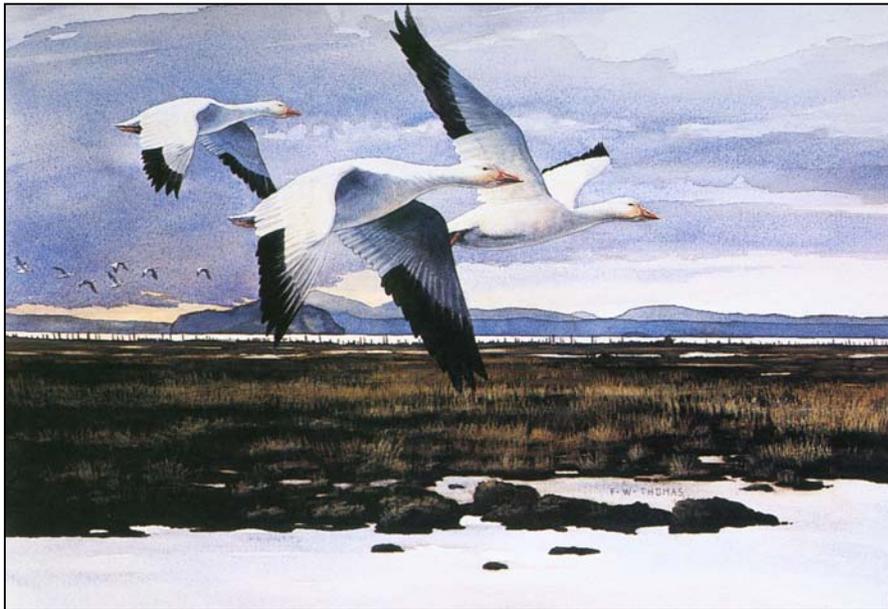


Wrangel Island Population of Lesser Snow Geese



1993 Washington Duck Stamp Artwork by Fred Thomas

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.

**PACIFIC FLYWAY MANAGEMENT PLAN
FOR THE
WRANGEL ISLAND POPULATION OF LESSER SNOW GEESE**

Prepared for the:

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

Prepared by:

White Goose Subcommittee
Pacific Flyway Study Committee

March 1992
July 2006

Approved by: *Terry M. Mansfield*
Chairman, Pacific Flyway Council

July 19, 2006
Date

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

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PACIFIC FLYWAY MANAGEMENT PLAN
FOR THE WRANGEL ISLAND POPULATION OF
LESSER SNOW GEESE

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PACIFIC FLYWAY MANAGEMENT PLAN FOR THE WRANGEL ISLAND POPULATION OF LESSER SNOW GEESE

INTRODUCTION

This plan provides guidelines for cooperative management of the population of lesser snow geese (*Chen caerulescens caerulescens*) that breed on Wrangel Island, Russia and winter primarily in British Columbia, Washington, Oregon, and California. The plan provides updated information and management strategies to the original Wrangel Island snow goose plan developed by the Pacific Flyway Council in 1992 (Pacific Flyway Council 1992). The Wrangel Island lesser snow goose population represents the last major snow goose population breeding in Asia, and the primary Russian goose population that winters in North America. Another population of lesser snow geese that breeds primarily from Banks Island, NT to the North Slope of Alaska (105 to 107 degrees longitude) is treated in the Management Plan for the Western Arctic Population of Lesser Snow Geese (Pacific Flyway Council 1992).

GOALS AND OBJECTIVES

The overall goals of the plan are to maintain and enhance this population and its habitats, as well as educational, scientific, aesthetic, and harvest values of this resource.

Objectives include:

- A. Maintain a total spring population of 120,000 snow geese on Wrangel Island (3-year average).
- B. Maintain current wintering distribution of the population.
- C. Maintain adequate habitat to meet the above population objective.
- D. Sustain traditional educational, scientific, aesthetic, and harvest uses.

STATUS

A. Distribution and Abundance

Breeding range – Wrangel Island is located at 71° N off the coast of northeastern Siberia, bounded by the Arctic Ocean, East Siberian Sea, and Chukchi Sea (Figure 1). The entire 800,000-ha island was designated as a State Nature Preserve in 1976. The main nesting colony of this population is situated on the west-central part of the island, along the middle reaches of the Tundra River in a valley of the Severnye (northern) Mountains (Figure 1). The colony is relatively small, occupying a maximum area of 2,600 ha since 1969. In years with high numbers of lemmings, snowy owl nests are relatively common, and small “owl-associated” colonies (up to 2,000 birds) establish near the main colony and along the Neizvestnaya and Momontovaya rivers (Baranyuk 2001). Snow geese historically nested on the Siberian

mainland near Wrangel Island, but over time these populations have declined significantly to remnant levels (Syroechkovski 1997). It is suspected that a number of snow geese (100-300) wintering in the U.S. may still nest on the Siberian mainland near Wrangel Island, on the Chukochya and Kolyma River deltas (Syroechkovski 1997, Baranyuk 1999, Kerbes 1999).

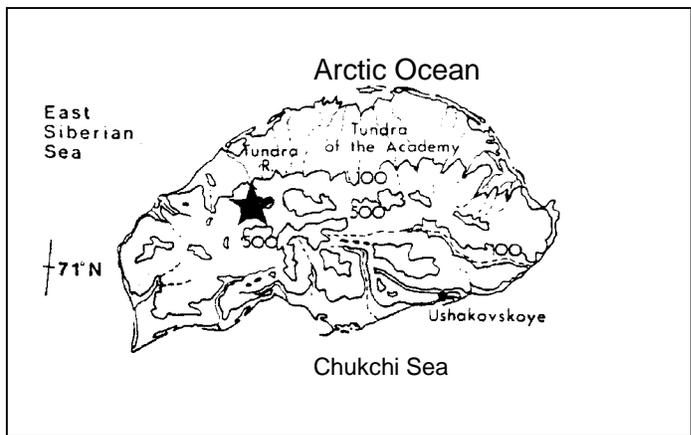


Figure 1. Map of Wrangel Island, Russia, showing approximate location of lesser snow goose breeding colony (star).

Snow geese typically begin arriving at the colony in May. The first systematic survey of the spring population returning to the island was conducted in 1970, when 150,000 geese were counted in early June (Bousfield and Syroechkovsky 1985). The spring population declined to around 50,000 birds by the mid-1970s due to several consecutive years of breeding failures, increased to about 100,000 by the late 1980s and then decreased to about 65,000 during the early 1990s (see Figure 2 and Appendix A). Since that time, it has increased to almost 120,000 birds by 2004-2005. The total spring population estimate is obtained by combining colony transect estimates and estimates of nonbreeders from areas near the colony (Kerbes et al. 1999).

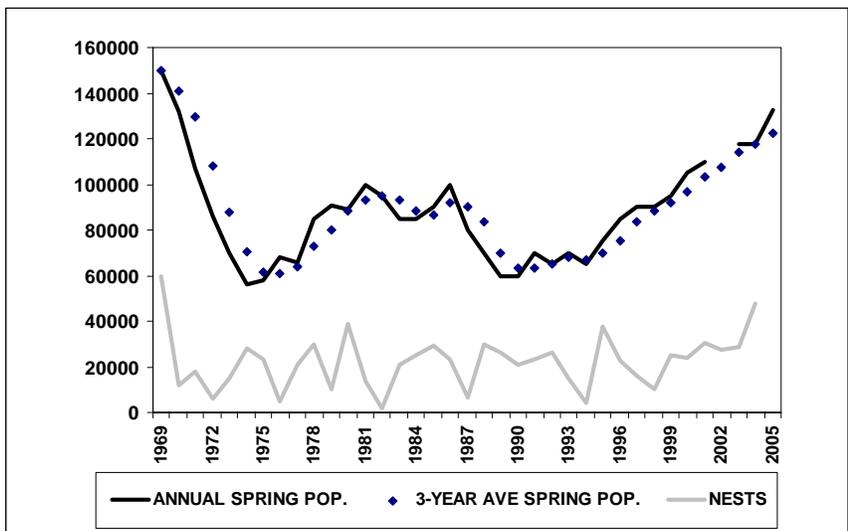


Figure 2. Wrangel Island snow goose spring population and nest indices.

Fall Migration areas-- Wrangel Island snow geese undertake one of the longest migrations of any geese wintering in North America (Hines 1999b). Snow geese begin leaving Wrangel Island in late August and begin orienting toward two separate wintering areas (see Figure 3, Appendix B), including those using the Fraser and Skagit river deltas of British Columbia and Washington (Fraser-Skagit) and the Central Valley of California. Based on satellite telemetry in 1991, fall migration can be characterized as a combination of long stopovers and rapid, distant flights between them (Baranyuk and Takekawa 1998). In the fall, although some of the birds migrate east across Alaska's North Slope and eventually move through the Canadian Prairies, almost all of the population (>90%) migrates along coastal areas (Armstrong et al. 1999, Hines et al. 1999b). The first major stopovers are on the Chukotka region of Siberia, south and east of Wrangel Island on the mainland, including areas around Cape Billings and Koluthin Bay (Baranyuk and Takekawa 1999). From there the birds cross the Bering Sea to St. Lawrence Island and to the Seward Peninsula, but their first major stop in North America is on the northern Yukon-Kuskokwim River Delta (YKD). Fall staging occurs mostly around the mouth of the Yukon River and the south coast of Norton Sound. In late September, a small portion of the population stages further east in Cook Inlet, but their occurrence in fall is variable. Some of the coastal migrants make a final stop at the mouth of the Stikine River near Wrangell, Alaska before pushing on to wintering areas. The first small flocks arrive on the Fraser-Skagit in late September and build in numbers throughout October and early November.

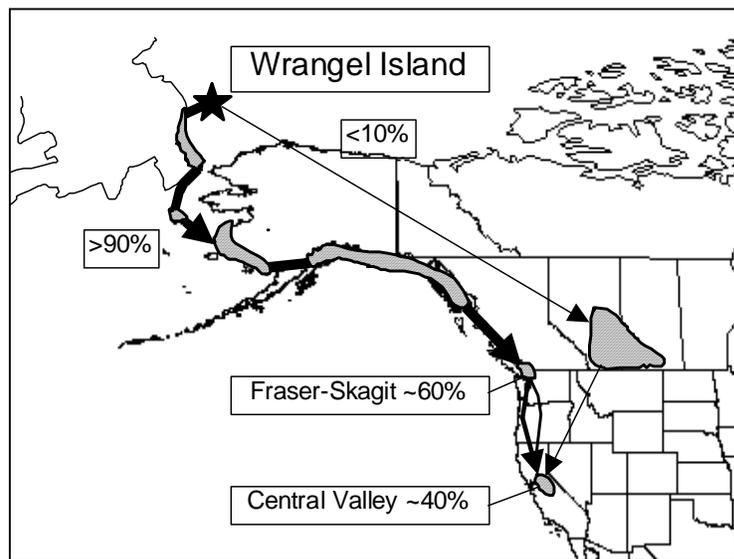


Figure 3. Fall migration routes and wintering distribution of Wrangel Is. snow geese (adapted from Hines et al. 1999b, Baranyuk and Takekawa 1999).

Some geese staging on the Fraser-Skagit during fall migration continue on to southern wintering areas along the coast and through the Summer Lake - Klamath Basin of Oregon and California. Based on neck collar observations, approximately 78% of the California wintering population arrives via the Fraser-Skagit coastal route (Armstrong et al 1999). As shown in Figure 3, about 10% of the entire Wrangel Island population follows a fall migration route

inland through Yukon, NT, Alberta/Saskatchewan, Montana, and eastern Oregon to the Klamath Basin and California (Armstrong et al 1999).

Migrants into the Summer Lake - Klamath Basin prior to November are usually Wrangel Island birds, followed within 1-2 weeks by western Arctic snow geese. Numbers from both of these populations build through mid-November. It appears that relatively fewer geese are migrating through Oregon and northeastern California to California's Central Valley (see Figure 4 and Appendix C), despite increasing estimates of geese on Wrangel Island and on the Fraser-Skagit. Wrangel Island and western Arctic snow geese usually depart from the Klamath Basin in mid- to late November, primarily to the Central Valley but also to the Imperial Valley, New Mexico, and Mexico.

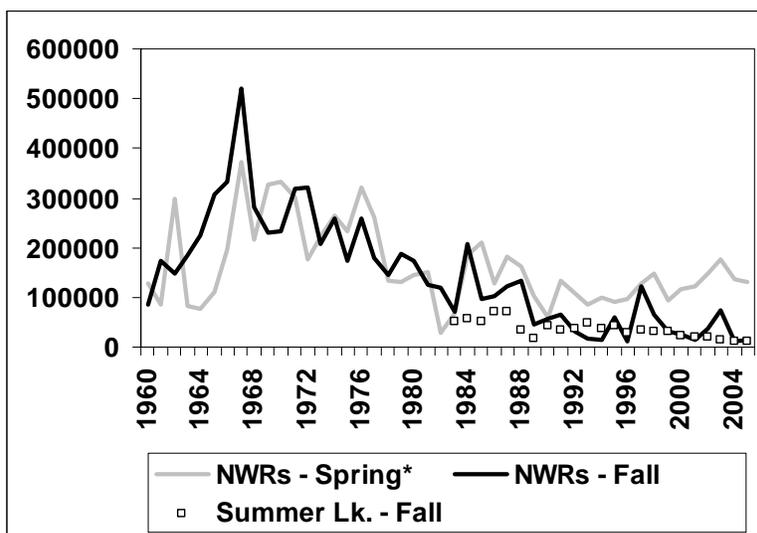


Figure 4. Tule Lake / Lower Klamath NWR peak white goose trends (Note: after 1990, over 90% of white geese staging in spring on Lower Klamath NWR have been Ross' geese [D. Mauser, pers. comm.]).

Wintering areas-- The primary wintering areas for Wrangel Island snow geese include the Fraser-Skagit and the Central Valley of California, although a small wintering flock (mean= 1,572, n=21) of Wrangel Island snow geese occurs along the lower Columbia River of Oregon and Washington from Sauvie Is. to the mouth of the river (Appendix C). The proportions of Wrangel Island population wintering in the Fraser-Skagit and California have changed greatly over the past 40 years, with a significant shift to the north (Hines et al. 1999, Boyd and Cooke 2000, Figure 3). In the 1960s, between 78-90% of the population wintered in California (Hines et al. 1999). Marking studies in the 1980s indicated a winter distribution mainly in California (64%), with a smaller proportion (36%) in the Fraser-Skagit area (Syroechkovsky and Litvin, 1986). By the late 1980s, 50-56% of the population wintered on the Fraser-Skagit deltas (Baranyuk, 1992; Hines et al. 1999) and by 2000, the ratio shifted to about 60% in the Fraser-Skagit and about 40% in California (Boyd and Cooke 2000). The change in distribution among primary wintering areas may have resulted from a shift in wintering area for geese previously found in California, or differential survival and productivity rates of the two wintering flocks

(Hines et al 1999a). Recent analyses by Williams et al (in prep.) indicates that fidelity to current wintering areas is extremely high ($\geq 98\%$), with little evidence of significant short term interchange between the northern and southern flocks. Similarly, there is little evidence of exchange between Wrangel Island and Western Arctic breeding populations on an annual basis.

The Fraser-Skagit flock averaged 33,333 (n=58) for the winter survey period during 1948-05. Surveys have been conducted using aerial photo counts since 1978. Although the Fraser-Skagit survey showed a decline to a low of 12,346 during 1974, between 1992 and 2004 it increased dramatically with an average growth rate of 7% per year, higher than the average growth rate of 5% for the spring population on Wrangel Island during the same period. The Fraser-Skagit population averaged 68,517 between 2001 and 2005 (see Figure 4 and Appendix D). Good production on Wrangel Island is evident in the high proportion of juveniles in the population from the early 1990's through 2005.

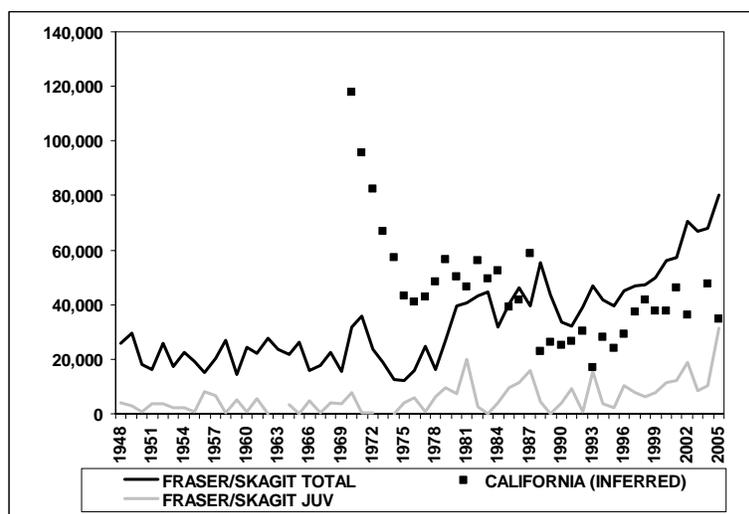


Figure 5. Wrangel Island snow goose winter trends

The absolute number of Wrangel Island snow geese wintering in California and other areas is difficult to determine, because the Wrangel Island and Western Arctic populations mix in areas south of the Fraser-Skagit and the lower Columbia. Estimates of Wrangel Island snow geese wintering in these areas are presented in Figure 5, and calculated by subtracting winter counts from the Fraser-Skagit and lower Columbia from the Wrangel Island spring population estimate. Increases in estimates on Wrangel Island of approximately 60,000 from 1992-2005 (Figure 2) are difficult to detect in the light goose index in areas of the Pacific Flyway outside of the Fraser-Skagit (the Pacific Flyway December goose survey averaged 575,000 for areas outside of the Fraser-Skagit in 2002-04). Additionally, an increasing proportion of light geese in California's Central Valley is comprised of Ross' geese (Moser 2001).

Historically, snow geese from the Fraser-Skagit deltas were more likely to exhibit red facial staining than geese wintering in California, due to the high iron content of intertidal foraging areas on the deltas (Baranyuk et al.1999). Over the past 10 years, however, Fraser-Skagit geese have lost much of this staining due to their increased use of upland feeding areas on public and private lands (Boyd 2000). Kuznetsov et al. (1998) suggested some potential genetic variation between the northern and southern wintering flocks. Baranyuk (1999) documented

significantly larger body size in males and females of the northern flock compared to geese wintering in California.

Spring migration areas—Migration use areas during spring are generally the same as depicted during fall migration as shown in Figure 3, although some important differences exist. Beginning in February and March, geese from the Fraser-Skagit deltas and a minor component of California wintering flock follow a coastal migration route to staging areas in Alaska where they feed and advance as snow melt allows (Armstrong et al. 1999; Hupp et al. 2001). Up to 10,000 snow geese (avg = 5,000, n = 8 years of surveys) have been observed at the Stikine River Delta in Southeast Alaska during mid-April. Small numbers of snow geese use areas in Prince William Sound, however Upper Cook Inlet in Southcentral Alaska is the next major staging area where up to 34,000 snow geese (avg = 18,000, n = 9 years of surveys) have been observed in late April. Wrangel Island snow geese also concentrate on the Lower Yukon River in early May, however survey data are not available. In May, the geese move to mainland Russia and then on to Wrangel Island. Birds wintering in California also begin moving north from the Central Valley to the Klamath Basin, Summer Lake, and Malheur in February and March. In mid-April, more than 74% of the Wrangel Island population wintering in California follows an inland migration route, staging on Freezeout Lake in Montana and in the Canadian prairies. Little is known about spring migration routes in northwestern Canada, Alaska, or northeastern Siberia (Armstrong et al. 1999), although snow geese migrate through the interior of Alaska, across the Seward Peninsula (Kessel 1989), and along the North Slope. The geese may remain on staging areas or in transit until mid-May before departure to Wrangel Island (Armstrong et al. 1999).

Depending on weather conditions along the vastly different migration routes, coastal and/or inland migrants begin arriving on Wrangel Island in late May and most have arrived by early June. Nest site selection and resulting nest success for each flock may be influenced by their respective arrival times.

B. Productivity and Survival

Nesting chronology and productivity-- Geese begin nesting on Wrangel Island as soon as snow conditions permit, usually a few days after they arrive on the breeding grounds. The proportion of adults breeding or attempting to breed, as measured by ground-based colony transects, fluctuates greatly depending on the extent of spring snow melt and weather conditions during late May - early June (Baranyuk 2005). The first nest is typically initiated by the end of May, with the peak of nesting usually occurring during the first week of June. Average incubation period for one egg is 22-24 days and for the entire clutch is approximately 28-30 days (Baranyuk, pers. comm.), during which time females may lose more than 30% of their peak spring body weight. This weight loss is typical of Arctic nesting geese and is due to a paucity of forage in the nesting area, cold temperatures, and the need to continuously incubate clutches. Females are often emaciated at hatch; evidence from other locations in similar circumstances suggests some birds may even die of starvation while still on the nest (Ankney and McInnes, 1978).

Nesting propensity and clutch size in a given year are influenced by the timing of snow melt;

the longer that snow persists on the nesting grounds, the fewer number of geese that attempt to nest and the fewer eggs that are laid per clutch (Baranyuk 1992). Under extreme weather conditions, many adults forego nesting altogether or they abandon their nests due to their need for food. In addition to weather, reindeer and muskoxen sometimes roam through the colony, destroying nests and reducing available forage. Clutch size is also influenced by Arctic fox predation, which is closely tied to the availability of lemmings. In addition to foxes, avian predators (e.g. gulls, jaegers) also take eggs and young goslings. Brood rearing occurs on the broad coastal plain on the northern part of the island, near the mouth of the Tundrovaya River. Average clutch size on the Tundra River colony is 3.7 (with dumping eggs - 4.2), average brood size leaving the colony is 3.4, and average brood size leaving the island is 2.6 (Appendix A). During 1975-1994, aerial age composition surveys were flown in fall on the Yukon-Kuskokwim Delta as an indication of productivity after the birds left Wrangel Island. Results of these surveys indicated a strong relation to annual nest success and subsequent age composition from the Fraser-Skagit area (unpubl. data, USFWS Yukon Delta NWR).

Productivity has been monitored using age-ratio surveys on the Fraser-Skagit area since 1948. Historic age ratio counts on the Fraser-Skagit area were conducted using ground surveys, but since 1987 these have been estimated from aerial photos taken during December - January population surveys (Appendix D).

Survival—Several studies have estimated survival rates of Wrangel Island snow geese using collars and leg bands. These studies have shown that survival rates have increased dramatically from 1975-2002. Survival rates for adult geese during 1975-1977 estimated from leg band recoveries were 0.668 ± 0.084 , approximately 0.10-0.15 lower than for western Canadian Arctic geese, and among the lowest values reported for snow geese (Hines et al. 1999a). Unlike leg band studies, survival estimates based on collar observations are of apparent survival, and typically don't take into account collar loss. Survival estimates from neck collar studies in the late 1980s showed survival rates of 0.685 ± 0.033 for females, and no differences between northern and southern wintering areas (Hines et al 1999a). However, survival rates of Wrangel birds wintering in California were significantly lower than western Arctic snow geese in California, possibly indicating higher mortality outside of the wintering period (Hines et al 1999a). More recent neck collar analyses by Williams et al (in prep) reported similar apparent annual survival rates (including permanent emigration and neckband loss) for birds wintering on Fraser-Skagit (0.67-0.78) and California (0.66-0.80) between 1993-1994 and 1996-1997. Conn et al. (2004) reported apparent annual survival rates (including permanent emigration) from 0.78-0.84 for adults wintering in California during 1994-1996, using neck collar data. Current estimates of adult average annual survival by Trost et al (in prep.) using leg band recoveries are estimated to be very high (>90%).

C. Habitat Use and Management

Snow geese in the Fraser-Skagit area forage on intertidal marsh and agricultural areas during fall and winter. Historically, snow geese using the Fraser Delta area foraged primarily in intertidal estuaries until the late 1970s, when they first began using agricultural fields (Campbell et al 1990). In 1987, Boyd (1995) initiated systematic monitoring of intertidal areas (primarily three-square bulrush) using vegetation plot surveys, and these have been continued on a regular

basis. In some intertidal areas of both deltas, intense grubbing of three-square bulrush by snow geese has resulted in low biomass levels in general and, in some parts of the upper bulrush zone, almost complete extirpation of the plant (Boyd 1995 and Boyd, unpubl. data). Several species of cordgrass (*Spartina spp.*), introduced from eastern North America, threaten to displace native bulrush on the Skagit Delta, but recent management efforts appear to be successful at controlling these invasive species.

Agricultural crop availability to snow geese on the Fraser-Skagit deltas has changed in recent years. Preferred agricultural crops used by snow geese include pasture, winter cover crops (e.g. mainly cereal rye, but also barley, wheat, oats, and clover), as well as waste grain and potatoes. Following harvest of primary summer crops (e.g. alfalfa, barley, corn, grass, oats, peas, potatoes, and wheat), planting of fall and winter cover crops increased during the 1990's as more landowners used this technique to reduce soil erosion and nutrient loss. In the Fraser River Delta, the Greenfields project is a cooperative project that encourages farmers to plant winter cover crops by providing a financial incentive of \$45/acre. The project is delivered by the Delta Farmland and Wildlife Trust with funding from several partners including CWS and DUC and involves 40-60 farmers who plant a total average of 3,500 acres of winter cover crops each year (Merkens 2004). Over the last twenty years, WISG have also gradually moved further inland to forage. Unoccupied and suitable habitats are available in the eastern portion of Delta and there is potential for further conflicts with agriculture should the geese start using this habitat.

Winter habitat conditions on the Fraser-Skagit deltas have also improved for snow geese due to the establishment of sanctuaries. On the Fraser Delta, the 648 ha Reifel Migratory Bird Sanctuary and the 300 ha Alaksen National Wildlife Area were established by CWS in 1963 and 1972, respectively. On the Skagit Delta, the 200 ha Fir Island / Hayton Reserve was established by WDFW in 1996. Both of these reserves are planted with winter cover crops favored by snow geese. Another 4,200 ha are managed for fish and wildlife by WDFW on the Skagit Delta.

The presence of large flocks of snow geese is already a concern in some parts of the Fraser River Delta, and depredation concerns have started to develop on the Skagit Delta beginning in 2005-06. Near the Vancouver International Airport, snow geese are routinely excluded from intertidal foraging areas due to aviation safety concerns. Existing agricultural areas in refuges are often heavily grazed by geese, leading birds to seek forage on private lands. On the Skagit Delta, crop damage concerns involve grass seed and winter wheat fields during March-April.

In southern Oregon (including Summer Lake Wildlife Area) and northeastern California (Gilmer et al 2004), snow goose use has declined in recent years. In Oregon, during fall migration snow geese make extensive use of alkaline and freshwater emergent marsh habitats found at the 18,700 acre Summer Lake Wildlife Area. Roots and tubers of American three-square and alkali bulrush are preferred forage plants on the area. Agricultural crops, with the exception of alfalfa and native and tame hay pasture are minimal in the surrounding area. In the Klamath Basin, snow goose use occurs primarily in California with limited use occurring in agricultural fields found in the Strait's Drain area in Oregon.

During spring migration, snow goose use occurs over a wide area of south central Oregon in Harney, Klamath and Lake Counties. Precipitation, snowmelt and runoff result in flooded wetland basins and floodplains where native and tame grass pastures are utilized for foraging. Agricultural crops of alfalfa and small grains are also utilized in portions of Klamath County. Klamath Basin wetlands, including Langell, Poe, Sprague River, Swan Lake, and Yonna Valleys provide foraging habitat for snow geese. In Lake County, the Chewaucan Marshes, Goose Lake, Summer Lake Wildlife Area, and Warner Valleys, snow geese utilize emergent marsh and flooded hayfields and pastures for foraging. Numerous large lakes and ponds found in each of these areas provide critical resting and roosting sites in close proximity to foraging sites. The Silvies River floodplain and other wetlands in the Harney Basin provide foraging habitat for large numbers of staging snow geese.

In winter, snow geese from Wrangel Island and the Western Arctic mingle with increasing numbers of Ross' geese primarily in California's Sacramento Valley. Agricultural habitats, primarily rice, are the main foraging habitat in this area. Rice acreage in California has averaged about 455,000 acres over the last 20 years and about 509,000 acres over the last 10 years (<http://www.usda.gov/nass/>). Roosting occurs at National Wildlife Refuges and State Wildlife Areas, both of which have increased in size and acreage, as well as in lightly or un-hunted flooded rice fields. Beginning in 1991 with legislation to phase out the burning of rice stubble, increasing proportions of the rice crop in the Central Valley have been plowed, disked, and / or flooded to decompose rice stubble. It is estimated that about 60% of the rice crop is flooded each year (P. Butner, CA Rice Comm. pers. comm.).

Unlike other populations of lesser snow geese, birds in the Fraser-Skagit wintering population only exploit natural forage during spring migration through Alaska and do not use agricultural habitats. They exploit underground parts of Lyngbyaei sedge (*Carex lyngbyaei*) during spring staging in salt marsh habitats on the Stikine River Delta in Southeast Alaska, and primarily consume underground parts of goose tongue (*Plantago maritima*), arrow grass (*Triglochin maritimum*), and sedges (*C. ramenskii* and *C. lyngbyaei*) during spring staging in coastal wetlands of Cook Inlet. Habitats used by snow geese in Cook Inlet are used concurrently by Canada geese (*Branta hutchinsii minima* and *B. h. taverneri*) that nest in western Alaska. Grubbing by snow geese altered plant species composition (Zacheis et al. 2001) and nutrient cycling (Zacheis et al. 2002) in Cook Inlet wetlands but did not result in long-term deterioration of spring habitats. Snow cover affects distribution and use of wetlands in Cook Inlet as flocks prefer to feed near melting snow patches and avoid areas that lack snow cover (Hupp et al. 2001). In years of early snow melt, migration through Cook Inlet is rapid and smaller numbers of snow geese stop over. No data are available regarding spring and fall habitat use by snow geese on the Yukon-Kuskokwim Delta.

D. Public Use

Wrangel Island snow geese are harvested in Alaska during both spring and summer subsistence hunts and fall seasons. Although harvest data are not very precise, and a more thorough statewide harvest survey is being implemented, snow geese are taken by subsistence hunters mostly (~60%) during spring migration, but also in fall. Statewide subsistence harvest may range about 6-8,000 birds annually, with the YKD as a primary harvest area (~2,500 birds).

Snow geese are also harvested in southern Norton Sound, Seward Peninsula, and the Bering Strait region including St. Lawrence Island. Estimates of sport harvest derived from state surveys 1971-1997 indicate that an average of about 400 snow geese are taken annually in fall, mostly in western Alaska, Cook Inlet, and Stikine River.

To improve accuracy and precision of estimates of the Fraser-Skagit flock, focused harvest surveys began in the early 1990s. In BC, CWS initiated a special postal survey of Fraser River area snow goose hunters in 1991. Since 1993 in WA, all hunters have been required to obtain a hunting authorization and are also required to report harvest of snow geese during the season. Results are analyzed using a two-wave response design after Dillman (1978). Harvest estimates for the Fraser-Skagit segment have averaged 5,328 (n=58 years) since 1948 and 6,163 (n=5) for the period 2001-05 (see Appendix D). In the Skagit area, hunter access to private lands has become more limited during the past 20 years because many farms have been leased as hunting clubs for a few individuals or closed to public access (M. Davison, WDFW, pers. comm.).

A total harvest estimate for Wrangel Island snow goose is not available because the Wrangel population mixes with western Arctic geese in Oregon and California. Snow goose hunting season dates, season lengths, and bag limits in areas important to Wrangel Island geese are listed in Appendix E. Harvest of snow geese in Oregon and California includes both Wrangel and western Arctic populations (see Appendix F). The majority of snow goose harvest in Oregon occurs in south-central Oregon (Klamath Basin/Summer Lake) where Wrangel Island geese are typically the first to arrive, while the majority of snow goose harvest in California now occurs in the Sacramento Valley.

Nonconsumptive use of snow geese has been increasing throughout the range. For example, viewing activities on California state waterfowl areas tripled from the early 1970s to early 1980s. Similar increases have been recorded in Washington and British Columbia. In British Columbia, snow geese attract over 6,000 visitors to the Reifel Migratory Bird Sanctuary when the geese are present in large numbers during the October-November period. In Washington, the Fir Island / Hayton Reserve maintained by WDFW provides winter food and a popular observation area for viewing. In Oregon, Summer Lake Wildlife Area and the Harney Basin are popular viewing areas. During winter in California and spring in Oregon, festivals occur that promote non-consumptive uses of snow geese. During migration through Alaska, snow geese are a hallmark viewing attraction during spring and fall. The aggregation at Stikine Delta is well known to people in Wrangell and Petersburg, and spring arrivals at the mouth of the Kenai River draw birders from local communities and Anchorage. Small numbers of snow geese are also a spring attraction on the Anchorage Coastal Wildlife Refuge.

MANAGEMENT ISSUES

- A. Consistent survey methodology has been implemented to estimate the size of the snow goose population on Wrangel Island annually, but funding and logistics have prevented the implementation of accurate aerial photo protocols.
- B. The distribution of snow geese from Wrangel Island has changed, leading to increased wintering in the Fraser-Skagit area and reduced migration through Oregon and to California.
- C. Increasing numbers of geese foraging on intertidal areas of the Fraser-Skagit deltas may reduce the biomass and extent of their preferred natural food, three-square bulrush.
- D. Agricultural crop depredation may limit the number of snow geese tolerated in migration and wintering areas.
- E. Urban and industrial expansion into upland foraging areas and degradation of intertidal areas are long-term threats to migration and wintering areas in British Columbia and Washington.
- F. Oil spills and chronic oil pollution are a constant threat throughout the coastal migration range, particularly on Cook Inlet staging areas.
- G. The spread of exotic cordgrass (*Spartina* spp.) threatens to reduce the carrying capacity of Skagit-Port Susan estuaries in Washington.
- H. In some years, predation by arctic foxes and disturbance by ungulates (reindeer and muskoxen) on the Wrangel Island colony have negatively impacted breeding birds and recruitment.

RECOMMENDED MANAGEMENT STRATEGIES

A. Surveys and Banding

1. Conduct annual ground surveys in spring to estimate the abundance of snow geese and production on Wrangel Island, and distribute information to management agencies.

Lead Agency: WINP
Participating: USFWS, CWS, WDFW
Priority: 1
Schedule: Ongoing

2. Conduct the Midwinter Waterfowl Survey to assess winter population trends for the Skagit-Fraser segment, using photo counts when possible to improve accuracy.

Lead Agency: USFWS
Participating: CWS, WA
Priority: 1
Schedule: Ongoing

3. Conduct age-ratio counts on the Fraser-Skagit area, using aerial photo counts to reduce bias.

Lead Agency: CWS, WDFW
Participating:
Priority: 1
Schedule: Ongoing

4. Annually band at least 500 geese on Wrangel Island to monitor survival and distribution changes.

Lead Agency: WINP
Participating: USFWS, CWS, States
Priority: 2
Schedule: Ongoing

B. Habitat

1. Protect important habitat from urban encroachment, commercial exploitation, and industrial development through easements, leasing, acquisition, and support for habitat protection initiatives.

Lead Agency: PCJV, USFWS, CWS, WINP, States, Provinces
Participating:
Priority: 1
Schedule: Ongoing

2. Manage public lands, as well as influence agricultural practices and incentive programs on private lands, to maintain current distribution in migration and wintering use areas.

Lead Agency: PCJV, States, Provinces
Participating: CWS
Priority: 2
Schedule: Ongoing

3. Monitor spread of cordgrass and eliminate from intertidal foraging areas in the Fraser-Skagit area, while maintaining three-square bulrush areas.

Lead Agency: WDFW, CWS
Participating: WDNR, USFWS
Priority: 2
Schedule: Ongoing

C. Harvest Management

1. Implement harvest strategy (see Appendix G) to direct hunting regulation changes, and monitor and evaluate strategy for potential refinements.

Lead Agency: USFWS, CWS, Provinces, States

Participating:

Priority: 1

Schedule: Ongoing

2. Conduct special hunter surveys for the Fraser-Skagit area to estimate annual harvest.

Lead Agency: CWS, WDFW

Participating: USFWS

Priority: 1

Schedule: Ongoing

3. Support efforts to minimize effects on WISG from efforts to control overabundant white goose populations in other parts of North America.

Lead Agency: USFWS, CWS, Provinces, States

Participating:

Priority: 2

Schedule: Ongoing

4. Monitor subsistence harvest levels in Alaska, Canada, and Russia.

Lead Agency: USFWS

Participating: ADFG, CWS, WINP, YK

Priority: 3

Schedule: Ongoing

D. Research and Communications

1. Describe fall/spring migration routes, timing, and important staging sites used by Wrangel snow geese in Canada, Alaska, and Siberia through the use of satellite telemetry.

Lead Agency: CWS, USGS

Participating: WINP

Priority: 1

Schedule: 2008

2. Investigate trends in biomass and growth dynamics of American bulrush, impacts of grubbing by snow geese on intertidal marshes, and the carrying capacity of the Fraser-Skagit.

Lead Agency: CWS
Participating: WDFW
Priority: 1
Schedule: Ongoing

3. Analyze existing banding data to evaluate occurrence and harvest of Wrangel Island snow geese in migration and wintering areas where they mix with other populations.

Lead Agency: USFWS, CWS, USGS
Participating: states, provinces
Priority: 1
Schedule: >2008

4. Continue to improve U.S., Canada, and Russia communications through scientific exchanges, site visits, and cooperative research projects.

Lead Agency: USFWS, CWS, WINP, States, Provinces
Participating:
Priority: 2
Schedule: Ongoing

5. Assess the role of predation and reindeer / muskoxen trampling on survival and reproduction, including relative mortality rates, periods of vulnerability, habitat impacts, interaction of weather and predation, and seasonal/annual variation.

Lead Agency: WINP
Participating: USFWS, CWS, USGS
Priority: 2
Schedule: Ongoing

6. Refine evaluation of genetic differences among wintering flocks, western Arctic, and breeding subgroups (e.g. main colony vs. satellite colonies).

Lead Agency: WINP
Participating: USGS, CWS, WDFW
Priority: 2
Schedule: 2006-08

7. Determine the significance of body condition during spring migration to snow goose survival and reproduction rates; identify where birds derive nutrients for reproduction and how these differ between the two wintering flocks.

Lead Agency: USGS
Participating: USFWS, CWS, WINP, States

Priority: 2
Schedule: 2008

8. Using existing demographic data collected on Wrangel Island and on the Fraser-Skagit deltas, develop a reliable population model to forecast trends and identify significant factors influencing population dynamics of that wintering segment.

Lead Agency: CWS
Participating: WDFW, USGS
Priority: 3
Schedule: Ongoing

ANNUAL REVIEW

Progress toward achieving the goals and objectives of this plan will be monitored annually by the White Goose Subcommittee and coordinated with plans for the western Arctic population and Ross' goose populations. The schedule for rotation of the subcommittee chair shall follow the following order (terms begin October 1 of year listed and continue for 2 years):

<u>Year</u>	<u>Chair</u>
2005	California
2007	Alaska
2009	Oregon
2011	Washington
2013	USFWS-R1
2015	Idaho

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Appendix A. Wrangel Island population / productivity information from Vasily Baranyuk

YEAR	TOTAL SPRING POP.	ADULTS SPRING	%JUV SPRING	BREED POP	COLONY SIZE (HA)	NESTS	%SUCC. NESTS	CLUTCH SIZE	BROOD SIZE LV COLONY	BROOD SIZE LV ISLAND
1966								3.6		
1967								4.9		
1969				114.0	1962	58.2		3.7		
1970	150.0	120.0	20.0	120.0	2600	60.0	96.0	3.7	3.5	2.5
1971	132.0	120.0	9.1	24.0	825	12.0	55.0	4.7	3.4	2.3
1972	107.0	106.0	0.6	36.0	950	18.0	45.0	4.2	3.5	2.3
1973	86.0	85.9	0.0	12.0	200	6.0	67.0	6.0	3.9	
1974	70.0	69.5	0.7	32.0	800	15.0	0.0	4.7		
1975	56.0	56.0	0.0	56.0		28.0	74.4	3.8	3.4	2.4
1976	58.0	46.0	20.7	46.0	1840	23.0	79.0	3.7	3.2	2.8
1977	68.2	57.2	16.1	10.0	400	5.0	76.8	5.0	3.7	
1978	65.4	64.9	0.8	42.0	2200	21.0	80.0	4.2	3.7	2.4
1979	84.5	62.1	26.5	60.0	1860	30.0	90.0	3.8	3.6	
1980	90.7	80.3	11.5	20.0	315	10.0	70.0	5.4	3.3	
1981	89.0	86.2	3.2	78.0	2118	39.0	95.0	4.0	3.7	3.1
1982	100.0	81.0	18.5	28.0	688	14.0	65.0	4.1	3.2	2.8
1983	95.0	92.8	2.4	3.4	125	1.7	5.9	4.8		
1984	85.0	85.0	0.0	42.0	1500	21.0	83.3	3.7	3.2	2.1
1985	85.0	80.0	5.4	50.0	1457	25.0	87.7	3.7	3.2	2.4
1986	90.0	70.0	20.4	58.0	2100	29.0	90.0	3.9	3.6	3.2
1987	100.0	85.0	15.0	47.0	1900	23.5	80.0	3.7	3.4	2.8
1988	80.0	80.0	17.7	13.0	675	6.5	51.0	5.2	3.4	2.7
1989	70.0	70.0	1.4	60.0	1025	30.0	60.0	3.8	3.3	
1990	60.0	60.0	0.0	53.0	940	26.5	49.2	3.8	3.2	2.2
1991	60.0	56.0	6.6	41.6	888	20.8	82.0	4.1	3.4	2.7
1992	70.0	56.0	20.0	46.2	742	23.1	70.1	4.0	3.5	3.5
1993	65.0	64.5	0.8	52.2	910	26.1	85.1	3.9	3.2	
1994	70.0	52.5	25.0	30.0	1000	15.0	13.0	2.8	2.1	
1995	65.0	64.0	0.8	8.8	430	4.4	50.0	4.7	2.8	
1996	75.0	75.0	0.0	75.4	740	37.7	75.4		3.7	2.4
1997	85.0	70.0	15.0	55.2	628	22.6	71.2	4.0	3.5	
1998	90.0	80.0	10.0	31.8	750	15.9	66.0	4.6	3.5	
1999	90.0	85.0	5.6	20.8	278	10.4	75.0	4.7	3.3	
2000	95.0	87.4	8.0	49.6	738	24.8	87.8	3.5	3.2	2.8
2001	105.0	92.4	12.0	48.0	900	24.0	87.0	3.6	3.2	2.3
2002	110.0			60.6		30.3	81.5	4.0	3.5	
2003				55.0		27.5	77.5			
2004	117.5	105.0	4.9	56.8		28.4	75.0	3.6		
2005	117.5			95.8	900	47.9	82.3	4.2	3.7	
2006	132.5							3.7		

Appendix B. Description of Habitats Used by Wrangel Island Snow Geese

Area	Use	Number	Season	Remarks	Threats or Safeguards
RUSSIAN FEDERATION					
Wrangel Island	Breeding	~120,000	Summer	Possibly 200,000 in 1960s	State Nature Preserve. High predation pressure in some years.
ALASKA					
North Slope	Migration	unknown (almost all geese from Banks)	Fall, Spring	Molting area, Wrangel population interchange with Western Arctic population	Region-wide oil and gas production, but most use areas not developed.
Kobuk-Selawik Delta	Migration	Unknown	Fall, Spring	Greater use in fall migration	
Seward Peninsula	Migration	Unknown	Fall, Spring	Spring staging area, up to 5000	
St. Lawrence Island	Migration	Unknown	Fall, Spring		
Yukon-Kuskokwim Delta	Migration	Unknown	Fall, Spring	Mostly Fraser-Skagit; 15-20,000	
Nunivak Island	Migration	1,000 maximum	Fall	Fall staging	
Carter Spit	Migration	Unknown	Spring		
Egegik & Cinder Deltas & Pilot Point	Migration	Unknown – many thousands	Fall	Fall only	Critical habitat designation by state
Kenai & Kasilof River	Migration	Unknown	Spring	Mostly Fraser-Skagit flock	Urban expansion on river deltas
Chickaloon Flats	Migration	5,000	Spring	Mostly Fraser-Skagit flock	State tidelands, adjacent to Kenai NWR
Cook Inlet: Palmer-Hay Flats, Trading Bay, Susitna Flats, Redoubt Bay	Migration	Unknown	Fall, Spring	Spring 10-20,000 Fall small variable numbers	Nearly all habitats designated state game refuges or critical habitats. Active oil and gas production.
Copper River Delta	Migration	Unknown	Fall	Fall staging	USFS owned & state critical habitat
Yakutat Area	Migration	Unknown	Fall, Spring	Mostly Fraser-Skagit flock staging area	USFS & state owned
Stikine River Delta	Migration	Unknown	Fall, Spring	Mostly Fraser-Skagit flock	Mostly in USFS management
CANADA					
Yukon North Slope	Migration	Unknown (almost all geese from Banks)	Fall, Spring		
Hay Lake, Alberta	Migration	Unknown	Fall	Reliance on this location diminished considerably over past 40+ years (from spring / fall surveys at this location through the 80's and 90's)	Possible oil spill; Ramsar Site + Wildland Park (Provincial designation)

SE Alberta & SW Saskatchewan	Migration	400,000 w/ W. Arctic	Fall	Feeding & staging area	
Fraser River Delta, BC	Winter	70,000 (w/Skagit)	Winter	Population increasing	Reifel Refuge, development
WASHINGTON					
Skagit River Delta/ Port Susan Bay	Winter	70,000 (w/Fraser)	Winter	Population increasing	State Wildlife Area & TNC Possible oil spill, development
Willapa Bay	Migration		Fall	Historical wintering	Federal Refuge
OREGON & NORTHERN CALIFORNIA					
Sauvie Island and lower Columbia River	Winter	2,500-3,500	Winter	Wrangel	Some state wildlife areas and federal refuges
Summer Lake	Migration	10,000-75,000 w/ W. Arctic	Fall, Spring	Wrangel & W. Arctic	State Wildlife Area
Klamath Basin & Northeast California	Migration	10,000-50,000 w/ W. Arctic in fall; 100,000-150,000 w/ W. Arctic in spring	Fall, Spring	Wrangel & W. Arctic	Mostly federal refuge
Lake and Harney Co.	Migration	10,000-150,000 w/ W. Arctic in spring	Spring	Wrangel & W. Arctic	Some federal refuge and state lands, but mostly private lands.
CENTRAL & SOUTHERN CALIFORNIA					
Central Valley	Winter	450,000 w/ W. Arctic	Winter	80% in Sacramento Valley, some are Wrangel birds	Some state & federal areas Agricultural development, disturbance, disease
Imperial Valley	Winter	12,600 w/ W. Arctic	Winter	Some Wrangel birds	One state area & one federal refuge
MONTANA					
Freezeout Lake	Migration	50,000 w/ W. Arctic	Fall, Spring	Oregon-California flock	State controlled

Appendix C. White goose indices in use areas south of Fraser-Skagit wintering area

Year	Peak Spring Index*			Peak Fall Index			SLWA	Winter Index			
	TLNWR	LKNWR	Total	TLNWR	LKNWR	Total		LCR-OR	LCR-WA	LCR-Total	CA Inferred
1960	87000	40000	127000	74000	10000	84000					
1961	75000	10000	85000	168000	6000	174000					
1962	270000	28000	298000	107000	40000	147000					
1963	67000	16200	83200	140000	45200	185200					
1964	51600	25300	76900	218040	7050	225090					
1965	102100	8600	110700	300050	7560	307610					
1966	190150	4700	194850	318400	13160	331560					
1967	352500	20000	372500	502000	19700	521700					
1968	200500	17000	217500	277100	5800	282900					
1969	240028	87725	327753	229900	1100	231000			2		
1970	208500	123000	331500	230200	2050	232250			557		117767
1971	261000	40330	301330	289000	30200	319200			307		95725
1972	156000	20000	176000	306150	16450	322600			912		82288
1973	200000	22500	222500	168000	38400	206400			45		66975
1974	212000	52000	264000	191000	69000	260000			367		57183
1975	226000	6180	232180	172700	200	172900			440		43214
1976	304000	18100	322100	253000	6000	259000			845		41138
1977	241000	20000	261000	166200	12000	178200			468		42828
1978	127000	7000	134000	143600	40	143640			1049		48276
1979	132000	200	132200	183000	5000	188000			1042		56567
1980	101900	42000	143900	172000	2000	174000			677		50323
1981	143350	6000	149350	110000	14360	124360			2008		46492
1982	24300	4000	28300	104200	15000	119200			702		56208
1983	45000	23600	68600	70000	50	70050	51000		1002		49372
1984	159000	27000	186000	204000	4000	208000	58000		913		52487
1985	185000	26000	211000	94000	4100	98100	50000	2859	2706	5565	39235
1986	54000	73000	127000	96000	7500	103500	70000	2037	1	2038	41724
1987	130700	52000	182700	120800	300	121100	69830	1521	23	1544	58816
1988	146800	14000	160800	128800	4300	133100	34750	1904	5	1909	22741
1989	80000	21000	101000	46000	0	46000	17746	152	4	156	26084
1990	41800	19000	60800	56000	600	56600	44000	1240	4	1244	24987
1991	109000	24200	133200	66000	0	66000	35510	1427	0	1427	26515
1992	80000	27000	107000	12300	18000	30300	37381	621	4	625	30276
1993	64000	21600	85600	17000	0	17000	47325	676	175	851	17149
1994	67500	32000	99500	14000	40	14040	37312	2	4	6	28094
1995	55000	35000	90000	59000	30	59030	42197	1506	0	1506	23894
1996	70000	26000	96000	11000	300	11300	27272	489	3	492	29308
1997	68000	60400	128400	45100	77500	122600	33838	573	0	573	37444
1998	101000	46000	147000	61000	5500	66500	31150	1030	0	1030	41838
1999	52400	42000	94400	19000	11000	30000	31552	2568	20	2588	37711
2000	66000	52000	118000	23000	2000	25000	21927	962	0	962	37820
2001	94000	27300	121300	14000	120	14120	19595	1750	6	1756	46101
2002	120000	28000	148000	36000	0	36000	18859	429	2900	3329	36208
2003	121500	53600	175100	73000	800	73800	14556		728	728	
2004	84600	52000	136600	6000	4000	10000	11882	1771	3	1774	47585
2005	89000	43000	132000	11000	4000	15000	12525	2902	0	2902	34558

*For years at least after 1990, over 90% of spring white geese on Lower Klamath are Ross geese

Appendix D. Fraser-Skagit wintering and harvest information

APPENDIX B. Fraser-Skagit population and harvest information

YEAR	% YOUNG			WINTER INDEX	SURVEY NOTES	HARVEST ¹			YKD	TOTAL	HARVEST STRATEGY PARAMETERS				
	PRESEAS	POSTSEA	HARVEST			FRASER(BC) ²	SKAGIT(WA) ²	BC-WA ²			EST. ADULTS	ADULTS (3-YR)	TOT (3-YR)	H. (3-YR)	HR (3-YR)
1948	34.9	16.3	79.6	26,000			6,948	6,948		6,948	21,762	21,762	26,000	6,948	0.267
1949	10.0	10.4	50.0	29,400	*		720	720		720	26,342	24,052	27,700	3,834	0.138
1950	5.5	4.1	40.6	18,160			960	960		960	17,415	21,840	24,520	2,876	0.117
1951	34.6	24.1	77.5	16,075			6,600	6,600		6,600	12,201	18,653	21,212	2,760	0.130
1952	25.0	14.8	63.9	25,700	*		7,200	7,200		7,200	21,896	17,171	19,978	4,920	0.246
1953	14.6	13.4	54.3	17,230			7,380	7,380		7,380	14,921	16,340	19,668	7,060	0.359
1954	18.8	9.9	68.9	22,558	**		9,840	9,840		9,840	20,325	19,047	21,829	8,140	0.373
1955	22.7	4.6	61.7	19,091	*		6,360	6,360		6,360	18,213	17,820	19,626	7,860	0.400
1956			54.9	15,100			6,144	6,144		6,144	6,810	15,116	18,916	7,448	0.394
1957	33.0		75.6	20,373	*		10,920	10,920		10,920	13,650	12,891	18,188	7,808	0.429
1958	2.0		66.7	26,986			4,380	4,380		4,380	26,446	15,635	20,820	7,148	0.343
1959	36.0		59.4	14,246	*		5,400	5,400		5,400	9,117	16,405	20,535	6,900	0.336
1960	3.4		42.9	24,425	***		3,480	3,480		3,480	23,595	19,719	21,886	4,420	0.202
1961	25.0		63.4	22,180			4,320	4,320		4,320	16,635	16,449	20,284	4,400	0.217
1962	0.0			27,641	***		2,052	2,052		2,052	27,641	22,624	24,749	3,284	0.133
1963				23,600			3,360	3,360		3,360		22,138	24,474	3,244	0.133
1964	30.3	15.8	49.8	21,800	***		10,512	10,512		10,512	18,356	22,998	24,347	5,308	0.218
1965			0.0	26,100			3,204	3,204		3,204	26,100	22,228	23,833	5,692	0.239
1966	35.4	31.1	64.4	15,800	***		9,300	9,300		9,300	10,886	18,447	21,233	7,752	0.361
1967	2.6		6.3	17,800			4,752	4,752		4,752	17,337	18,108	19,900	5,672	0.289
1968			18.0	22,600	***		6,252	6,252		6,252	18,532	15,585	18,733	6,768	0.361
1969	25.0		73.3	15,400	***		9,636	9,636		9,636	11,550	15,806	18,600	6,880	0.370
1970	25.0		63.9	31,676	*		9,024	9,024		9,024	23,757	17,946	23,225	8,304	0.358
1971	1.0			35,968	*		7,728	7,728		7,728	35,608	23,638	27,681	8,796	0.318
1972	1.0			23,800	***		8,016	8,016		8,016	23,562	27,642	30,481	8,256	0.271
1973				18,980			3,456	3,456		3,456		29,585	26,249	6,400	0.244
1974	0			12,450			2,460	2,460		2,460	12,450	18,006	18,410	4,644	0.252
1975	37.8	33.2	58.8	12,346	*	2,972	2,880	5,852		5,852	8,247	10,349	14,592	3,923	0.269
1976	36.3		67.3	16,017	*	1,102	5,064	6,166		6,166	10,203	10,300	13,604	4,826	0.355
1977	3.4		19.0	24,904	*	576	1,680	2,256		2,256	24,057	14,169	17,756	4,758	0.268
1978	40.0			16,075	*	401	3,420	3,821		3,821	9,645	14,635	18,999	4,081	0.215
1979	36.4			26,891	**	1,917	6,372	8,289		8,289	17,103	16,935	22,623	4,789	0.212
1980	11.0	19.0		39,700	**	1,725	4,908	6,633		6,633	32,157	19,635	27,555	6,248	0.227
1981	49.5			40,500	**11/19	3,378	18,240	21,618		21,618	20,453	23,237	35,697	12,180	0.341
1982	17.0	5.8	19.0	43,090	**12/4	2,666	2,664	5,330		5,330	40,591	31,067	41,097	11,194	0.272
1983		0.0	4.0	44,626	**11/8		3,648	3,648		3,648	44,626	35,223	42,739	10,199	0.239
1984	16.3	12.6		31,600	**	2,700	5,352	8,052		8,052	27,618	37,612	39,772	5,677	0.143
1985	32.0	24.0		40,200	**12/5	3,972	11,232	15,204		15,204	30,552	34,265	38,809	8,968	0.231
1986	29.0	25.0		46,238	**11/4		3,528	3,528		3,528	34,679	30,950	39,346	8,928	0.227
1987	43.0	40.0		39,640	**Ave.	2,329	2,964	5,293	2,102	7,395	23,784	29,672	42,026	8,008	0.191
1988	7.8			55,350	**11/19	1,556	2,860	4,416	5,201	9,617	51,033	36,498	47,076	4,412	0.094
1989	0.0			43,760	**Ave.	926	300	1,226	889	2,115	43,760	39,526	46,250	3,645	0.079
1990	12.2			33,769	**12/12	748	300	1,048	1,284	2,332	29,649	41,481	44,293	2,230	0.050
1991	30.3	28.6		32,058	**	1,642	1,692	3,334	863	4,197	22,889	32,100	36,529	1,869	0.051
1992	2.0			39,099	**	1,246	1,060	2,306	1,655	3,961	38,317	30,285	34,975	2,229	0.064
1993	32.8			47,000	**	2,232	2,231	4,463	2,119	6,582	31,584	30,930	39,386	3,367	0.085
1994	5.4	8.5		41,900	**	1,838	1,294	3,132	2,115	5,247	38,339	36,080	42,666	3,300	0.077
1995	5.0	5.4		39,600	**	750	584	1,334	2,305	3,639	37,462	35,795	42,833	2,976	0.069
1996	23.0			45,200	**	1,869	2,184	4,053	3,834	7,887	34,804	36,868	42,233	2,840	0.067
1997	19.2	16.2		46,983	**	1,536	1,598	3,134	1,379	4,513	39,372	37,212	43,928	2,841	0.065
1998	14.3	13.2		47,132	**	1,351	1,163	2,514	2,135	4,649	40,911	38,362	46,438	3,234	0.070
1999		15.6		49,701	**	1,380	1,781	3,161	1,339	4,500	41,948	40,743	47,939	2,936	0.061
2000		20.3		56,218	**	1,893	2,394	4,287	1,495	5,782	44,806	42,555	51,017	3,321	0.065
2001		21.1		57,143	**	1,458	1,744	3,202	3,072	6,274	45,086	43,946	54,354	3,550	0.065
2002		26.7		70,463	**	2,230	3,026	5,256	1,871	7,127	51,649	47,180	61,275	4,248	0.069
2003		12.8		66,798	**	2,390	2,849	5,239		5,239	58,248	51,661	64,801	4,566	0.070
2004		15.3		68,141	**	2,387	2,592	4,979	1,388	6,367	57,715	55,871	68,467	5,158	0.075
2005		39.0		80,040	**	3,991	8,150	12,141		12,141	48,824	54,929	71,660	7,453	0.104
Mean 1948-60	19.1	9.9	61.2	21,180			5,872	5,872		5,872	17,900	18,189	21,606	6,009	0.287
Mean 1961-70	20.1	23.5	47.5	22,460			6,241	6,241		6,241	18,977	19,233	21,938	5,730	0.268
Mean 1971-80	17.9	26.1		22,713		1,449	4,598	5,468		5,468	19,226	18,489	21,795	5,672	0.263
Mean 1981-90	22.1	16.9	9.5	41,877		2,284	5,109	6,936	2,068	7,884	34,674	33,953	41,710	7,544	0.187
Mean 1991-00	13.8	12.5		44,489		1,574	1,598	3,172	2,145	5,096	37,043	36,093	42,794	2,891	0.068
Mean 2001-05**		23.0		68,517		2,491	3,672	6,163		7,430	52,305	50,718	64,111	4,995	0.077

¹WA harvest estimation method changed to mandatory permit in 1993; BC method changed to special mail survey in 1991

²Fraser-Skagit harvest estimates adjusted for 20% wounding loss

2005 Fraser harvest estimate preliminary

SURVEY NOTES: *Photo count Skagit, visual estimate Fraser **Photo count Skagit and Fraser ***Fraser not counted

Appendix E. Hunting seasons, season lengths and bag limits in certain key areas important in the harvest of the Wrangel Island Population of lesser snow geese.

Year	AK:	Days	Daily	WA: Skagit	Days	Daily	OR: Lake & Klamath	Days	Daily
1971	Sep.1-Dec.14	105	6 geese	Oct.16-Jan.16	93	6 geese (3 dark)	Oct. 9-Jan. 9	93	6 geese (3 dark)
1972	Sep.1-Dec.14	105	6 geese	Oct.14-Jan.14	93	6 geese (3 dark)	Oct. 14-Jan. 14	93	6 geese (3 dark)
1973	Sep.1-Dec.16	107	6 geese	Oct.13-Jan.13	93	3 geese	Oct. 13- Jan. 13	93	6 geese (3 dark)
1974	Sep.1-Dec.16	107	6 geese	Oct.12-Jan.12	93	3 geese	Oct. 12-Jan. 12	93	6 geese (3 dark)
1975	Sep.1-Dec.16	107	6 geese	Oct.11-Dec.7	58	2 geese	Oct.11-Jan.11	93	3 snow
1976	Sep.1-Dec.16	107	6 geese	Oct.16-Dec.12	58	3 geese (2 snow)	Oct. 9-Jan. 9	93	3 snow
1977	Sep.1-Dec.16	107	6 geese	Oct.15-Jan. 1	79	3 geese (2 snow)	Oct.15-Jan.15	93	3 snow
1978	Sep.1-Dec.16	107	6 geese	Oct.14- Dec.31	79	3 geese (2 snow)	Oct. 14-Nov. 9 & Nov. 10-Jan. 14	93	1 white, 1st part 3 white, 2nd part
1979	Sep.1-Dec.16	107	6 geese	Oct.13-Dec.31	80	3 geese	Oct. 13-26 & Oct.27-Jan.13	14 79	1 white, 1st part 3 white, 2nd part
1980	Sep.1-Dec.16	107	6 geese	Oct.11-Dec.31	82	3 geese	Oct. 18-31 &	14	1 white, 1st part
				(Whatcom Co. closed)-----				79	Nov. 1-Jan. 18
1981	Sep.1-Dec.16	107	6 geese	Oct. 10-Jan. 3	86	3 geese	Oct. 17-30 &	14	2 geese, 1st part
				(Whatcom Co. closed)-----				79	Nov. 1 -Dec. 17
1982	Sep.1-Dec.16	107	6 geese	Oct. 9-Jan. 2	86	3 geese	Oct. 16-31 &	16	3 geese, 1st part
				(Whatcom Co. closed)-----				77	Nov. 1 -Dec. 16
1983	Sep.1-Dec.16	107	6 geese	Oct. 15-Jan. 1	79	3 geese	Oct. 15- 28 &	14	3 geese, 1st part
				(Whatcom Co Nov5-Jan 1)	(58)	(1 goose)	Oct.29-Jan.15	79	3 white, 2nd part
1984	Sep.1-Dec.16	107	6 geese	Oct.13-Dec.30	79	3 geese	Oct.13-Jan.13	93	3 white
				(Whatcom Co Nov3-Dec30)	(58)	(1 goose)			
1985	Sep.1-Dec.16	107	6 geese	Oct.12-Dec.29	79	3 geese	Oct.12-Jan.12	93	3 white
1986		107	6 geese	Oct. 11 -Dec. 28	79	3 geese	Oct.18-Jan.18	93	3 white
1987	Sep.1-Dec.16	107	6 geese	Oct. 17-Jan. 1	77	3 geese	Oct.17-Jan.17	93	3 white
1988	Sep.1-Dec.16	107	6 geese	Oct. 15-Jan. 8	86	3 geese	Oct.15-Jan.15	93	3 white
1989	Sep.1-Dec.16	107	6 geese	Oct. 14- Jan. 7 ^a	86	3 geese	Oct.14-Jan.14	93	3 white
1990	Sep.1-Dec.16	107	6 geese	Oct.13-Dec.30 ^b	79	3 geese	Oct.20-Jan.20	93	3 white
1991	Sep.1-Dec.16	107	6 geese	Oct.12-Dec.29	79	3 geese	Oct.19-Jan.19	93	3 white
1992	Sep.1-Dec.16	107	6 geese	Oct. 17-Jan. 3	79	3 geese	Oct.10-Jan.17	100	3 white
1993	Sep.1-Dec.16	107	6 geese	Oct. 16-Jan. 2	79	3 geese	Oct. 9-Jan. 16		

1994	Sep.1-Dec.16	107	6 geese	Oct. 15-Jan.1	79	3 geese	Oct. 8-Jan. 15		
1995	Sep.1-Dec.16	107	6 geese	Oct. 14-Dec. 31	79	3 geese	Oct. 7-Jan. 14		
1996	Sep.1-Dec.16	107	3 light	Oct. 12-Dec. 29	79	3 geese	Oct. 5-Jan. 12		
1997	Sep.1-Dec.16	107	3 light	Oct. 11-Jan. 4	86	3 geese	Oct. 5-Jan. 11		
1998	Sep.1-Dec.16	107	3 light	Oct. 10-Jan. 3	86	3 geese	Oct. 3-Jan. 9		
1999	Sep.1-Dec.16	107	3 light	Oct. 9-Jan. 2	86	3 geese	Oct. 9-Jan. 16		
2000	Sep.1-Dec.16	107	3 light	Oct. 7-Jan. 1	86	3 geese	Oct. 7-Oct. 18 & Oct. 21-Jan. 14		
2001	Sep.1-Dec.16	107	3 light	Oct. 6-Jan. 6	93	3 geese	Oct. 6-Oct. 17 & Oct. 20-Jan. 13		
2002	Sep.1-Dec.16	107	3 light	Oct. 5-Jan. 5	93	3 geese	Oct. 5-Dec. 3 & Dec. 20-Jan. 26		
2003	Sep.1-Dec.16	107	3 light	Oct. 11-Jan. 4	86	3 geese	Oct. 11-Nov. 30 & Dec. 10-Jan. 25		
2004	Sep.1-Dec.16	107	3 light	Oct. 16-Jan. 9	86	3 geese	Oct.9-Nov. 30 & Dec. 17-Jan. 30		
2005	Sep.1-Dec.16	107	3 light	Oct. 15-Jan. 8	86	4 geese	Oct. 8-Nov. 29 & Dec. 15-Jan. 29		

Appendix E. Continued.

Year	BC	Days	Daily	CA: NE	Days	Daily	CA: N.C. Valley	Days	Daily
1971	Oct 9-Dec 5	58	5 geese	Oct. 9-Jan. 9	93	6 geese(3 dark)	Oct. 16-Jan. 16	93	6 geese (3 dark)
	Feb 5-Mar 10	35	5 geese						
1972	Oct7-Dec 3	58	5 geese	Oct.14-Jan.14	93	6 geese(3 dark)	Oct. 14-Dec. 20 &	68	6 geese (3 dark)
	Feb 3-Mar 10	36	5 geese				Dec. 27-Jan. 20	25	6 geese (3 dark)
1973	Oct 6-Dec 2	58	5 geese	Oct. 13-Jan.13	93	6 geese(3 dark)	Oct. 20-Jan. 20	93	6 geese (3 dark)
	Feb 2-Mar 10	37	5 geese						
1974	Oct 5-Dec 1	58	5 geese	Oct.12-Jan.12	93	6 geese(3 dark)	Oct. 19-Jan. 19	93	6 geese (3 dark)
	Feb 9-Mar 9	29	5 geese						
1975	Oct 11-Nov 30	51	5 geese	Oct.11-Jan.11	93	3 snow	Oct.18-Jan.18	93	3 snow
	Jan 31-Mar 10	40	5 geese						
1976	Oct 9-Nov 28	51	5 geese	Oct. 9-Jan. 9	93	3 snow	Oct.23-Jan.23	93	3 snow

	Jan 29-Mar 10	41	5 geese						
1977	Oct 8-Nov 27	51	5 geese	Oct.15-Jan.15	93	3 snow	Oct. 22-Jan. 22	93	3 snow
	Jan 28-Mar 10	42	5 geese						
1978	Oct 7-Nov 28	53	5 geese	Oct. 14-Nov. 9&	27	1 white, 1st part	Oct. 21 - Dec. 25 &	36	3 white, 1st part
	Jan 27-Mar 10	43	5 geese	Nov. 10-Jan. 14	66	3 white, 2nd part	Dec, 26-Jan. 21	57	1 snow, 2nd part
1979	Oct 6-Nov 25	51	5 geese	Oct. 13-26 &	14	1 white, 1st part	Oct. 20-Jan. 20	93	1 white
	Jan 26-Mar 10	45	5 geese	Oct.27-Jan.13	79	3 white, 2nd part			
1980	Oct 11-Nov 30	51	5 geese	Oct. 18-31 &	14	1 white, 1st part	Nov. 1-Jan. 18	79	2 white
	Jan 25-Mar 10	45	5 geese	Nov. 1 -Jan. 18	79	3 white, 2nd part			
1981	Oct 10-Nov 29	51	5 geese	Oct. 17-30 &	14	1 goose, 1st part	Oct.31-Jan.17	79	3 white
	Jan 23-Mar 10	47	5 geese	Nov. 1 -Dec. 17	79	3 white, 2nd part			
1982	Oct 9-Nov 28	51	5 geese	Oct. 16-29 &	14	1 goose, 1st part	Nov. 6-Jan.23	79	3 white
	Jan 22-Mar 10	48	5 geese	Oct. 30-Jan. 16	79	3 white, 2nd part			
1983	Oct 8-Nov 27	51	5 geese	Oct. 15-29 &	14	1 goose, 1st part	Nov. 5-Jan. 22	79	3 white
	Jan 21-Mar 10	50	5 geese	Oct. 29-Jan. 15	79	3 white, 2nd part			
1984	Oct 6-Nov 25	51	5 geese	Oct.13-Jan.13	93	3 geese	Nov. 3-Jan. 20	79	3 geese
	Jan 19-Mar 10	51	5 geese						
1985	Oct 12-Nov 30	50	5 geese	Oct.12-Jan.12	93	3 geese	Nov. 2-Jan. 19	79	3 geese
	Jan 18-Mar 10	52	5 geese						
1986	Oct 10-Nov 30	51	5 geese	Oct.11-Jan.11	93	3 geese	Nov. 1-Jan. 18	79	3 geese
	Jan 17-Mar 10	53	5 geese						
1987	Oct 10-Nov 29	51	5 geese	Oct.10-Jan.10	93	3 geese	Oct. 31 -Jan. 17	79	3 geese
	Jan 16-Mar 10	55	5 geese						
1988	Oct 8-Nov 27	51	5 geese	Oct. 8-Jan. 8	93	3 geese	Oct.29-Jan.15	79	3 geese
	Jan 14-Mar 10	56	5 geese						
1989	Oct 7-Nov 26	51	5 geese	Oct.14-Jan.14	93	3 geese	Oct.28-Jan.14	79	3 geese
	Jan 13-Mar 10	56	5 geese						
1990	Oct 6-Nov 25	51	5 geese	Oct.13-Jan.13	93	3 geese	Oct.27-Jan.13	79	3 geese
	Feb 9-Mar 10	30	5 geese						
1991	Oct 12-Dec 1	51	5 geese	Oct.12-Jan.12	93	3 geese	Oct.26.-Jan.12	79	3 geese
	Feb 10-Mar 10	30	5 geese						
1992	Oct 10-Dec1 &	53	5 geese	Oct.10-Jan.10	93	3 geese	Oct.24-Jan.10	79	3 geese

	Feb 10 – Mar 10	29	5 geese						
1993	Oct 9-Nov 30 & Feb 10 – Mar 10	53	5 geese	Oct. 9-Jan. 9	93	3 geese	Oct. 30-Jan. 16	79	3 geese
	Feb 10 – Mar 10	29	5 geese						
1994	Oct 8-Nov 27 & Feb 11 – Mar 10	51	5 geese	Oct. 8-Jan. 8	93	3 geese	Oct. 29-Jan. 15	79	3 geese
	Feb 11 – Mar 10	28	5 geese						
1995	Oct 7-Nov 26 & Feb 11 – Mar 10	51	5 geese	Oct. 7-Jan. 7	93	3 geese	Oct. 28-Jan. 14	79	3 geese
	Feb 11 – Mar 10	29	5 geese						
1996	Oct 12-Nov 24 Feb 8 – Mar 10	44	5 geese	Oct. 5-Jan. 5	93	3 geese	Nov. 2-Jan. 19	79	3 geese
	Feb 8 – Mar 10	31	5 geese						
1997	Oct 5-Nov 25 Feb 5 – Mar 10	52	5 geese	Oct. 4-Jan. 4	93	3 geese	Nov. 1-Jan. 18	79	3 geese
	Feb 5 – Mar 10	34	5 geese						
1998	Oct 10-Nov 29 Feb 6 – Mar 10	51	5 geese	Oct. 3-Jan. 3	93	3 geese	Oct. 31-Jan. 17	79	3 geese
	Feb 6 – Mar 10	33	5 geese						
1999	Oct 9-Nov 28 Feb 5 – Mar 10	51	5 geese	Oct. 9-Jan. 16	100	3 geese	Nov. 6 –Jan. 23	79	3 geese
	Feb 5 – Mar 10	35	5 geese						
2000	Oct 7-Nov 26 & Feb 3 – Mar 10	51	5 geese	Oct. 7-Jan. 14	100	3 geese	Nov. 4-Jan. 21	79	3 geese
	Feb 3 – Mar 10	36	5 geese						
2001	Oct 6-Nov 25 Feb 9 – Mar 10	51	5 geese	Oct. 6-Jan. 13	100	3 geese	Nov. 3-Jan. 20	79	3 geese
	Feb 9 – Mar 10	30	5 geese						
2002	Oct 12-Dec 1 & Feb 8 – Mar 10	51	5 geese	Oct. 12-Jan. 19	100	3 geese	Nov. 2-Jan. 26	86	3 geese
	Feb 8 – Mar 10	31	5 geese						
2003	Oct 11-Jan 4 & Feb 21 – Mar 10	85	5 geese	Oct. 11-Jan. 18	100	3 geese	Nov. 1-Jan. 25	86	3 geese
	Feb 21 – Mar 10	19	5 geese						
2004	Oct 9-Jan 2 & Feb 20 – Mar 10	86	5 geese	Oct. 9-Jan. 16	100	3 geese	Oct. 30-Jan. 30	93	3 geese
	Feb 20 – Mar 10	19	5 geese						
2005	Oct 8-Jan 2 & Feb 21 – Mar 10	87	5 geese	Oct. 8-Jan. 15	100	4 geese	Oct. 22-Jan. 29	100	4 geese
	Feb 21 – Mar 10	18	5 geese						

APPENDIX F: Lesser snow goose harvest estimates from federal surveys.

Lesser Snow (Blue) Goose Harvest (HIP) by State and Flyway, 1999-2004.

Year	AZ	CA	CO	ID	MT	NV	NM	OR	UT	WA	WY	PF Total	AK	CF Total	MF Total	AF Total
1999	165	41,435	0	336	1,485	193	0	4,473	187	2,683	67	51,025	165	487,753	317,412	54,820
2000	790	26,594	0	0	1,936	108	0	7,978	119	1,421	0	38,945	94	380,158	234,699	71,935
2001	0	33,377	0	399	637	327	0	6,213	92	3,526	0	44,572	0	345,139	315,508	77,802
2002	274	30,279	0	179	938	117	0	7,845	0	6,566	0	46,197	329	268,572	197,297	39,295
2003	300	33,037	0	451	582	315	0	5,186	95	2,641	0	42,607	0	247,982	286,279	36,105
2004	1,200	35,355	0	124	1,188	183	0	945	80	1,535	0	40,611	0	216,202	192,256	31,548
Averages:																
1999-00	478	34,014	0	168	1,710	151	0	6,226	153	2,052	34	44,985	130	433,955	276,056	63,377
2001-10	443	33,012	0	288	837	235	0	5,047	67	3,567	0	43,497	82	269,474	247,835	46,187
All Years	455	33,346	0	248	1,128	207	0	5,440	95	3,062	11	43,993	98	324,301	257,242	51,917
% Change from:																
1999-03	292.4%	7.3%		-54.4%	6.5%	-13.6%		-85.1%	-18.9%	-54.4%	-100.0%	-9.1%	-100.0%	-37.5%	-28.9%	-43.7%
2003	300.0%	7.0%		-72.4%	104.1%	-41.8%		-81.8%	-16.3%	-41.9%		-4.7%		-12.8%	-32.8%	-12.6%
% Flyway Harvest												% U.S. Harvest				
1999-00	1.1%	75.6%	0.0%	0.4%	3.8%	0.3%	0.0%	13.8%	0.3%	4.6%	0.1%	5.5%	0.0%	53.0%	33.7%	7.7%
2001-10	1.0%	75.9%	0.0%	0.7%	1.9%	0.5%	0.0%	11.6%	0.2%	8.2%	0.0%	7.2%	0.0%	44.4%	40.8%	7.6%
All Years	1.0%	75.8%	0.0%	0.6%	2.6%	0.5%	0.0%	12.4%	0.2%	7.0%	0.0%	6.5%	0.0%	47.9%	38.0%	7.7%

**HARVEST STRATEGY FOR THE
WRANGEL ISLAND POPULATION OF
LESSER SNOW GEESE
2006-2010**

BACKGROUND

This harvest strategy is of interest to the U.S. Fish and Wildlife Service (USFWS), Canadian Wildlife Service (CWS), Pacific Flyway states and provinces, first nations, and other constituents to jointly conserve and manage the Wrangel Island population of lesser snow geese (WISG). Although WISG occur and are harvested in Alaska (AK), California (CA) and Oregon (OR), the Fraser-Skagit segment of the population wintering in British Columbia (BC) and Washington State (WA) accounts for about 60% of the population. It is almost impossible to estimate either abundance or harvest of the WISG wintering in CA and OR because these birds mix with much larger numbers of snow geese from northwest Canada. Accordingly, this Strategy is focused primarily on managing harvest on the Fraser-Skagit segment. Based on population dynamics and marking information, the Fraser-Skagit segment currently has strong winter philopatry, with very little documented immigration from or emigration to other wintering areas.

Population growth-- This harvest strategy stems, in part, from the increased abundance of this population since the early 1990s and from the need to maintain it within prescribed, manageable boundaries. The intent of this strategy is to maintain WISG into the future, but not allow it to grow out of control as has happened with the mid-continent population of lesser snow geese. The latter population grew exponentially in the 1980s and 1990s, resulting in crop depredation problems on the winter range and severe habitat degradation on the spring staging and breeding grounds (Batt 1997). However, the Wrangel Island ecosystem is different from mid-continent breeding areas; higher latitude nesting conditions, severe weather conditions, high predation pressure in some years, competition from other herbivores, and a limited carrying capacity on the molting area may limit growth rates compared to the mid-continent. Historically, estimates of WISG in the spring reached over 200,000 geese but declined to a low of 56,000 in 1975, and are currently estimated to be near the flyway plan objective of 120,000. (Appendix A).

Trends in harvest-- Harvest estimates for the Fraser-Skagit segment have averaged 5,328 (n=58 years) since 1948 and 6,163 (n=5) for the period 2001-05 (see Appendix D). Except for most of the 1990s, fall harvest has historically been larger in WA than in BC. A total estimate of WISG fall harvest is not available because Wrangel Island geese mix with snow geese from the western Arctic in OR and CA. Alaska subsistence harvest may average approximately 6-8,000 Wrangel Island snow geese per year (includes birds from both wintering segments), mostly taken on the Yukon-Kuskokwim Delta, with additional harvest in the Bering Strait and Northwest Arctic regions. Subsistence harvest in BC and WA is considered to be negligible. "Harvest rates" from the Fraser-Skagit segment, calculated by comparing harvest survey results

(adults + juveniles) to fall/winter surveys, averaged about 7% between 1990 and 2005 (range = 5 - 10%) (see Figure A and Appendix D).

HARVEST STRATEGY

Entire population--The parties to this plan recognize the need to support and maintain a long-term harvest strategy that ensures maintenance of the population and equitable harvests among users. The primary method of regulating the Wrangel Island population will be from sport and subsistence seasons. The response effects of changes in regulations and management programs should be evaluated every 5 years. In recognition that WISG are a shared resource throughout the flyway, the following harvest guidelines will apply to this population:

1. If the 3-year average population index on Wrangel Island drops below 50,000 geese, all hunting will be suspended in the Fraser-Skagit area and light goose seasons will be established to minimize the harvest of WISG in other areas of the flyway.
2. If the 3-year average population index on Wrangel Island is above 160,000, the flyway will evaluate the possibility of establishing new conservation seasons in migration and wintering areas.
3. Efforts to control overabundant white goose populations in other parts of North America (e.g. Alberta) should minimize effects on WISG.

Fraser-Skagit flock--A simple model for a closed population can be used to calculate the mean annual “harvest rate” needed to maintain a stable Fraser-Skagit flock:

$$N_{t+1} = N_t + \text{Recruitment} - \text{Mortality}$$

where N_t = Population size in year 1; N_{t+1} = Population size in year 2; Recruitment = % young in the population (post-season); Mortality = Natural Mortality + (Subsistence) Harvest in Russia/YKD + (Sport) Harvest on the Fraser-Skagit deltas.

To maintain the Fraser-Skagit segment at a relatively “stable” level N_{t+1} must equal N_t over the long term, meaning that Recruitment must equal Mortality. Given that mean Recruitment for the Fraser-Skagit segment is approximately 20% and the sum of Natural Mortality + (Subsistence) Harvest in Russia/YKD is estimated at approximately 8%, the mean harvest rate needed to maintain a stable Fraser-Skagit segment should be 12% (= 20% - 8%), with a buffer of $\pm 2\%$ to account for estimation errors.

The following harvest guidelines will apply to the Fraser-Skagit flock:

1. Harvest regulations will be directed at the growing wintering flock in the Fraser-Skagit area rather than the smaller, decreasing proportion that migrates through Oregon to winter in California.
2. When the adult segment of the population is greater than the upper threshold of 70,000 adults, (3-year average), the Fraser-Skagit harvest rate should be **>14%** of the most

recent 3-year average index.

3. When the adult segment is within the fall population goal of 50-70,000 individuals, the Fraser-Skagit harvest rate should be between **10-14%** of the most recent 3-year average index.
4. If the adult segment is less than the lower threshold of 50,000 individuals, (3-year average) the Fraser-Skagit harvest rate should be **<10%** of the most recent 3-year average index.
5. If the adult segment is less than 30,000 individuals (3-year average) or the 3-year average total population index on Wrangel Island drops below 50,000 geese, all hunting should be suspended in the Fraser-Skagit area.
6. After a closure and when the population increases above a 3-year average index of 35,000 white birds in the Fraser-Skagit, or when the 3-year average Wrangel Island index increases above 50,000, limited hunting may be considered; in this case, the harvest rate should be **<6%** of the most recent 3-year average.
7. This harvest strategy must be monitored through continuation of the mid-winter photo counts, Wrangel Island spring surveys, and surveys of fall/winter and subsistence harvest.

Figure A. Fraser-Skagit trends in adult geese and estimated total harvest rates (adults+young)

