both the duration and magnitude of the flight stopping in Montana, with swans often overflying the state. Another more western route extends from southern Alberta across Idaho through Malheur Lake, the Willamette Valley and the Klamath Basin to the delta of the San Joaquin and Sacramento Rivers (Paullin and Kridler 1988). Swans migrating through interior British Columbia may also join this corridor in eastern Washington and Oregon.

In spring, fewer swans are believed to follow the coastal corridors than in fall. Departures from California may follow routes both eastward through Utah and Montana, and northeast through eastern Oregon and Idaho (Paullin and Kridler 1988; Ely et al. 1997). Although some spring migrants have been seen in northeast Montana and Saskatchewan, most are believed to move into southwest Alberta, then northwest to the Mackenzie River drainage and the Northwest Territories, then westward along a broad front across the Yukon Territories to interior Alaska. The peak of spring migration of swans into eastern Alaska (upper Tanana and Copper River drainages) is late April to the first week of May (Cooper and Ritchie 1988).

Wintering Areas

A unique group of about 600 WP swans breeds at the southern end of Alaska Peninsula and winters on Unimak Island and near Izembek Lagoon (J.E. Sarvis pers. communications). Marked individuals from this flock have been seen wintering some years in the southern portion of the flyway but remain during other winters on this easternmost Aleutian Island.

Some tundra swans winter in coastal areas from Southeast Alaska to San Francisco Bay. In northern areas, tundra swans usually winter with Pacific Coast Population trumpeter swans (*Cygnus buccinator*). About 300-500 tundra swans winter along the southern British Columbia coast with most of the Pacific Coast Trumpeter Swans. Other notable wintering areas include about 5,000 swans in Washington, mostly in the Skagit River Delta; up to 10,000 swans in Oregon along the Columbia River from the Columbia Basin to the mouth and in the southwestern part of the state.

The primary winter terminus of WP tundra swans has been the delta of the San Joaquin and Sacramento Rivers in California. When bypasses of the Sacramento River flood, swans move inland from the delta to use new habitats, even if only during the day and returning at night to the delta to roost (CDFG 1978). However, in recent years, swans have expanded into other parts of the Sacramento Valley where increasing acreage of flooded rice provides advantage. Swans are found at other localities throughout the Central Valley in winter and are less numerous in the southern portions of the state.

Tundra swans of the Western Population have wintered in all 11 Pacific Flyway states and in the province of British Columbia, but they are rarely reported in Mexico (Bartonek et al. 1981). Over the long-term, average winter distribution of WP swans

among 11 Pacific Flyway states (neither Alaska nor British Columbia are surveyed on a regular basis) has been: California 75%, Oregon 11%, Utah 6%, Washington 3%, and Nevada 5% (Appendix A). Idaho, western Montana, western Wyoming, and Arizona have occasionally recorded wintering tundra swans.

Variations in weather substantially affect the distribution of tundra swans during fall migration and winter. The abundance of fall and winter water in the west has a marked effect on annual distribution of tundra swans. The distribution of snow- and ice-free habitats also can significantly alter the phenology of migration and winter distribution of WP swans among Pacific Flyway states, particularly between Utah and California. During mild winters, Utah will harbor above-average numbers of swans, such as in January 1981 when 33,665 swans were counted (Appendix A).

In the mid-1980s, a rapid rise in the Great Salt Lake eliminated most marshes used by swan. This loss of habitat, combined with more frequent severe winters in the same timeframe, resulted in record low numbers of swans in Utah until the mid-1990s (Appendix A). During the same period, dry conditions in Nevada resulted in low numbers of wintering swans. Although California is always the principal winter terminus for WP swans, the annual abundance of winter water has a strong influence on the distribution of swans. During dry winters, swans aggregate in large numbers on reliable water bodies; during wet winters they are dispersed in smaller flocks.

The annual index used for managing the WP is derived from the coordinated Pacific Flyway Midwinter Waterfowl Survey (Appendix A). The accuracy of this survey for swans varies because of annual differences in weather-related phenology of late migration, prevalence of ice and snow, and the abundance of water in January. In addition, survey conditions may be degraded in wet winters when fog reduces visibility and cloud cover precludes complete aerial survey coverage. The most accurate indices of WP tundra swans are likely those from dry years when swans are concentrated in California. Because variable swan distributions and survey conditions produce substantial year-to-year vacillations in the January indices, most management guidelines for the population are based on 3-year moving averages of midwinter indices and long-term trends.

The Midwinter Waterfowl Survey has been conducted in 11 of the Pacific Flyway states since 1935, but only standardized and comparable after 1948. During the 1950s and 1960s, WP tundra swans averaged about 40,000 birds, and 10-year averages have increased in each subsequent decade (Appendix A). The calculated regression slope of winter counts indicated an annual increase of about 1,400 birds from 1948 to 1982 and an annual increase of about 4,000 birds during the period 1973-82. During the 1980s and 1990s, the population doubled in size to about 120,000 (Appendix A: see 1997, 1999).

Productivity, Production, and Juvenile Mortality

Population size, structure and productivity of WP tundra swans summering on the Yukon-Kuskokwim Delta has been measured since 1963 and reported by Lensink (1972), Dau (1981) and Bowman et al. (2000)(Appendix C). The number of nesting birds is more significant in determining annual production than clutch size, although both factors are related to weather. Recent ground surveys of random plots on the coastal zone of the Y-K Delta indicate an increasing trend in the number of tundra swan nests (Bowman et al. 2000; Appendix C). During 1991-2000, estimates of swan nests expanded to the coastal zone averaged 8,700, with peak numbers of 10,766 nests in 1996 and 13,647 nests in 1998. Clutch size of 427 nests during 1963-79 averaged 4.3 eggs (Dau 1981). During the past 10 years, clutch size averaged 4.03 on random plots in the Y-K Delta coastal zone (Bowman et al. 2000) and 4.7 at Kashunuk River (Babcock et al. in prep.). The historical low average clutch size was 3.3 eggs in 1971 and the high was 5.2 eggs in 1978.

Lensink (1972) observed and Dau (1981) reaffirmed that the average size of broods varied directly with the size of clutches. Wilk (1988) related larger brood sizes in Bristol Bay in the southern WP range to later nesting and decreasing average brood sizes in nesting areas farther north. Broods undergo attrition throughout the summer, especially during the first month, so that by migration they average between 60% and 70% of clutch size.

Fall and winter age composition surveys are conducted in Utah (Appendix D) and Washington (Appendix E) to annually monitor tundra swan productivity. The 1980-99 averages of 2.36 young/family in Utah and 2.35 young/family in Washington suggest summer-to-fall brood losses, including migration, are about 50% of clutch size. Bart et al. (1991) compared breeding ground brood sizes, age ratios during migration and age ratios in winter for EP tundra swans. They estimated that survival of young was 52% during their first migration and 76% thereafter during their first winter.

Information on age ratios from swan flocks in Utah and Washington during 1980-99 suggests that age structure is changing in the WP population. Age ratios have declined in Utah ($R=0.57$, $P<0.01$) and Washington ($R=0.68$, $P<0.01$) over the last 20 years, although the decline in Utah appears to be more recent. A decline in the proportion of young in fall counts is reflected in decreasing gray swans in the harvest (Appendix K). This trend in age ratios may be expected for a species with high survival rates and delayed maturity where adults and subadults comprise a large percentage of a growing population. It also may indicate that density dependence is being expressed in declining rates of territory occupancy, productivity or juvenile survival.

Non-hunting Mortality

Tundra swans exhibit strong nest defense and parental care behavior that mitigates the effects of predation on young, and survival rates increase markedly after fledging.

Migration takes a toll among first-year swans, but adult survival rates are generally high (Bart et al. 1991). Diseases, lead poisoning and collisions with structures are primary sources of mortality among subadult and adult swans, aside from hunting (Bartonek et al. 1991), but the distribution and magnitude of these losses is not well documented.

Lead poisoning from spent lead shot and fishing sinkers has been a well known source of mortality in swans (Friend et al. 1981; Blus et al. 1989). Between December 1981 and December 1988, lead poisoning was the major cause of death in 29% of 392 swan cases submitted to the National Wildlife Health Research Center (Bartonek et al. 1991).

Avian cholera has long affected wintering waterfowl in California, but it is an increasingly important cause of mortality among waterfowl in eastern Idaho and at Freezeout Lake, Montana. During six winters from 1975-76 through 1980-81, a total of 6,837 dead tundra swans were picked up on state management areas and National Wildlife Refuges in Region 1 of the USFWS. Most were either diagnosed or presumed attributable to avian cholera (C.T. Osugi pers. comm.). Over 1,000 swans died of cholera in California during the winters of 1974-75 and 1987-88 (Bartonek et al. 1991). Swans are also susceptible to botulism, coccidiosis and aspergillosis.

IV. PUBLIC USE AND MANAGEMENT

History of Swan Hunting

In the fall of 1962, Utah became the first state where tundra swans could be legally hunted since the enactment of the Migratory Bird Treaty Act of 1918. Utah initially issued 1,000 permits and interest in hunting swans has subsequently grown. Swan hunting was first authorized in parts of Nevada in 1969, the Pacific Flyway portion of Montana in 1970, and Alaska in 1988. In general, participation in swan hunting has been high; permit hunts in Pacific Flyway states rarely have been undersubscribed. Nationwide, swan hunting has expanded with additional seasons for Eastern Population tundra swans (Central Flyway portion of Montana 1983, North Carolina 1984, North Dakota and Virginia 1988, South Dakota 1990, and a standing authorization for New Jersey).

For many years, the Pacific Flyway states have worked with the USFWS, The Trumpeter Swan Society and other groups to both: (1) manage abundant and widely distributed WP tundra swans in the Pacific Flyway, maintaining optimal hunting opportunity, and (2) enhance the number and winter range distribution of RMP trumpeter swans (estimated at about 4,000 birds in winter 2000-01). The degree to which trumpeters are vulnerable to harvest in traditional tundra swan seasons has become a central issue in evaluating and planning trumpeter swan restoration efforts.

In August 1995, the USFWS issued a finding of No Significant Impact with regard to the Environmental Assessment: Proposal to establish general swan hunting seasons in parts of the Pacific Flyway for the 1995-99 seasons (Bartonek et al. 1995). Subsequent framework regulations established a 5-year experimental swan season in Montana, Utah and Nevada with the following provisions (see also Appendices F, G, H and K):

1. HARVEST QUOTA: A fixed quota was set for the entire term of the 5-year experiment. A quota of 20 trumpeter swans was annually divided between Utah and Nevada (15 to Utah and 5 to Nevada); achievement of the quota would trigger closure of swan seasons. The quota level was subject to annual review, including the reported and estimated take of trumpeter swans. Montana was not subject to a quota.

2. DESIGNATED AREAS OPEN TO SWAN HUNTING: Montana: Hunting remained open in Cascade, Hill, Liberty, and Toole Counties; Chouteau County was added; and those portions of Pondera and Teton Counties lying west of U.S. 287-89 were closed. Utah: The area open to hunting was reduced to the Great Salt Lake Basin (those portions of Box Elder, Weber, Davis, Salt Lake, and Tooele counties lying south of State Hwy 30 and I-80/84, west of I-15, and north of I-80). No changes were implemented to hunt areas in Nevada.

3. SEASON DATES AND LENGTH: (earlier season ending dates) Montana: Season ending date not later than December 1. Utah: Season ending date not later than the first Sunday in December. Nevada: Season ending date not later than the first Sunday following January 1.

4. TERM PERIOD: (5-Year Term) Swan harvests and monitoring programs were to be reviewed annually. In order to better evaluate the effects of the regulation packages on harvests of all swan species during potentially variable years, framework changes were to be minimal during a 5-year period, unless the Service deemed circumstances warranted change.

The 1995-1999 experimental swan hunt conditions required an evaluation of the results of the hunt. An evaluation report was completed in January 2000 (Trost et al. 2000). Primary conclusions by the USFWS were that continued swan hunting was justified in the Pacific Flyway because WP tundra swans are increasing and recent season frameworks did not present an impediment to growth and range expansion of RMP trumpeter swans (see below for documentation of trumpeter swans in the harvest, 1994-1999).

In early 2000, the USFWS issued a draft Supplemental Environmental Assessment (SEA) on the Continuation of General Swan Hunting Seasons in Parts of the Pacific Flyway and extensively sought comments from the public and public interest groups. A final SEA was issued on July 12 and a Finding of No Significant Impact was issued on

July 23. The Service opted to continue swan hunting regulations similar to the 1995-99 frameworks, with the following adjustments:

1. The area open to swan hunting in Utah was restricted to only that portion of the Salt Lake Basin that was open during the five-year experiment lying south of the northern boundary of the Bear River Migratory Bird Refuge.

2. The total number of Tundra swan permits authorized for the State of Utah was reduced from 2,750 to 2,000.

3. The Trumpeter swan season closure quota for Utah was reduced from 15 to 10.

4. Season dates in Utah will be extended one week (second Sunday in December) from frameworks in the 1995 Environmental Assessment.

5. Swan hunting seasons and conditions for Montana and Nevada during the 1995-99 experimental period were made operational in 2000.

6. Nevada and Utah are required to employ physical examination of harvested swans in any authorized seasons. Montana may use either physical examination or the bill-card measurement system (Drewien et al. 1999) to monitor the species composition of their harvest.

7. The states are encouraged to achieve the highest possible hunter compliance with permit conditions. USFWS intends to reduce subsequent-year tundra swan permit allocations by 10% if harvest reporting rates are less than 80%. Permit allocations will be restored if reporting rates are restored to 80%. Quotas, where applicable, will be based on actual reported harvests, but season decisions will take into account non-compliance and wounding loss rates.

Harvest Trends

Management of swan hunting through state-issued permits has provided relatively precise data on harvest and hunter activity in the Pacific Flyway. Appendices G-I show season dates and lengths, numbers of permits, hunter activity, and swan harvest for each state conducting swan hunts. Appendix J summarizes these data for the entire Pacific Flyway.

The number of swan permits issued in the Pacific Flyway has increased as the population allowed higher harvest and hunter interest grew. From 1,000 permits issued in 1962, the flyway total reached 3,000 by 1969 and continued nearly fully subscribed at 3,500 through 1987 (Figure 4). Permit applications usually exceeded 8,000 per year during 1970-82, including four years with over 10,000 applications. Swan harvest has shown a similar increase from approximately 400 birds annually in the early 1960's to over 1,300 by 1969. During the period 1970-81, when three states were authorized a

total of 3,500 permits annually, total harvest (including average wounding loss of 22%) averaged 1,500 swans per season, including the flyway's highest annual harvest of 1,996 swans in 1981 (Appendix J). After 1980, the numbers of permit applications and harvest declined (Appendix J).

The number of available swan permits was increased to 3,950 during 1988-92; 4,450 in 1993; 4,700 in 1995 and 5,000 since 1997. Since 1987, the total number of permit applications has increased, but the number issued has averaged 19% below the total number available in the flyway. In 1997 and 1998, about 77% of the flyway's 5,000 permits were issued.

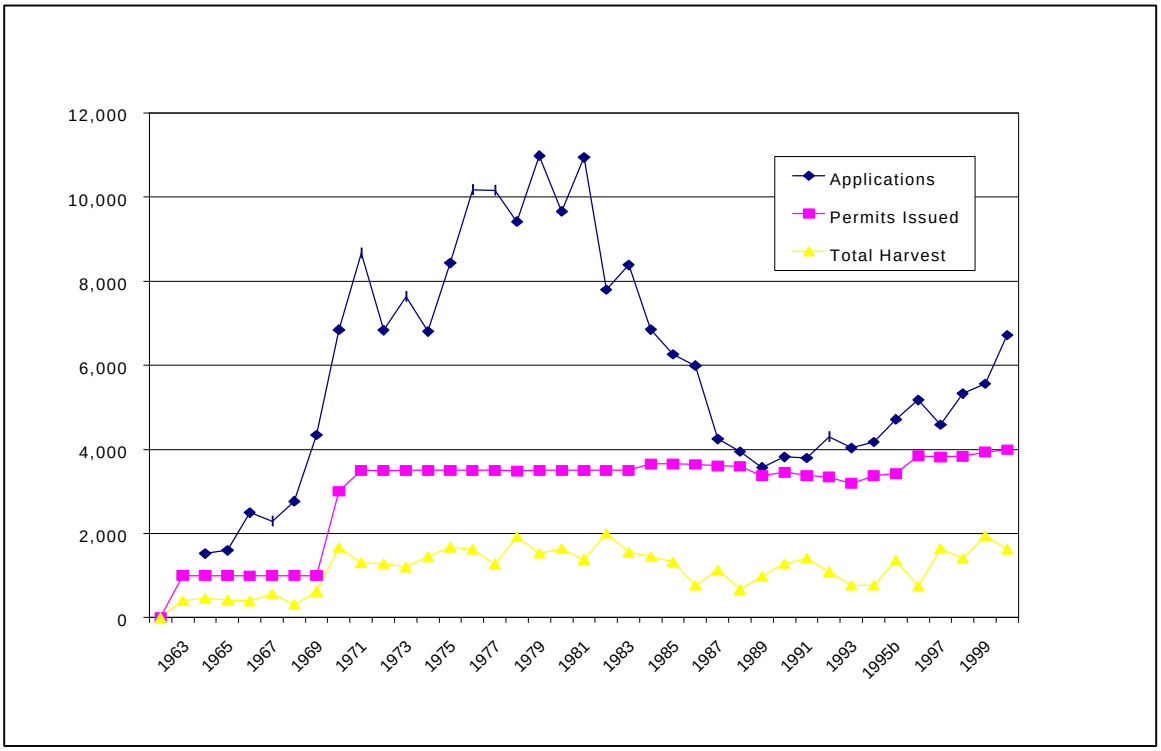

Figure 4. Swan permit applications, permits Issued and harvest in the Pacific Flyway.

The 10-year average flyway harvest during1986-95 was 1,021, about 31% below the previous 10-year period (Figure 4). Most of the decline was due to loss of hunting opportunity in Utah associated with flooding of the Great Salt Lake (GSL) marshes (Appendix F. During nearly the same period (1987-96), poor water conditions in Nevada resulted in declines of 52% in permit applications and 58% in swan harvest (Appendix G). As water levels receded in the GSL and habitat conditions improved in Nevada, interest in swan hunting renewed and permit applications rose in both states.

Since 1994, with 3-year average population indices over 60,000 swans and a harvest objective of 2,300 swans, total harvest has averaged 62% of the objective and ranged

from 33% in 1995 to 85% in 1998. With improved conditions in Utah and Nevada, the flyway harvest during 1996-99 has averaged 1,654 tundra swans.

Over the course of swan hunting in the Pacific Flyway, an average of 3,000 permits per year have been issued, over 11,000 hunter-days have been expended afield annually, and an average fall/winter harvest of nearly 1,000 swans has been sustained. On average, Pacific Flyway swan hunters invest about 4.4 days in the field annually, and about 35.9% have been successful. Success rates (proportions of permits filled) vary widely across the WP range, related to seasonal availability and abundance during hunt periods. In EP tundra swan seasons through 1992, 43% of hunters were successful, where most of the harvest is in North Carolina winter terminus areas (Ad Hoc Eastern Population Tundra Swan Committee 1998).

Age Composition in Harvest

The proportion of gray-plumage (young) birds in the Pacific Flyway harvest has ranged from 29 to 62% and averaged 40% over the long term (Figure 5; Appendix J). Because young swans in wintering areas generally comprise only about 20% of the population, they are being harvested at a greater rate than subadult and adult swans. The differential harvest results from younger birds that are less wary and more vulnerable to gunning than are older birds.

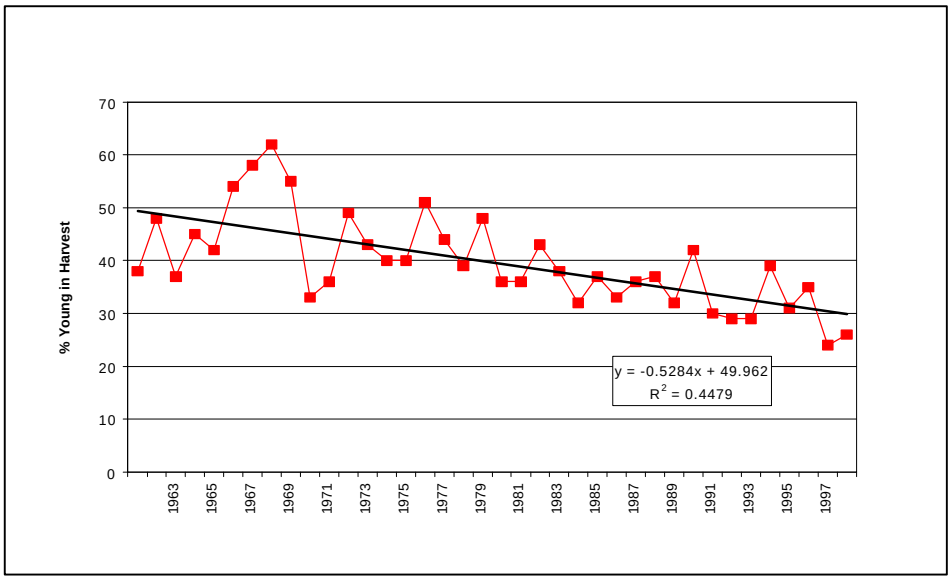

Figure 5. Proportion of young swans (gray plumage) in the Pacific Flyway swan harvest.

Harvest Monitoring and Occurrence of Trumpeter Swans in the Harvest

Band recovery data suggests that at least 3 trumpeter swans were illegally harvested in Pacific Flyway tundra swan seasons through 1994. Under a 5-year experimental general swan season supported by an Environmental Assessment (Bartonek et al. 1995), a limited take of trumpeter swans was authorized in Montana, Utah and Nevada in 1995. These states implemented a variety of methods to detect trumpeter swans in the harvest (Drewien et al. 1999). Thirty-three trumpeter swans were documented in the harvest, out of over 5,200 swans examined and a harvest of over 7,100 swans during 1994-99 (Appendix L).

Subsistence Harvest

Historical data on subsistence harvest of swans in Alaska is generally poor. The Alaska Department of Fish and Game, Subsistence Division, compiled data from village harvest surveys conducted in 151 communities during the 1980s (Wolfe et al. 1990). These data were gathered over an extensive period, with varying degrees of regional geographic coverage and detail in harvest data collection. Results were normalized to 1985 village populations, allowing a characterization of harvest level in the mid-1980s. This report estimated that about 6,900 swan were harvested in the WP tundra swan range, with over 90% from the Yukon-Kuskokwim region and 6% from the Seward Peninsula-Norton Sound region. Statewide harvest data were updated with the inclusion of recent village surveys in southwest and northwest Alaska, and adjusted to 1996 village population sizes (Paige and Wolfe 1998). The 1996 harvest estimate for the WP tundra swan range was 9,803 swans, with 92% on the Y-K Delta.

On the Yukon-Kuskokwim Delta, the primary WP breeding area, Klein (1966) reported that residents took about 5,600 swans in 1964. Copp and Smith (1981) estimated the spring-summer harvest in this same region to be about 2,600 swans, with additional fall harvest occurring. Village household surveys have been conducted regularly on the Y-K Delta since 1985 (Wentworth and Seim 1996; Wentworth 1998; Wentworth and Andrew 1999; Wentworth 2000). During this period, the 15-year average harvest has been 6,077 swans, with the highest estimate of 9,529 swans in 1995 (Figure 6; Appendix K). The moderately increasing long-term trend in regional harvest has a slope more gradual than the indicated increase in the population (Figures 2 and 3), but harvest has been declining in the past five years. From 1987 to 1997, average seasonal distribution of swan harvest was 50.4% in spring, 22.5% in summer and 27.1% in fall (Wentworth 1998). The average annual harvest of swan eggs has been 699, ranging from 185 to 1,379 (Appendix K).

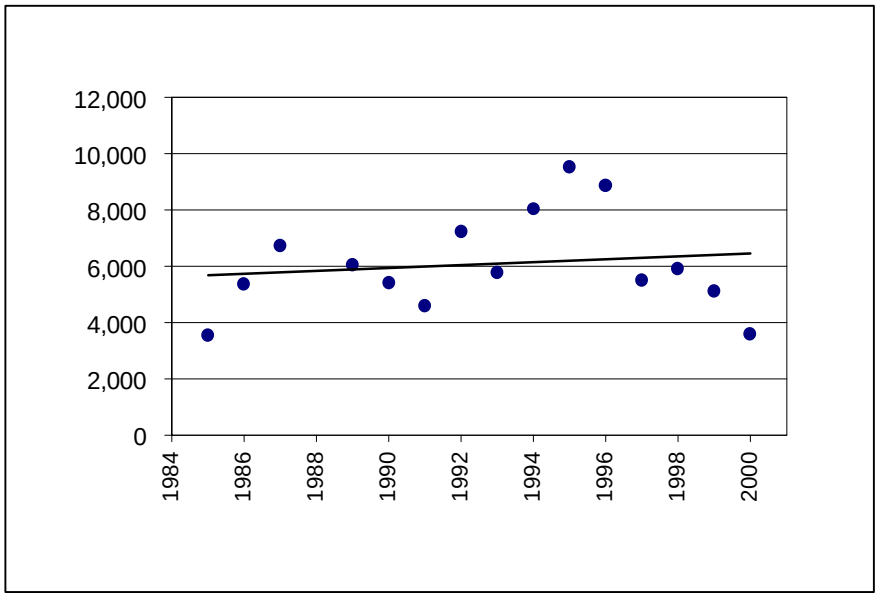

Figure 6. Subsistence harvest of WP tundra swans on the Yukon-Kuskokwim Delta.

Recent waterfowl subsistence surveys have been undertaken in other parts of the WP range (Seim and Wentworth 1996; Wentworth 2000). Cooperative harvest surveys have been conducted since 1995 in 26 communities within the Bristol Bay region (Wong and Wentworth 1999). The results indicate an average annual swan harvest of about 390 swans, most from villages in Togiak NWR, and low numbers of eggs (Appendix K). Results from household surveys in 15 Bering Strait and St. Lawrence Island communities over the period 1989-95 indicated a harvest level of about 458 tundra swans per year in the mid-1990s, with 21% taken in spring and 73% taken in fall (Paige et al. 1996). About 101 swan eggs were taken in the region, only by mainland villages.

Harvest in Relation to Population Size

During the 15 seasons immediately prior to regulated swan hunting (1947-61), the midwinter population of WP swans averaged about 32,000 birds and was increasing at 1,762 birds indicated by regression analysis (Bartonek et al. 198lb). After permit hunting was initiated in 1962, the population continued to increase through 1980, but at a slower rate, averaging 972 swans per year. The difference in average annual increase between these periods was 1,313 swans per year. The fact that this difference was close to the average annual permit harvest (1,157 birds) suggests that hunting may have been a factor influencing the WP swan population.

Subsistence harvest has been recognized in the Pacific Flyway management regime, and all available data are used in assessing harvest effects on the population. The respective consequences of subsistence harvest and fall/winter harvest are different,

but harvest composition is poorly documented for subsistence hunts. Spring and summer hunting may take higher proportions of adult breeding birds than fall/winter hunts that probably include more vulnerable young of the year and subadults. Although swan harvest increased on the Y-K Delta during the mid-1990s, there is no continuing upward trend.

If subsistence harvest in Alaska totals 8,000-10,000 swans and eggs, and fall/winter permit hunts add a harvest of 1,200 - 1,500 swans, the annual harvest of WP tundra swans may be as high as 11,500. This equates to a harvest rate of about 10-12% over the past five years. During the period of WP growth in the 1990s, harvest has had less apparent effect on the population than during the 1960s through the 1980s.

The close relationship between changes in harvest and swan population response is not surprising, considering the life history characteristics of swans (delayed maturation, high adult survival rates, low annual productivity). Similar to the case with large races of Canada geese, the high rate of adult survival in swans leaves little room for compensation effects between hunting and natural mortality. Therefore, hunting mortality of swans is considered largely additive, warranting conservative harvest management and vigilant monitoring programs.

Nonconsumptive Uses

Swans, being large, conspicuous, and long-lived, serve as ideal subjects for scientific investigations. In the 1970s, the nongovernmental Swan Research Group of the International Waterfowl Research Bureau fostered an international banding and marking program for swans that significantly influenced research and management of swans in North America and elsewhere. This work was extended by the Wildfowl Trust of North American (Grasonville, MD) and Environmental Studies at Airlie (Warrenton, VA). In addition, for many years The Trumpeter Swan Society has produced and contributed to a wide variety of science, education and management programs for both tundra and trumpeter swans.

Neck-collaring of both tundra and trumpeter swans has aroused interest in "swan watching" and swan photography among the general public. Some nonprofessional volunteers make significant numbers of sightings of marked swans, which contribute toward a better understanding of site fidelity, migration and survival of swans. Swans also lend themselves to being the focal point of classroom studies on marsh ecology, migratory birds, and animal behavior. Recent satellite telemetry studies of EP and WP tundra swans have stimulated great interest in swan migration and ecology by the public and schools, especially through widely accessible Internet sites.

Management Activities

A majority of WP tundra swans are inventoried twice annually, i.e. the Midwinter Waterfowl Survey conducted in January in all portions of the Pacific Flyway, except

Alaska and Canada, and the Breeding Waterfowl Survey conducted from mid-May through early June over much of the swan's breeding range. Additionally, measures of productivity are taken of nesting WP swans at selected sites on the Yukon-Kuskokwim Delta, Izembek Lagoon, and during winter in Washington and Utah. Information collected on harvest and hunter participation in Alaska, Montana, Utah, and Nevada is thorough and sufficient to document the effects of harvest and hunting regulations.

V. PROBLEMS

1. Subsistence harvest of WP swans in western Alaska during spring and fall has been largely outside legal frameworks. It has been difficult to determine the magnitude and trends in this harvest. Amendments to international treaties, executed in 1999, provide legal recognition of subsistence hunting and opportunities to establish effective harvest regulation and assessment programs.

2. There is a need to maintain and expand data collection on vital rates of the WP swans. Recently, there have been measures of clutch size, but data on nest success and recruitment are incomplete. Age ratio data from migration areas are the primary measure of recruitment. There have not been comprehensive studies of WP survival rates. Additional data are needed on the composition of harvest (especially subsistence) and non-hunting mortality to more thoroughly understand factors that control population size.

3. Petroleum and mineral exploration and development, with associated infrastructure and transportation hazards, have the greatest potential for limiting productivity of breeding swans in western and northwest Alaska.

4. Depredations by swans on winter grains and grass, and compaction of soil in tilled fields have occurred mainly in British Columbia. Field feeding by swans has also been observed in other areas of the Pacific Flyway, but it is not believed to be either a widespread phenomenon or causing major problems. EP swans have depredated commercial soft-shell clam beds and have developed a tradition for field feeding which has caused some crop damage complaints in Maryland, Virginia, and North Carolina (Munro 1981).

5. In many portions of the Pacific Flyway, there is insufficient public interest or support to offer hunting seasons on tundra swans. In most western states, tundra swans may seasonally occur in the same areas as either resident or migrant populations of trumpeter swans. Currently, RMP trumpeter swans are increasing, and there is a need to improve their security through winter range expansion. Successful management for the array of objectives for both swan populations requires improved understanding of interspecific differences in behavior, habitat selection, competition, and vulnerability to harvest in areas where both species occur during swan hunting seasons.

VII. RECOMMENDED MANAGEMENT PROCEDURES

The following management procedures are recommended. The degree and timing of their implementation by the responsible agencies will be subject to staffing, budgetary, and legislative constraints beyond the scope of this plan. Whenever possible, management procedures in this plan should be coordinated and consistent with those for other populations of Pacific Flyway birds, particularly those for RMP and Pacific Coast trumpeter Swans.

Habitat Protection

1. Habitats of WP swans are well known, but uses of areas by particular flocks are not well defined. Breeding areas in Alaska are largely within National Wildlife Refuges, State Special Areas and on lands controlled by Alaska Native regional corporations. In breeding areas, particular attention should be directed towards minimizing disturbance from people, vehicles, and aircraft during the critical nesting period.

   Migration staging areas in Montana, Utah, Nevada, Oregon, and California are mostly on State-managed wildlife areas or National Wildlife Refuges. WP swans generally winter on state and federal wildlife areas, but there has been increasingly substantial use of private agricultural land in California's Central Valley. For the most part, swans use lands where wildlife is already recognized as being an important, if not the most important, resource being managed. Therefore, these lands should continue to be managed for waterfowl in general with consideration being given to swans and those other waterfowl species that are more dependent upon natural wetlands than agricultural areas.

   In areas, of swan concentrations, primarily in migration corridors and on the wintering grounds, efforts should be made to avoid and minimize losses from collisions with towers, transmission lines and aircraft traffic. This should be accomplished through impact assessments of proposed utility and airport projects, informed land use planning and appropriate regulatory measures in permitting processes.

Lead Agencies:	States, Provinces, USFWS, CWS
Priority:	1
Schedule:	Ongoing

Inventory and Monitoring

1. Record and compile indices of singles + pairs and total WP tundra swans on the Alaska-Yukon Waterfowl Breeding Population Survey strata 8-11.

Lead Agency: USFWS - Region 7
Priority: 1
Schedule: Ongoing

2. Compile an index of WP tundra swans during Pacific Flyway Midwinter Waterfowl Surveys, conducted in January.

Lead Agencies: All states (except Alaska), USFWS - DMBM
Priority: 1
Schedule: Ongoing

3. Conduct periodic breeding pair, nest and productivity aerial surveys on Yukon Delta NWR and other important WP breeding areas (Selawik, Togiak and Alaska Peninsula NWRs).

Lead Agency: USFWS - Region 7
Priority: 2
Schedule: Ongoing

4. Estimate annual production through family group counts in Utah and Washington.

Lead Agencies: UDWR, WDFW
Priority: 2
Schedule: Ongoing

General Public Use

1. Outreach Programs. The Subcommittee on WP tundra swans will encourage and assist in producing materials in printed, pictorial, Internet and other forms on identification, life history and conservation of Pacific Flyway swans. Agencies and cooperators should develop opportunities to incorporate education about swans into interpretive facilities, school curriculum materials, hunter information products and other public sources of information.

Lead Agencies: States and Provinces, USFWS, CWS
Participating: The Trumpeter Swan Society, other NGOs
Priority: 2
Schedule: Ongoing

2. Propagation.--Aviculturists and scientists frequently request and obtain tundra swans for display and research projects. Eggs, cygnets, and adults should continue to be made available to fulfill the *bona fide* needs of these users. Requests for swans to be taken from the wild should be reviewed and approved by the Pacific Flyway Council, subject to respective permitting authorities and

with concurrence from recipient jurisdictions. Stipulations should be placed upon disposition of swans if they no longer are needed. To prevent creation of nuisances and risk of disease transmission, swans that have been in captivity should not be released back to the wild.

Lead Agencies:	USFWS, CWS, States and Provinces
Priority:	2
Schedule:	Ongoing

Harvest Management

Continuation of swan hunting, which provides both recreation and sustenance, is an objective of this plan. Currently, all authorized swan seasons are closely managed through issuance of hunting permits. Not all states share in swan hunting opportunity because social, political, and/or biological circumstances preclude it in some regions. In consideration of these circumstances and flexibility for future harvest programs, hunting of WP tundra swans will be managed according to the following guidelines:

1. Management of Subsistence Harvest in Alaska

U.S. domestic implementation guidance for amendments to the migratory bird treaties with Canada and Mexico provides a mechanism for involving Alaska subsistence hunters in management of migratory birds and developing regulations for spring and summer hunting. This process also will establish programs to improve information and education exchange, harvest assessment and hunter compliance. The Pacific Flyway Council will participate and assist in this cooperative process to improve management of WP swans and other migratory bird populations.

Lead Agencies:	Alaska Migratory Bird Co-management Council, USFWS and Alaska
Participating:	Pacific Flyway Council, CWS and Provinces
Priority:	1
Schedule:	Ongoing

2. Harvest Objectives and Distribution

a. Pacific Flyway harvest objectives are to provide hunting opportunities commensurate with sustaining the WP at or above population objective levels and to maintain relatively stable hunt regimes. Management of harvest levels is based on the following guidelines: (1) the overall estimated harvest rate for WP tundra swans should not exceed 10%; (2) Alaska subsistence harvest, including eggs, is assumed to be about 5% of the population; (3) a wounding loss rate of 20% is applied to all harvests; (4) the number of available permits is based on a historical permit success rate of 36% applied to allowable harvest.

There are many factors, other than biological capacity of the population, that constrain swan hunting in the Pacific Flyway, including the wishes of the public in individual jurisdictions, management of other waterfowl species and implementation of efforts to maintain and restore trumpeter swans. Maximum harvest levels and numbers of permits that could be available relative to the size of the population may be estimated with the following formula:

Population Index =	(3-year average of Singles + Pairs Index) X 2
Maximum Total Harvest =	PI X 0.10
Maximum Retrieved Harvest =	MTH X 0.8
Maximum Permit Harvest =	MRH – Subsistence
Maximum Permits Available =	MPH X 2.7

b. WP swan permits will be allocated among states, provinces and territories to maintain traditional hunting opportunity throughout the range and equitably distribute harvest among all participating jurisdictions. The current number of permits available is well within the biologically sustainable limits. At present, social, political, and legal considerations currently constrain the number of authorized permits. Therefore, an annual allocation process is not necessary at this time. The Pacific Flyway will consider new hunts or expansions of existing hunts on an as needed basis.

3. Hunt Program Procedures

The following guidelines will apply to all states/provinces participating in a WP tundra swan hunt.

a. Daily bag limits will be one bird; up to three swans per season may be allowed per hunter under single or sequential permits.

b. Swan season selections must fall within duck and/or goose season framework dates.

c. All swan hunters must possess a non-transferable permit issued by the state or province; fees may be charged at the discretion of the agency.

d. States will issue non-reusable tags to be validated by permittees and attached to the swan upon harvest.

e. States must survey hunters for harvest and hunt activity data, and ensure adequate reporting rates.

4. Harvest Monitoring

a. Education products should be made available to hunters on swan management, the occurrence of trumpeter swans in hunt areas and identification criteria,

harvest reporting requirements, and efficient methods of harvest and retrieval of swans.

b. Data will be compiled on the composition of tundra and trumpeter swans in the harvest by:

   Utah and Nevada: Requiring hunters to document harvested swans at check stations or by providing swan parts.

   Montana: Check station inspection, parts collection or providing all hunters with a bill measurement card and requiring that culmen measurements and swan color (age) be reported.

c. After each hunt is conducted, the responsible agency will provide the following information to the tundra swan subcommittee for compilation into an annual flyway report: (a) number of applications received for permits; (b) number of permits issued; (c) percent of permittees that actively hunted; (d) estimated number of hunter-days afield; (e) estimated retrieved harvest; (f) estimated unretrieved/ lost swans; and (g) percent gray (immature) swans in the harvest.

d. Estimates of the magnitude and distribution of subsistence harvest in Alaska should be obtained to monitor harvest distribution and total harvest rate for the WP.

e. All swan hunters will be required to report harvest to agency personnel within five days of the date of kill by methodologies developed by the administering agency.

5. Procedures for New Hunt Proposals

a. Prior to requesting a new tundra swan hunt, the state/province must submit a hunt plan proposal to the Study Committee at least 30 days prior to the flyway technical meeting at which approval is sought. Hunt proposals must include: (a) description of hunt area boundaries; (b) a summary of numbers of swans, species composition and seasonal use patterns in the proposed hunt area; (c) number of permits requested; (d) anticipated harvest; (e) season length and dates; (f) description of the permit process; and (g) proposed methods for obtaining reliable data on harvest and hunter activity.

b. States initiating first-time swan hunting seasons or proposing major changes in harvests or hunt areas are encouraged to obtain adequate public participation before proposals are brought before the Pacific Flyway Study Committee and Council.

c. Hunt areas should be designed to minimize (not preclude) the chance killing of trumpeter swans; where conflicts arise, both the WP Tundra Swan and PCP or

RMP Trumpeter Swan Subcommittees will resolve problems and revise management plans as necessary to guide future actions. However, there may be additional federal requirements to assess potential impacts on trumpeter swans before new seasons or hunt areas are authorized.

d. New hunts will be considered experimental for a period of three years, after which an evaluation for operational status will be conducted.

Lead Agencies:	USFWS and CWS
Participating:	States and Provinces
Priority:	1
Schedule:	Ongoing

Research

The following research topics have been identified for the population during the term of this plan. Member agencies will seek opportunities to interest cooperators in development of relevant studies and identifying sources of funding to accomplish the work.

1. Population Modeling. Modeling of tundra swan populations, taking into consideration both nonhunting and hunting mortalities is desirable so that the consequences of various management strategies can be evaluated.

2. Disease Ecology. Disease mortality among swans on migration and wintering areas may contribute significantly to overall mortality of swans in some years. Emphasis should be directed towards detecting avian cholera and applying methods to minimize losses from this disease. The prevalence of lead poisoning should be determined.

3. Population Delineation. Additional color-marking or telemetry, with observation of marked birds on migration and in wintering areas are needed to determine if the WP is composed of subpopulations with different population dynamics. Particular attention should be given to WP swans that winter on Unimak Island and those breeding along the Alaska Peninsula.

Annual Review of Plan

The Subcommittee shall meet at least annually or as needed to review progress toward achieving the goal and objectives of this plan and to recommend revisions. The Subcommittee shall report accomplishments and shortcomings of cooperative efforts to the Pacific Flyway Council through the Pacific Flyway Study Committee; to those state, provincial, and federal agencies having management responsibilities; and to agencies and organizations either interested or cooperating in the management of swans. In addition, the Subcommittee shall ensure that its plans and activities are coordinated with those of other swan subcommittees.

Composition of the Subcommittee should be comprised of, but not limited to, representatives from those state, provincial, and federal agencies having management responsibility for this population. These member agencies are responsible for coordinating and integrating the objectives and procedures of this plan with resource and land management agencies, and public interest groups within their jurisdictions.

Lead Agency:	Subcommittee
Priority:	1
Schedule:	Twice annually (March and July)

Chairmanship is rotated biannually among members, beginning October 1:

Idaho	1999
Montana	2001
Nevada	2003
Oregon	2005
Utah	2007
USFWS Region 6	2009
Washington	2011
Alaska	2013
California	2015

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APPENDICES

APPENDIX A. Indices of tundra swans counted on Pacific Flyway Midwinter Waterfowl Surveys.

	State											Flyway	3-year
Year	Arizona	California	Idaho	Montana	Nevada	Oregon	Utah	Washington	Wyoming	Colorado	New Mexico	Total	Average
1949	40	15,051	72	0	207	636	5	55				16,066	
1950	12	12,729	70	0	2,645	668	623	82				16,829	
1951	2	17,041	119	0	2,821	548	11,145	11				31,687	21,527
1952	35	17,162	47	0	850	556	360	210				19,220	22,579
1953	4	20,226	103	0	5,451	1,293	429	168				27,674	26,194
1954	9	13,773	102	0	7,209	3,275	1,632	206				26,206	24,367
1955	2	25,397	134	0	5,167	1,907	1,443	675				34,725	29,535
1956	35	28,679	1	0	1,927	7,464	7,980	196				46,282	35,738
1957	53	23,263	226	0	13,202	3,979	1,915	332		0		42,970	41,326
1958	10	28,322	110	0	10,227	5,755	4,515	1,007				49,946	46,399
1959	23	20,590	230	1	9,847	4,405	3,464	1,040		0		39,600	44,172
1960	43	29,427	156	4	619	3,716	934	606	3	0	0	35,508	41,685
1961	38	32,232	110	41	455	5,741	1,492	719	0	0	0	40,828	38,645
1962	20	23,460	208	11	1,068	4,880	1,266	1,443	0	0	0	32,356	36,231
1963	4	21,820	728	9	1,568	4,375	16,398	1,434	14	0	0	46,350	39,845
1964	16	27,031	164	5	4,324	6,828	795	1,379	0	0	3	40,545	39,750
1965	2	25,949	127	6	8,055	4,235	3,624	651	0	0	0	42,649	43,181
1966	0	18,705	303	2	7,966	4,349	2,379	1,100	0	0	0	34,804	39,333
1967	16	35,907	246	4	5,231	5,823	864	855	0	0	0	48,946	42,133
1968	8	25,969	27	9	267	7,703	287	1,360	0	0	0	35,630	39,793
1969	6	66,195	69	22	2,005	3,694	1,394	1,491	3	0	0	74,879	53,152
1970	6	21,890	200	3	3,758	2,945	1,577	620	0	1	0	31,000	47,170
1971	4	91,824	143	12	619	4,508	276	1,470	0	0	0	98,856	68,245
1972	2	74,528	93	16	333	6,204	269	1,402	0	0	0	82,847	70,901
1973	0	27,628	27	27	99	5,285	191	660	0	0	0	33,917	71,873
1974	4	61,542	110	13	679	4,951	1,094	1,332	43	0	0	69,768	62,177
1975	0	45,987	100	39	315	6,451	130	1,850	0	0	0	54,872	52,852
1976	0	40,675	204	5	2,682	6,067	375	1,342	0	0	0	51,350	58,663
1977	0	37,920	139	20	1,117	6,418	254	1,401	0	0	0	47,269	51,164
1978	0	28,960	224	59	405	8,943	4,816	2,190	0	0	0	45,597	48,072
1979	0	47,730	214	1	205	3,917	33	1,423		0	0	53,523	48,796
1980	0	37,295	82	8	6,240	15,271	4,276	2,037		0	0	65,209	54,776
1981	0	34,945	253	84	5,117	5,292	33,665	4,197		0	0	83,553	67,428
1982	0	79,295	261	14	1,045	4,391	3,402	2,906	0	0	0	91,314	80,025
1983	7	54,860	112	22	2,791	3,752	5,425	333	0	0	0	67,302	80,723
1984	0	47,945	184	12	2,372	4,779	5,604	965	12	0	0	61,873	73,496
1985	1	39,500	101	139	1,575	4,769	69	2,619	25	0	0	48,798	59,324
1986	2	55,417	121	0	232	6,682	46	3,647	10	0	0	66,157	58,943
1987	0	30,208	228	3	10,742	9,535	99	1,948	35	0	0	52,798	55,918
1988	0	50,527	49	155	31	4,738	12	3,661	19	1	0	59,193	59,383
1989	0	68,482	242	178	92	7,511	38	2,101	28	1	0	78,673	63,555
1990	0	30,008	278	149	630	7,955	68	939	24	1	0	40,052	59,306
1991	0	38,616	55	1	206	6,436	56	2,248	0	0	0	47,618	55,448
1992	0	45,119	137	277	321	14,571	103	3,209	0	0	0	63,737	50,469
1993	0	52,632	5	328	284	7,868	202	883	0	0	0	62,202	57,852
1994	0	66,301	56	293	1,266	7,228	1,646	2,616	0	0	0	79,406	68,448
1995	0	37,096	167	258	2,120	6,779	5,190	1,332	0	0	0	52,942	61,181
1996	0	66,817	148	94	1,573	8,046	16,988	4,398	0	0	0	98,064	76,804
1997	0	93,696	154	2	2,451	14,562	8,445	3,211	0	0	0	122,521	91,176
1998	32	49,521	85	85	4,804	8,699	3,398	3,424	0	0	0	70,048	96,878
1999	14	103,946	110	89	627	9,038	3,151	2,802	0	0	0	119,777	104,115
2000	0	63,026	220	331	5,916	3,409	12,378	4,342	0	0	0	89,622	93,149
2001	0	65,511	174	113	4,584	9,918	2,430	4,597	0	0	0	87,327	98,909
2002	0	47,432	205	240	981	5,157	2,130	2,521	9	0	0	58,675	78,541
Avg:													
1949-59	20	20,203	110	0	5,414	2,771	3,046	362	n/d	0	n/d	31,928	32,426
1960-69	15	30,670	214	11	3,156	5,134	2,943	1,104	2	0	0	43,250	41,375
1970-79	2	47,868	145	20	1,021	5,569	902	1,369	5	0	0	56,900	57,991
1980-89	1	49,847	163	62	3,024	6,672	5,264	2,441	16	0	0	67,487	65,357
1990-99	5	58,375	120	158	1,428	9,118	3,925	2,506	2	0	0	75,637	72,168
All yrs	8	41,959	152	59	2,913	5,813	3,348	1,660	6	0	0	55,918	56,372
% of PF:													
All yrs	0.0%	75.0%	0.3%	0.1%	5.2%	10.4%	6.0%	3.0%	0.0%	0.0%	0.0%		
1990s	0.0%	77.2%	0.2%	0.2%	1.9%	12.1%	5.2%	3.3%	0.0%	0.0%	0.0%		

APPENDIX B. Indices of Western Population tundra swan breeding population from the Alaska-Yukon Breeding Waterfowl Survey (strata 8-11).

Year	Singles + Pairs	% Single & Pair	In Flocks	Total Swans
1964	34,900	81.4%	8,000	42,900
1965	39,700	60.7%	25,700	65,400
1966	36,300	91.4%	3,400	39,700
1967	28,600	43.3%	37,400	66,000
1968	36,700	71.7%	14,500	51,200
1969	40,800	70.6%	17,000	57,800
1970	42,900	89.7%	4,900	47,800
1971	43,600	69.0%	19,600	63,200
1972	42,200	71.8%	16,600	58,800
1973	38,900	75.7%	12,500	51,400
1974	43,100	66.3%	21,900	65,000
1975	33,500	56.9%	25,400	58,900
1976	39,500	30.2%	91,100	130,600
1977	38,200	53.9%	32,700	70,900
1978	46,600	65.4%	24,700	71,300
1979	48,600	61.3%	30,700	79,300
1980	52,500	65.2%	28,000	80,500
1981	37,700	49.6%	38,300	76,000
1982	49,500	48.2%	53,100	102,600
1983	63,300	80.4%	15,400	78,700
1984	49,000	81.7%	11,000	60,000
1985	58,400	56.4%	45,100	103,500
1986	53,500	83.5%	10,600	64,100
1987	48,700	57.4%	36,200	84,900
1988	50,300	53.2%	44,200	94,500
1989	58,400	33.2%	117,400	175,800
1990	62,600	28.9%	153,800	216,400
1991	69,000	82.9%	14,200	83,200
1992	66,400	80.1%	16,500	82,900
1993	57,000	58.9%	39,700	96,700
1994	67,100	61.7%	41,600	108,700
1995	65,700	52.0%	60,600	126,300
1996	75,000	64.4%	41,500	116,500
1997	82,700	53.1%	72,900	155,600
1998	83,200	53.0%	73,700	156,900
1999	89,800	69.6%	39,200	129,000
2000	79,300	78.1%	22,200	101,500
2001	74,000	64.3%	41,000	115,000
2002	80,400	69.9%	34,700	115,100
Averages:				
All Years	54,041	63.7%	36,846	90,887
1964-69	36,167	69.8%	17,667	53,833
1970-79	41,710	64.0%	28,010	69,720
1980-89	52,130	60.9%	39,930	92,060
1990-00	73,246	62.9%	50,123	123,369

APPENDIX C. Productivity data for Western Population tundra swans from the breeding grounds.

	Yukon-Kuskokwim Delta		
Year	Y-K Coast Nests[a]	Avg Clutch[b]	Avg Brood[c]
1962			
1963		4.3	2.9
1964		3.3	2.4
1965		4.3	2.7
1966		4.1	2.7
1967		4.9	3.0
1968		4.8	3.6
1969		4.7	3.5
1970		4.5	3.3
1971		3.3	2.5
1972		3.5	2.6
1973		4.3	3.1
1974		4.3	3.1
1975		3.4	3.3
1976			3.2
1977			2.8
1978		5.2	2.7
1979		4.6	3.0
1980			
1981			
1982			
1983			
1984			
1985			
1986	6,437	3.89	
1987	6,448	3.79	
1988	7,044	4.60	
1989	6,683	4.29	
1990	8,525	4.09	
1991	5,307	4.20	
1992	8,831	3.80	
1993	8,164	4.04	
1994	8,300	4.33	
1995	5,838	3.76	
1996	10,766	4.90	
1997	9,857	4.21	
1998	13,647	3.32	
1999	7,294	3.67	
2000	8,995	3.73	
2001	6,990	3.32	
10-yr Avg	8,868	3.91	

[a] From Bowman et al. (2000) data from random ground plots on the Y-K Delta coastal zone.

[b] 1963-1979 from Lensink (1972) and Dau (1982); 1986-1999 from Bowman et al. (2000).

[c] 1963-1979 from Lensink (1972) and Dau (1982).

Appendix D. Age composition and family size of tundra swans in northern Utah from classifications during October-January .

	Grouped Birds			Family Associations			Combined Totals		
Year	Adults	Yng	% Yng	Families	Yng	Yng/Fam	Adults	Yng	% Yng
1963	1,397	527	27.4%	99	218	2.20	1,595	745	31.8%
1964	1,193	171	12.5%	372	717	1.93	1,937	888	31.4%
1965	883	541	38.0%	141	362	2.57	1,165	903	43.7%
1966	4,326	2,002	31.6%	626	1,464	2.33	5,578	3,466	38.3%
1967	4,753	3,975	45.5%	595	1,722	2.89	5,943	5,697	48.9%
1968	10,597	6,679	38.7%	933	2,609	2.80	12,463	9,288	42.7%
1969	19,527	15,414	44.1%	637	2,031	3.19	20,801	17,445	45.6%
1970	28,478	6,907	19.5%	500	1,181	2.36	29,478	8,088	21.5%
1971	5,465	1,422	20.6%	516	1,165	2.26	6,497	2,587	28.5%
1972	5,102	1,193	19.0%	440	967	2.20	5,982	2,160	26.5%
1973	3,696	2,105	36.3%	670	1,549	2.31	5,036	3,654	42.0%
1974	9,610	1,733	15.3%	577	1,333	2.31	10,764	3,066	22.2%
1975	2,443	163	6.3%	218	539	2.47	2,879	702	19.6%
1976	1,457	171	10.5%	245	640	2.61	1,947	811	29.4%
1977	2,960	123	4.0%	459	1,091	2.38	3,878	1,214	23.8%
1978	3,848	342	8.2%	596	1,343	2.25	5,040	1,685	25.1%
1979	7,210	2,198	23.4%	960	2,456	2.56	9,130	4,654	33.8%
1980	7,868	3,116	28.4%	687	1,594	2.32	9,242	4,710	33.8%
1981	11,636	3,917	25.2%	1,246	2,635	2.11	14,128	6,552	31.7%
1982	4,173	1,305	23.8%	271	600	2.21	4,715	1,905	28.8%
1983	12,456	6,373	33.8%	774	2,229	2.88	14,004	8,602	38.1%
1984	1,298	639	33.0%	65	159	2.45	1,428	798	35.8%
1985	670	276	29.2%	77	173	2.25	824	449	35.3%
1986	754	513	40.5%	195	464	2.38	1,144	977	46.1%
1987	402	224	35.8%	68	175	2.57	538	399	42.6%
1988	1,364	762	35.8%	235	556	2.37	1,834	1,318	41.8%
1989	1,263	696	35.5%	144	352	2.44	1,551	1,048	40.3%
1990	3,548	1,708	32.5%	351	902	2.57	4,250	2,610	38.0%
1991	2,286	1,176	34.0%	232	594	2.56	2,750	1,770	39.2%
1992	3,102	920	22.9%	209	476	2.28	3,520	1,396	28.4%
1993	1,809	630	25.8%	180	449	2.49	2,169	1,079	33.2%
1993 [a]	2,380	598	20.1%	143	381	2.66	2,666	979	26.9%
1994	3,434	1,346	28.2%	262	633	2.42	3,958	1,979	33.3%
1995	5,655	2,178	27.8%	783	1,777	2.27	7,221	3,955	35.4%
1996	7,317	2,434	25.0%	588	1,125	1.91	8,493	3,559	29.5%
1997	108,626	22,934	17.4%	855	2,034	2.38	110,336	24,968	18.5%
1998	87,629	13,033	12.9%	501	1,099	2.19	88,631	14,132	13.8%
1999	67,388	10,481	13.5%	603	1,333	2.21	68,594	11,814	14.7%
2000	47,752	3,371	6.6%	173	324	1.87	48,098	3,695	7.1%
2001	26,838	2,012	7.0%	80	162	2.03	26,996	2,174	7.5%
Avg	13,065	3,158	24.9%	433	1,040	2.39	13,930	4,198	31.4%

[a] 1993 composition data from aerial photography.

Appendix E. Age composition and family size of tundra swans in Washington from classifications during October-January .

	Grouped Birds			Family Associations		
Year	Sample	% Yng		Families	Yng	Yng/Fam
1980-81	554	22.6				
1981-82	1,024	23.1				
1982-83	1,223	16.3		14	29	2.07
1983-84	1,640	27.6		34	92	2.71
1984-85	586	19.6				
1985-86	1,360	10.5				
1986-87	966	19.8				
1987-88	1,118	21.5				
1988-89	749	17.6				
1989-90	868	14.6		76	187	2.46
1990-91	1,038	11.4				
1991-92	5,257	13.7				
1992-93	1,274	12.0		62	141	2.27
1993-94	4,485	14.5		87	178	2.05
1994-95	9,807	15.2		79	171	2.16
1995-96	4,828	16.7		57	158	2.77
1996-97	3,255	14.5		66	152	2.30
1997-98 [a]	2,038	10.9				
1998-99	1,595	13.2				
1999-00	2,161	11.8				
2000-01	2,003	13.3				
2001-02						
Avg	2,278	16.2		59	139	2

Source: Russ Canniff (WDFW Unpubl. data)

[a] Through 1996-97, data based on all swans in Skagit County during November - April;
Since 1997-98, data based on mid-January surveys in Skagit, Whatcom and Snohomish Counties.

APPENDIX F. Seasons, permits, hunter activity and harvest of Western Population tundra swans in Utah.

	Seasons			Permits			Hunter Activity		Harvest			Percent
Year	Opening	Closing	No. Days	Author-ized	Applications Received	Permits Issued	% Active Hunters	Hunter Days	Retrieved	Unretrieved	Total	Gray Swan in Bag
1962	20-Oct	26-Dec	68	1,000		1,000			320	81	401	38
1963	5-Oct	2-Jan	90	1,000	1,519	1,000			392	62	454	48
1964	10-Oct	7-Jan	90	1,000	1,599	1,000	94	4,600	335	86	421	37
1965	9-Oct	6-Jan	90	1,000	2,495	995	92	4,700	336	60	396	45
1966	8-Oct	5-Jan	90	1,000	2,294	1,000	95	4,000	491	75	566	42
1967	7-Oct	4-Jan	90	1,000	2,766	1,000	91	4,800	246	69	315	54
1968	12-Oct	5-Jan	86	1,000	4,342	1,000	93	4,300	520	102	622	58
1969	11-Oct	4-Jan	86	2,500	6,346	2,500	89	10,000	1,290	266	1,556	62
1970	3-Oct	3-Jan	93	2,500	7,670	2,500	88	11,600	812	170	982	52
1971	2-Oct	2-Jan	93	2,500	5,823	2,495	86	11,067	916	175	1,091	33
1972	7-Oct	7-Jan	93	2,500	6,563	2,500	84	11,097	754	118	872	38
1973	6-Oct	6-Jan	93	2,500	5,619	2,500	87	9,533	981	236	1,217	50
1974	5-Oct	5-Jan	93	2,500	7,397	2,500	88	11,305	928	217	1,145	42
1975	4-Oct	4-Jan	93	2,500	8,874	2,500	87	11,072	929	169	1,098	46
1976	2-Oct	2-Jan	93	2,500	8,877	2,500	86	9,685	764	131	895	41
1977	1-Oct	1-Jan	93	2,500	8,097	2,488	91	8,411	1,277	311	1,588	54
1978	7-Oct	7-Jan	93	2,500	9,574	2,500	86	8,635	916	352	1,268	45
1979	6-Oct	6-Jan	93	2,500	8,349	2,500	86	9,118	804	241	1,045	43
1980	4-Oct	4-Jan	93	2,500	9,264	2,500	84	8,557	803	185	988	52
1981	3-Oct	3-Jan	93	2,500	6,326	2,500	89	8,938	1,141	311	1,452	38
1982	2-Oct	2-Jan	93	2,500	7,112	2,500	88	10,744	944	280	1,224	40
1983	8-Oct	8-Jan	93	2,500	5,509	2,500	85	9,688	781	245	1,026	47
1984	13-Oct	6-Jan	86	2,500	5,008	2,500	86	11,005	744	98	842	44
1985	12-Oct	29-Dec	79	2,500	4,693	2,495	81	11,550	343	73	416	37
1986	4-Oct	21-Dec	79	2,500	2,933	2,500	83	10,598	551	111	662	42
1987	2-way split [a]		79	2,500	2,509	2,499	77	10,996	226	32	258	33
1988	8-Oct	1-Jan	86	2,500	1,772	2,500	75	8,164	501	100	601	37
1989	7-Oct	2-Jan	88	2,500	1,599	2,500	77	8,475	694	146	840	40
1990	6-Oct	6-Jan	93	2,500	2,201	2,500	82	8,456	874	151	1,025	33
1991	5-Oct	5-Jan	93	2,500	3,096	2,500	78	8,304	774	159	933	42
1992	3-Oct	3-Jan	93	2,500	3,039	2,500	75	9,405	450	42	492	31
1993	2-Oct	3-Jan	94	2,500	3,041	2,500	81	12,550	337	41	378	28
1994 [b]	8-Oct	15-Dec	69	2,500	3,469	2,500	84	9,948	768	120	888	29
1995 [c]	7-Oct	3-Dec	58	2,750	3,496	2,750	79	13,008	348	70	418	41
1996 [c]	5-Oct	1-Dec	58	2,750	2,941	2,750	87	10,801	897	241	1,138	31
1997 [c]	4-Oct	7-Dec	65	2,750	3,449	2,750	87	10,835	704	193	897	35
1998 [c]	3-Oct	6-Dec	65	2,750	3,312	2,750	88	9,504	1,142	283	1,425	25
1999 [c]	2-Oct	5-Dec	65	2,750	4,325	2,750	85	8,637	858	212	1,070	26
2000 [d]	7-Oct	10-Dec	65	2,000	3,913	2,000	84	8,025	550	105	655	19
2001			65	2,000	3,846	2,000	78	6,991	249	57	306	21
Average	6-Oct	29-Dec	84	2,244	4,745	2,243	85	9,187	692	154	847	40

Permits provided on a first-come, first-served basis in 1962.
Permits were undersubscribed, but all were eventually sold over counter.

[a] Oct 3 - Dec 6 and Dec 21 - Jan 3.

[b] Hunting of swans was statewide 1962-93; closed in 1994 in Cache, Daggett, Rich and Uintah counties; season ends by Dec 15.

[c] In 1995 swan hunting was allowed only in the Great Salt Lake vicinity; season frameworks were shortened to the first Sunday in December.

[d] Hunting restricted to areas south of Bear River NWR; season end in Utah extended to the second Sunday in Dec.

APPENDIX G. Seasons, permits, hunter activity and harvest of Western Population tundra swans in Nevada.

	Seasons			Permits			Hunter Activity		Harvest			Percent
Year	Opening	Closing	No. Days	Author-ized	Applications Received	Permits Issued	% Active Hunters	Hunter Days	Retrieved	Unretrieved	Total	Gray Swan in Bag
1969	1-Nov	28-Dec	58	500		500		1,410	87	20	107	63
1970	31-Oct	3-Jan	65	500		500		1,370	208	28	236	49
1971	6-Nov	2-Jan	58	500	510	500	83	1,475	102	18	120	37
1972	4-Nov	7-Jan	65	500	571	500	80	1,635	124	14	138	34
1973	3-Nov	6-Jan	65	500	686	500	75	1,315	109	10	119	47
1974	2-Nov	12-Jan	72	500	534	500	77	1,455	190	25	215	39
1975	1-Nov	4-Jan	65	500	690	500	78	1,123	188	35	223	38
1976	30-Oct	2-Jan	65	500	682	500	82	1,378	206	21	227	34
1977	5-Nov	15-Jan	72	500	638	500	76	1,326	84	10	94	46
1978	4-Nov	7-Jan	65	500	621	500	74	1,407	90	4	94	47
1979	3-Nov	13-Jan	72	500	604	500	78	1,314	214	42	256	32
1980	1-Nov	4-Jan	65	500	767	500	79	1,428	103	16	119	31
1981	7-Nov	10-Jan	65	500	500	500	89	1,115	301	49	350	32
1982	23-Oct	9-Jan	79	500	534	500	80	1,200	161	22	183	20
1983	22-Oct	8-Jan	79	650	650	650	78	1,833	169	24	193	29
1984	20-Oct	6-Jan	79	650	650	650	76	1,618	229	22	251	31
1985	12-Oct	29-Dec	72	650	650	650	67	1,381	145	12	157	34
1986	19-Oct	4-Jan	79	650	608	608	79	1,530	196	58	254	34
1987	17-Oct	3-Jan	79	650	594	594	68	1,694	94	11	105	38
1988	8-Oct	8-Jan	93	650	260	260	75	770	78	4	82	49
1989	14-Oct	14-Jan	93	650	324	324	78	1,076	81	4	85	37
1990	20-Oct	20-Jan	93	650	297	297	78	994	67	6	73	36
1991	19-Oct	19-Jan	93	650	258	258	70	721	62	2	64	47
1992	17-Oct	17-Jan	93	650	100	100	71	242	29	2	31	36
1993	16-Oct	23-Jan	100	650	205	205	66	668	55	3	58	31
1994	15-Oct	22-Jan	100	650	206	206	78	601	89	7	96	43
1995	21-Oct	7-Jan	79	650	383	383	75	1,224	69	20	89	41
1996	19-Oct	5-Jan	79	650	376	376	89	1,091	122	17	139	37
1997	18-Oct	4-Jan	79	650	381	381	86	1,282	131	16	147	38
1998	17-Oct	3-Jan	79	650	492	492	85	1,552	185	24	209	16
1999	16-Oct	2-Jan	79	650	518	518	84	1,815	213	19	232	31
2000	14-Oct	7-Jan	79	650	509	493	62	1,288	78	7	85	41
2001			79	650	308	308	78	1,171	62	3	65	19
Average	24-Oct	8-Jan	77	586	487	447	77	1,258	131	17	148	37

Permits provided on a first-come, first-served basis in 1969-7(

Hunting of swans allowed only in Churchill county 1969-82; Churchill, Lyon and Pershing counties 1983 to present.

APPENDIX H. Seasons, permits, hunter activity and harvest of Western Population tundra swans in the Pacific Flyway portion of Montana.

	Seasons			Permits			Hunter Activity		Harvest			Percent
Year	Opening	Closing	No. Days	Author-ized	Applications Received	Permits Issued	% Active Hunters	Hunter Days	Retrieved	Unretrieved[a]	Total	Gray Swan in Bag
1970	10-Oct	10-Jan	93	500	500	500	55	1,130	179		179	41
1971	9-Oct	9-Jan	93	500	500	500	49	1,128	91		91	33
1972	1-Oct	1-Jan	93	500	500	500	53	1,122	150		150	31
1973	6-Oct	6-Jan	93	500	500	500	46	757	101	11	112	45
1974	28-Sep	29-Dec	93	500	500	500	70	1,217	259	56	315	48
1975	4-Oct	4-Jan	93	500	616	500	70	874	266	37	303	34
1976	2-Oct	2-Jan	93	500	604	500	76	969	139	12	151	43
1977	1-Oct	1-Jan	93	500	678	500			214	26	240	35
1978	30-Sep	31-Dec	93	500	790	500	70	571	146	19	165	37
1979	29-Sep	30-Dec	93	500	708	500	78	1,119	275	62	337	32
1980	4-Oct	4-Jan	93	500	912	500	80	965	250	22	272	41
1981	3-Oct	3-Jan	93	500	972	500	66	703	177	17	194	30
1982	2-Oct	2-Jan	93	500	739	500	68	799	139	9	148	27
1983	1-Oct	1-Jan	93	500	689	500	75	931	218	17	235	40
1984	29-Sep	30-Dec	93	500	601	500	61	414	221	6	227	25
1985	12-Oct	29-Dec	79	500	648	500	55	596	185	12	197	21
1986	4-Oct	21-Dec	79	500	705	500	54	756	200	16	216	26
1987	3-Oct	20-Dec	79	500	841	500	79	829	280	23	303	32
1988	1-Oct	1-Jan	93	500	697	500	71	722	260	19	279	29
1989	30-Sep	31-Dec	93	500	867	500	80	779	302	38	340	29
1990	29-Sep	30-Dec	93	500	918	500	74	749	275	20	295	27
1991	12-Oct	29-Dec	79	500	864	500	37	444	79	7	86	35
1992	17-Oct	3-Jan	79	500	804	500	73	817	221	6	227	20
1993	16-Oct	2-Jan	79	500	760	500	76	1,191	290	28	318	30
1994	15-Oct	1-Jan	79	500	824	500	81	730	326	24	350	27
1995	14-Oct	1-Dec	49	500	1,088	500	66	765	186	13	199	30
1996	12-Oct	1-Dec	51	500	1,074	500	83	843	302	23	325	22
1997	18-Oct	1-Dec	45	500	1,295	500	79	709	300	57	357	24
1998	17-Oct	1-Dec	46	500	1,564	500	83	917	276	47	323	20
1999	16-Oct	1-Dec	47	500	1,647	500	78	1,033	226	13	239	17
2000	14-Oct	1-Dec	49	500	1,447	500	60	670	217	29	246	17
2001			50	500	1,328	500	68	930	289	29	318	
Average	6-Oct	26-Dec	80	500	849	500	68	844	220	24	242	31
Permits provided on a first-come, first-served basis in 1970-74												

[a] In 1997, the definition of wounded bird was broadened to include any bird visibly hit that could not be retrieved.

Hunting of swans allowed only in Teton County 1970-80; Teton and Cascade 1981-87; Toole, Liberty, Hill, Pondera, Teton and Cascade 1988-94; a portion of Teton and Pondera Counties were closed, and Choteau County was opened in 1995.

APPENDIX I. Seasons, permits, hunter activity and harvest of Western Population tundra swans in Alaska.

	Seasons			Permits			Hunter Activity		Harvest			Percent
Year	Opening	Closing	No. Days	Author-ized	Applications Received	Permits Issued	% Active Hunters	Hunter Days	Retrieved	Unretrieved	Total	Gray Swan in Bag
1988	1-Sep	30-Oct	60	300	112	112	63		16	0	16	75
1989	1-Sep	30-Oct	60	300	130	130	62		17	5	22	13
1990	1-Sep	30-Oct	60	300	81	81	57		16	0	16	47
1991	1-Sep	30-Oct	60	300	84	84	63	300	8	0	8	13
1992	1-Sep	30-Oct	60	300	89	89	65	232	17	0	17	44
1993	1-Sep	31-Oct	61	800	170	170	49		26	4	30	33
1994	1-Sep	31-Oct	61	800	216	216	55		40	2	42	34
1995	1-Sep	31-Oct	61	800	210	210	56		57	1	58	nd
1996	1-Sep	31-Oct	61	800	192	192	56		50	3	53	40
1997	1-Sep	31-Oct	61	1,100	204	204	62		58	7	65	33
1998	1-Sep	31-Oct	61	1,100	192	192	56		51	1	52	21
1999	1-Sep	31-Oct	61	700	227	227	65		91	5	96	14
2000	1-Sep	31-Oct	61	700	228	228	63		112	6	118	28
2001	1-Sep	31-Oct	61	900	255	255	59		113	3	116	12
Average	1-Sep	31-Oct	61	657	171	171	59	266	48	3	51	31
Permits distributed within hunt units by village vendors on a first-come, first-served bas												

Hunting of swans allowed only in Game Management Unit 22 1988-92; Units 18 and 22 1993 to present; and Units 18, 22 and 23 1997 to present.

In 1998, hunters were allowed up to 3 permits per season in Unit 23.

In 1999 and 2000, limits were 3 swans per permit in all units; available permits were reduced to ensure that a harvest cap was not reached.

APPENDIX J. Seasons, permits, hunter activity and harvest of Western Population tundra swans in the Pacific Flyway.

	Season Frameworks[a]				Permits			Hunter Activity		Harvest			Percent
Year	Earliest Opening	Latest Closing	No. Days	Concur with	Author-ized	Applications Received	Permits Issued	% Active Hunters	Hunter-Days	Retrieved Harvest	Reported Unretrieved	Total	Gray Swan in Bag
1962	6-Oct-62	6-Jan-63	68	Ducks	1,000		1,000			320	81	401	38
1963	5-Oct-63	5-Jan-64	90	Ducks	1,000	1,519	1,000			392	62	454	48
1964	10-Oct-64	10-Jan-65	90	Ducks	1,000	1,599	1,000	94	4,600	335	86	421	37
1965	9-Oct-65	9-Jan-66	90	Ducks	1,000	2,495	995	92	4,700	336	60	396	45
1966	8-Oct-66	8-Jan-67	90	Ducks	1,000	2,294	1,000	95	4,000	491	75	566	42
1967	7-Oct-67	7-Jan-68	90	Ducks	1,000	2,766	1,000	91	4,800	246	69	315	54
1968	5-Oct-68	12-Jan-69	86	Ducks	1,000	4,342	1,000	93	4,300	520	102	622	58
1969	4-Oct-69	11-Jan-70	58-93	Ducks	3,000	6,846	3,000	87	11,410	1,377	289	1,666	62
1970	3-Oct-70	17-Jan-71	65-93	Ducks	3,500	8,670	3,500	82	14,100	1,078	228	1,306	55
1971	2-Oct-71	16-Jan-72	58-93	Ducks	3,500	6,833	3,495	80	13,670	1,109	175	1,284	33
1972	Sat Clst Oct 1	Sun Clst Jan 20	65-93	Ducks	3,500	7,634	3,500	72	13,854	1,028	176	1,204	36
1973	Sat Clst Oct 1	Sun Clst Jan 20	65-93	Ducks	3,500	6,805	3,500	79	11,605	1,191	257	1,448	49
1974	Sat Clst Oct 1	Sun Clst Jan 20	72-93	Ducks	3,500	8,431	3,500	84	13,977	1,377	298	1,675	43
1975	Sat Clst Oct 1	Sun Clst Jan 20	65-93	Ducks	3,500	10,180	3,500	83	13,069	1,383	241	1,624	40
1976	Sat Clst Oct 1	Sun Clst Jan 20	65-93	Ducks	3,500	10,163	3,500	84	12,032	1,109	164	1,273	40
1977	Sat Clst Oct 1	Sun Clst Jan 20	72-93	Ducks	3,500	9,413	3,488	87	10,622	1,575	347	1,922	51
1978	Sat Clst Oct 1	Sun Clst Jan 20	65-93	Ducks	3,500	10,985	3,500	82	10,613	1,152	375	1,527	44
1979	Sat Clst Oct 1	Sun Clst Jan 20	72-93	Ducks	3,500	9,661	3,500	84	11,551	1,293	345	1,638	39
1980	Sat Clst Oct 1	Sun Clst Jan 20	65-93	Ducks	3,500	10,943	3,500	83	10,950	1,156	223	1,379	48
1981	Sat Clst Oct 1	Sun Clst Jan 20	62-93	Ducks	3,500	7,798	3,500	86	10,756	1,619	377	1,996	36
1982	Sat Clst Oct 1	Sun Clst Jan 20	79-93	Ducks	3,500	8,385	3,500	84	12,743	1,244	311	1,555	36
1983	Sat Clst Oct 1	Sun Clst Jan 20	79-93	Ducks	3,650	6,848	3,650	82	12,452	1,168	286	1,454	43
1984	Sat Clst Oct 1	Sun Clst Jan 20	79-93	Ducks	3,650	6,259	3,650	81	13,037	1,194	132	1,326	38
1985	8-Oct-85	13-Jan-86	72-79	Ducks	3,650	5,991	3,645	75	13,527	673	97	770	32
1986	4-Oct-86	11-Jan-87	79	Ducks	3,650	4,246	3,608	78	12,884	947	185	1,132	37
1987	3-Oct-87	10-Jan-88	79	Ducks	3,650	3,944	3,593	76	13,519	600	66	666	33
1988	Sat Clst Oct 1	Sun Clst Jan 20	86-93	n/a	3,950	2,841	3,372	74	9,656	855	123	978	36
1989	Sat Clst Oct 1	Sun Clst Jan 20	88-93	n/a	3,950	2,920	3,454	77	10,330	1,094	193	1,287	37
1990	Sat Clst Oct 1	Sun Clst Jan 20	93	n/a	3,950	3,497	3,378	80	10,199	1,232	177	1,409	32
1991	Sat Clst Oct 1	Sun Clst Jan 20	79-93	n/a	3,950	4,302	3,342	71	9,769	923	168	1,091	42
1992	Sat Clst Oct 1	Sun Clst Jan 20	79-93	n/a	3,950	4,032	3,189	74	10,696	717	50	767	30
1993	Sat Clst Oct 1	Sun Clst Jan 20	79-100	n/a	4,450	4,176	3,375	78	14,409	699	76	775	29
1994	Sat Clst Oct 1	varies [c]	69-100	n/a	4,450	4,715	3,422	81	11,279	1,222	153	1,375	29
1995[b]	Sat Clst Oct 1	varies	49-79	n/a	4,700	5,177	3,843	76	14,997	659	104	763	39
1996	Sat Clst Oct 1	varies	51-79	n/a	4,700	4,583	3,818	85	12,735	1,371	284	1,655	30
1997	Sat Clst Oct 1	varies	45-79	n/a	5,000	5,329	3,835	85	12,826	1,193	216	1,409	35
1998	Sat Clst Oct 1	varies	46-79	n/a	5,000	5,560	3,934	85	11,973	1,654	308	1,962	24
1999	Sat Clst Oct 1	varies	47-79	n/a	5,000	6,717	3,995	83	11,485	1,388	236	1,624	26
2000	Sat Clst Oct 1	varies [d]	49-79	n/a	4,250	6,097	3,221	79	9,983	957	118	1,075	21
2001	Sat Clst Oct 1	varies	50-79	n/a	4,450	5,737	3,063	75	9,092	713	92	805	17
Average					3,388	5,916	3,072	82	11,005	990	185	1,175	39

Certain parameters were not estimated by some states, total calculated using the average value for 3 subsequent years.

Estimates for hunter days not available for Alaska.

[a] Season Frameworks apply to UT, NV, and Pacific Flyway portion of MT. Alaska early season framework is Sept 1 - Jan 29 with 107 days.

[b] Utah season ends by Dec. 15, elsewhere Sun. closest Jan 20

[c] Season ends in Utah first Sun. in Dec.; Nevada first Sun. after Jan. 1; Montana no later than Dec.

[d] Season end in Utah extended to the second Sunday in Dec.

	Utah	Nevada	PF Montana	Alaska
1962-68	statewide			
1969	statewide	Churchill Co.		
1970-80	statewide	Churchill Co.	Teton Co.	
1981-82	statewide	Churchill Co.	Teton, Cascade Cos.	
1983-87	statewide	Churchill, Lyon, Pershing Cos.	Teton, Cascade Cos.	
1988-92	statewide	Churchill, Lyon, Pershing Cos.	Teton, Cascade, Toole, Liberty, Hill, Pondera Cos.	GMU 22
1993-94	statewide, except Cache, Rich, Daggett and Uinta Cos.	Churchill, Lyon, Pershing Cos.	Teton, Cascade, Toole, Liberty, Hill, Pondera Cos.	GMU 18 and 22
1995-96	Great Salt Lake Basin	Churchill, Lyon, Pershing Cos.	Chouteau,Cascade, Toole, Liberty, Hill, portions of Teton and Pondera Cos.	GMU 18 and 22
1997-99	Great Salt Lake Basin	Churchill, Lyon, Pershing Cos.	Chouteau,Cascade, Toole, Liberty, Hill, portions of Teton and Pondera Cos.	GMU 18, 22 and 23
2000-pres	Great Salt Lake Basin south of Bear River NWR	Churchill, Lyon, Pershing Cos.	Chouteau,Cascade, Toole, Liberty, Hill, portions of Teton and Pondera Cos.	GMU 18, 22 and 23

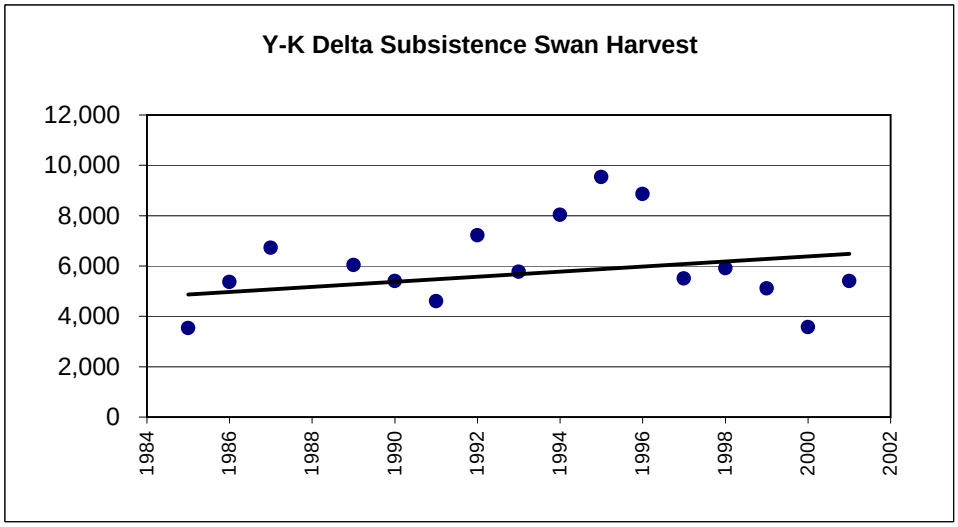
APPENDIX K. Estimates of subsistence harvest of Western Population tundra swans in western Alaska. (Wentworth and Seim 1996; Wentworth and Andrew 1999; Wong and Wentworth 1999; Wentworth 2000, 2001).

	Y-K Delta		Togiak NWR		Bristol Bay [b]		Alaska Peninsula [c]	
Year	Harvest	Eggs	Harvest	Eggs	Harvest	Eggs	Harvest	Eggs
1985	3,531	185	ns	ns	ns	ns	ns	ns
1986	5,363	505	ns	ns	ns	ns	ns	ns
1987	6,721	266	ns	ns	ns	ns	ns	ns
1988	ns [a]	ns	ns	ns	ns	ns	ns	ns
1989	6,034	1,367	ns	ns	ns	ns	ns	ns
1990	5,399	953	ns	ns	ns	ns	ns	ns
1991	4,599	564	ns	ns	ns	ns	ns	ns
1992	7,226	567	ns	ns	ns	ns	ns	ns
1993	5,767	961	ns	ns	ns	ns	ns	ns
1994	8,030	293	ns	ns	ns	ns	ns	ns
1995	9,529	856	226	51	110	0	4	14
1996	8,860	565	176	0	ns	ns	4	0
1997	5,501	531	101	0	71	0	7	12
1998	5,916	1,379	556	88	ns	ns	20	0
1999	5,107	766	446	0	ns	ns	12	0
2000	3,578	728						
2001	5,399							
Avg	6,035	699	301	28	91	0	9	5

[a] ns = no survey

[b] Dillingham, Nushagak River and Iliamna regions.

[c] King Salmon, north and south Alaska Peninsula regions.



APPENDIX L. Swan harvest, harvest monitoring and trumpeter swan detection in the Pacific Flyway.

	Tundra Swan Harvest			Swans Examined			Trumpeters Detected[a]			Inspection Rate[b]		
Year	Utah	Nevada	Montana[c]	Utah	Nevada	Montana[c]	Utah	Nevada	Montana[c]	Utah	Nevada	Montana[c]
1994	768	88	326	474	78	219	0	0	1	61.7%	88.6%	67.2%
1995	348	72	182	244	66	110	3	0	3	70.1%	91.7%	60.4%
1996	897	119	302	701	110	181	7[d]	1	3	78.1%	92.4%	59.9%
1997	704	131	300	497	116	217	3	0	1	70.6%	88.5%	72.3%
1998	1,142	185	276	879	156	168	1	0	3	77.0%	84.3%	60.9%
1999	858	213	226	647	186	153	0	0	7	75.4%	87.3%	67.7%
2000	550	78	217	454	65	203	1	0	3	82.5%	83.3%	93.5%
2001	249	62	289	229	51	244	0	0	0	92.0%	82.3%	84.4%
Total	5,516	948	2,118	4,125	828	1,495	8	1	21	$\bar{x}$ 73.6%	88.0%	68.9%

[a] Criteria for trumpeter detection: Adult = no yellow lore and posterior nare to bill tip 62mm or greater. Juvenile = no yellow lore and posterior nare to bill tip 61mm or greater.

[b] Inspection Rate = Swans Examined/Tundra Swan Harvest.

[c] Includes only the Pacific Flyway portion of Montana.

[d] Six of seven trumpeters detected in the Utah harvest were marked swans translocated from Idaho to Utah for a research project. The other one was a marked swan translocated from Idaho to Oregon 2 years earlier.