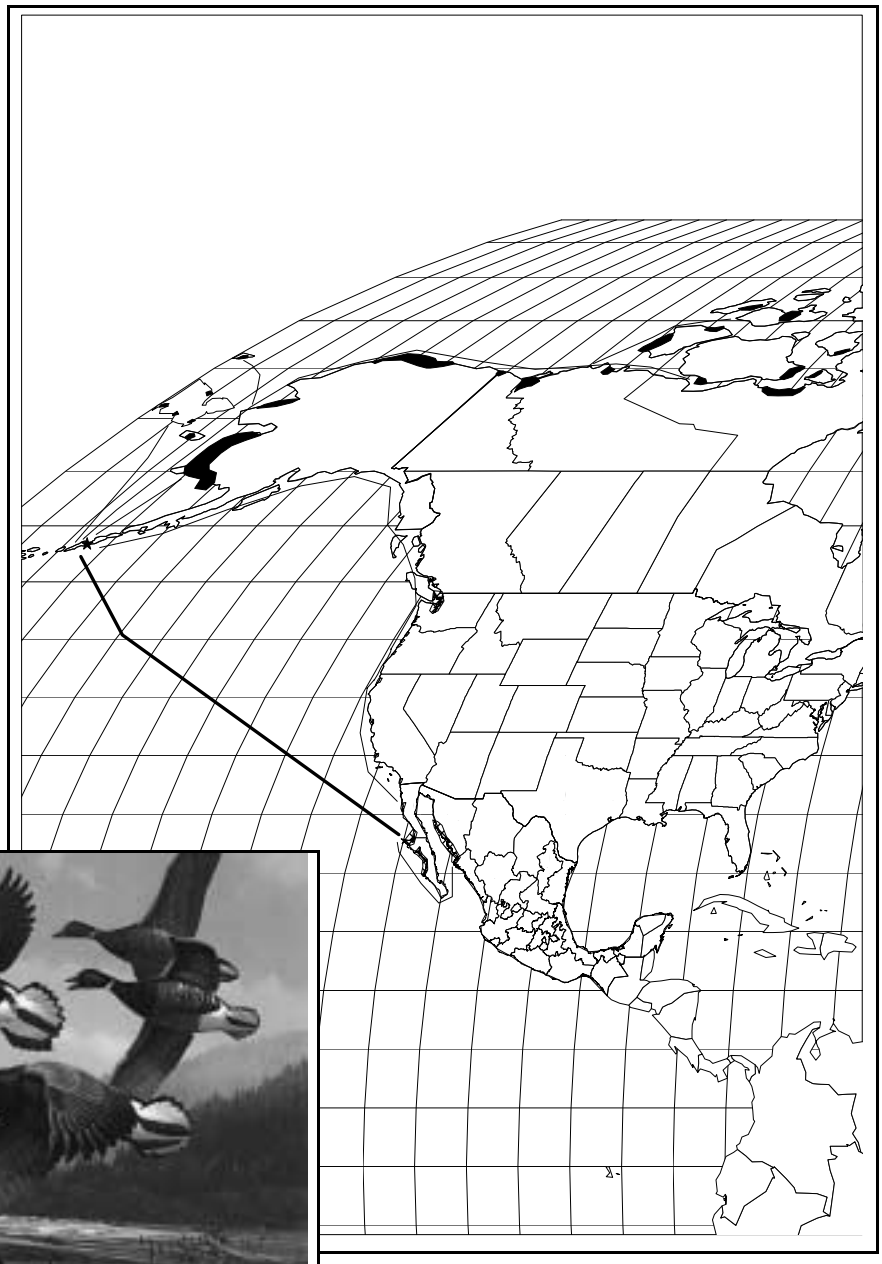
Pacific Flyway Management Plan for

Pacific Population of Brant



PACIFIC FLYWAY MANAGEMENT PLAN

FOR

PACIFIC BRANT

Prepared for the:

Pacific Flyway Council
Commonwealth of Russian States
Dirección General de Conservación Ecológica de Recursos Naturales
U.S. Fish and Wildlife Service
Canadian Wildlife Service

Prepared by:

Subcommittee on Pacific Brant
Pacific Flyway Study Committee

March 1978
Revised March 1981
Revised July 1992
Revised July 2002
Technical Revision July 2004

Approved by: _____/s/ Jay Lawson_____ __7/26/02___
Chairman, Pacific Flyway Council Date

Suggested Citation: Pacific Flyway Council. 2002. Pacific Flyway management plan for Pacific brant. Pacific Flyway Study Comm. [c/o USFWS, DMBM] Portland, OR Unpubl. rept., 40 pp. + appendices.

This management plan is one of a series of cooperatively developed plans for managing 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. 11 Ave, Portland, Oregon 97232. Information regarding the Pacific Flyway Council and management plans can be found on the Internet at PacificFlyway.gov.

Suggested citation: Pacific Flyway Council. 2002. Pacific Flyway Management Plan for Pacific Brant. C/o U. S. Fish and Wildlife Service, Portland, Oregon.

ACKNOWLEDGMENTS

The Pacific Flyway Council appreciates the work of the Brant Subcommittee to update and revise this management plan, and particularly Chris Dau and Russ Oates of USFWS in Anchorage who undertook the arduous task of managing reviews, re-writing and formatting several early drafts. Marty Drut, USFWS, Portland, facilitated further review and compilation of sections.

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The Council offers special thanks to Dr. Jim Sedinger and his students at the University of Alaska – Fairbanks for development of the brant population model and long-term research on breeding ecology and population dynamics on the Yukon-Kuskokwim Delta; to David Ward of the USGS Alaska Science Center for research and management information from Mexico; to Sean Boyd of CWS and Mike Davison, Washington Department of Fish and Wildlife, for information on Western High Arctic and black brant wintering in northern Puget Sound and the Fraser River estuary; to Fred Cooke, formerly of Simon Fraser University, for development of research on WHA brant and perspectives on management of northern wintering areas; and to Jim Hines for information on black brant and harvests in northwest Canada.

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I. INTRODUCTION

The Pacific Flyway brant *(Branta bernicla)* population (PFBP) is made up of brant breeding in Alaska, the western Canadian arctic, and the eastern Russian arctic, and wintering primarily along the Pacific Coast from Alaska to Mexico (Figure 1). In 1978 the Pacific Flyway Council implemented the first Pacific Brant Management Plan. The plan was revised in 1981 and 1992.

The PFBP breeds in Alaska, Canada and Russia (Appendix A) and is subdivided into two management units. Black brant predominate, breeding primarily in Alaska, the low Arctic of western Canada, and northeastern Russia (Palmer 1976, Banikov et al. 1983). Western High Arctic (WHA) brant breed on the Parry Islands in Northwest Territories and exhibit plumage characteristics ranging from the light gray breast and belly feathers of Atlantic brant to the black breast and belly feathers of black brant (Boyd and Maltby 1979). Most of the WHA population is composed of the lighter and intermediate plumage types.

The WHA population is currently distinguished from other North American brant populations (Boyd and Maltby 1979, Boyd and Maltby 1980, Boyd et al. 1988, Reed et al. 1989a, Reed et al. 1998). Genetic comparisons suggest the population may be reproductively isolated from black brant and Atlantic brant and comprise a separate stock with no subspecies designation (Shields 1990). This plan recognizes the separate status of WHA brant for management purposes.

It is recognized that the PFBP is a resource shared among the people of the United States, Canada, Mexico, Russia, and Japan. As such, a cooperative effort has been and will continue to be required for sound management.

II. GOAL AND OBJECTIVES

The goal of this plan is to identify the requirements and responsibilities necessary to cooperatively manage the PFBP on a sustained basis. This resource will be managed for sustained yield following management procedures designed to achieve and maintain population and winter distribution objectives. An essential part of this goal is the continued availability and health of brant habitats throughout their range.

This plan establishes population objectives of 150,000 black brant and 12,000 WHA brant, as measured by the 3-year running average of the midwinter waterfowl survey (hereafter midwinter survey). The combined objective for the PFBP is 162,000.

Consumptive (hunting) and non-consumptive (photography, bird watching, etc.) uses of this resource are recognized. PFBP objectives are established primarily to meet consumptive uses, since numerical requirements for such uses generally exceed those for non-consumptive uses. Management practices, seasons, and bag limits will be designed to provide for consumptive and non-consumptive uses of the resource by a maximum number of people. Some management practices and surveys requiring pooled resources are best accomplished by state, provincial, territorial, and federal agencies.

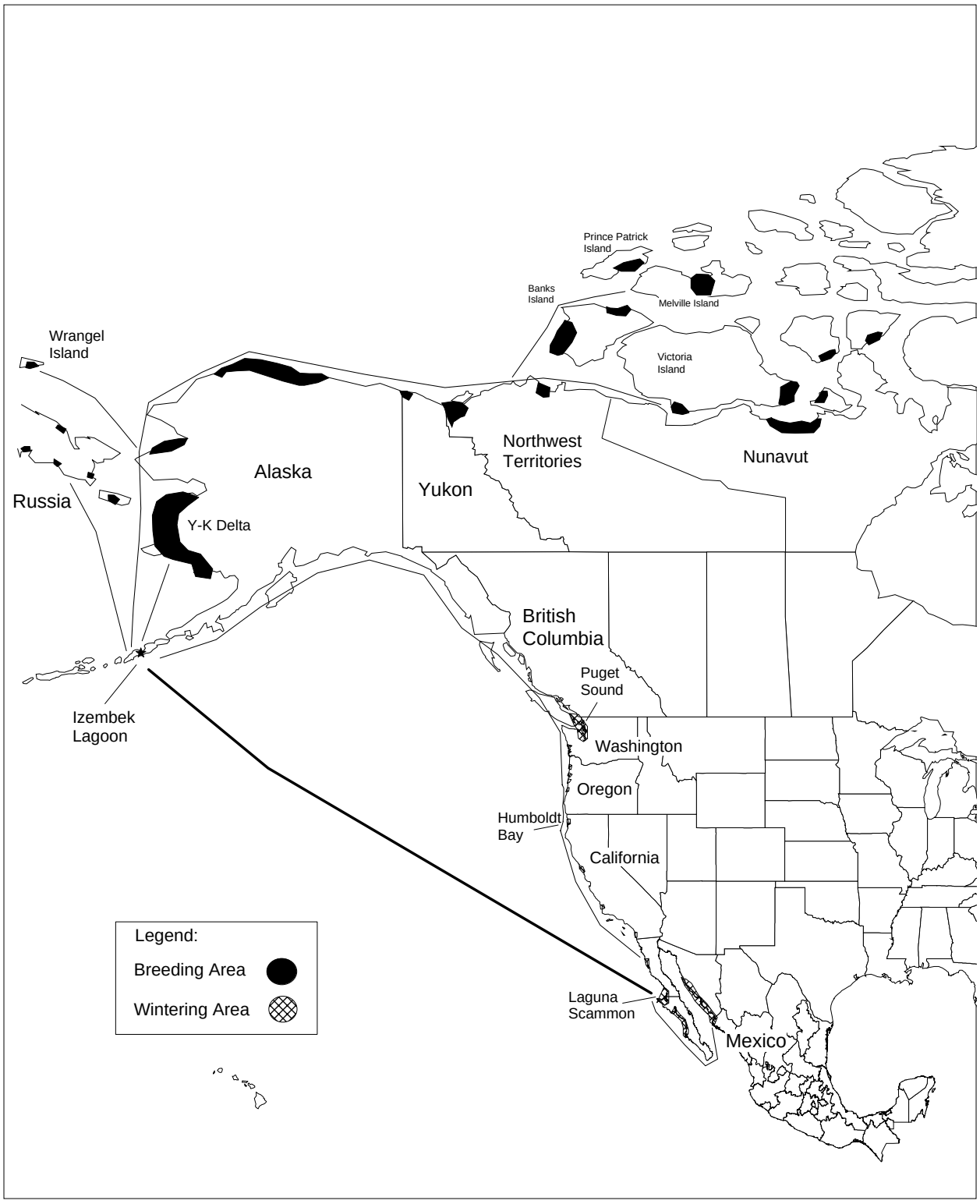

Figure 1. Breeding, migration, and winter distribution of Pacific Flyway brant.

A. Black Brant

Since adoption of the 1978 plan, the combined midwinter objective for all PFBP has been 185,000. This plan sets a lower objective for black brant based on a review of previous midwinter survey results, separate recognition of WHA brant, and current understanding of the dynamics of the PFBP. Midwinter survey indices from 1961-70 averaged 161,000. The indices exceeded 180,000 only twice between 1960-2000 and, in each case, the high indices averaged 46,000 more brant than the preceding or subsequent indices. High counts may have resulted from a combination of sampling and counting error. The average for the 1960s is believed to represent a more reasonable wintering population goal. Most winter surveys in California during the 1950s and 1960s were conducted in February or March when spring migrants were present.

The most recent version of the population model for Pacific brant (available soon at http://www.ag.unr.edu/brant) predicts a stable combined population of about 130,000, given current estimates of population parameters. A key determinant of population size is limitation of foraging habitat for goslings before fledging, which reduces recruitment below maximum attainable levels (Person et al. 1998, Sedinger et al. 1998, 2001). The current model projections are considered conservative because grazing geese are altering the habitat on the breeding grounds of the Yukon-Kuskokwim Delta (YKD), such that carrying capacity in the area is slowly increasing (Person et al. in review). In the 1980s, large areas of grazing habitat reverted to a form unavailable to brant broods. Increased grazing intensity associated with higher overall goose populations in the 1990s is facilitating the return of these habitats to a state that will support broods and increase carrying capacity on the YKD. These habitat dynamics provide further rationale for an objective of 162,000 (average from the 1960s) for the PFBP.

B. Western High Arctic Brant

Previous versions of Pacific brant plans did not specify population objectives for the WHA brant population. The population objective is a 3-year average of 12,000 WHA brant, as measured by the midwinter survey. This objective is based on historic counts averaging 12,200 brant (1953-1970).

C. Winter Distribution Objectives

In addition to objectives for population size, this plan continues objectives for the winter distribution of black brant and WHA brant. By the 1960s, brant had apparently shifted their winter distribution from the coastal U.S. to Mexico. Since adoption of the first brant management plan in 1978, the Pacific Flyway has established objectives and taken management actions to retain and increase the number brant wintering north of Mexico.

Table 1. Winter Distribution Objectives for the Pacific Flyway Brant Population.

	Subtotal	Total
Alaska	9,000	**9,000**
British Columbia		**8,000**
Queen Charlotte Islands	1,500	
Vancouver Island	3,500	
Fraser Valley Foreshore	3,000	
Washington		**25,000**
Samish/Padilla/Fidalgo Bays(WHA)	12,000	
Birch and Lummi Bays	8,000	
Dungeness Bay	1,000	
Hood Canal	500	
Other small areas in Puget Sound	500	
Willapa Bay/Grays Harbor	3,000	
Oregon		**3,000**
Tillamook/Netarts Bay	2,500	
Yaquina Bay	500	
California		**10,000**
Humboldt Bay	5,000	
Tomales-Drakes Bay	3,000	
Morro Bay	2,000	
Mexico		**107,000**
Baja	77,000	
Mainland	30,000	
TOTAL		**162,000**

III. STATUS AND DISTRIBUTION

A. Status, Trends, and Management Indices

Several surveys are conducted annually that assess the status of brant. Over 75 percent of the black brant migrate directly to wintering areas on the west coasts of both Baja California and mainland Mexico (Dau 1992). The remaining 10 percent occur in coastal bays from Cold Bay, Alaska to California. The midwinter waterfowl survey is the primary management index for black brant. Midwinter survey indices averaged 148,000 in the 1960s, although many surveys were conducted later in the spring in the United States, which likely resulted in some birds being counted twice. More consistently conducted midwinter surveys in January averaged: 136,100 from 1971-1980; 138,300 from1981 to 1990; and 133,300 from 1991 to 2000 (Appendix B).

Early workers estimated that more than 50 percent of the PFBP nested on the YKD (Spencer et al. 1951, Hansen and Nelson 1957, King and Lensink 1971) but no survey results exist to accurately quantify numbers of black brant nesting on the YKD prior to 1980. More recent information indicates that nearly 80 percent of the PFBP nests on the YKD (Derksen and Ward 1993, Sedinger et al. 1993). Nesting black brant (ground surveys on three major colonies only) on the YKD declined during the 1980s (Sedinger and Derksen 1992, Sedinger et al. 1993). This decline, however, was not fully reflected in the midwinter survey. Aerial videography in the 1990s (Anthony 2001) shows that nesting pairs on five major colonies have been slowly increasing, except in 2001 when nesting was affected by fox predation and late snow melt (Appendix C).

Indices to brant population levels (black and WHA brant combined) are also available from Izembek Lagoon near Cold Bay, Alaska, where brant stage for up to six weeks. Ground-based surveys are conducted to annually estimate productivity (Appendix D), and replicated aerial surveys are conducted to estimate the total fall population.

The disparity in trends between breeding, migration, and wintering indices is not understood. The disparities are thought to be due to differences in sampling methods, migration timing, and sampling errors, partially associated with climatic events.

Status and trends of WHA brant are even less clear than those for black brant. Derksen and Ward (1993) estimated that nesting effort for the WHA population was 2,000 birds, with 500 on Prince Patrick Island and 1,500 on Melville Island. Another index to this population is the midwinter waterfowl survey in north Puget Sound Washington, but it is not known if all brant counted there are WHA brant in all years. Color composition of the WHA brant population is not completely known, and has only been determined through molt captures (~25% black bellied brant). There is also a large annual variation in color composition of brant in north Puget Sound. Earlier research documented that all WHA brant wintered in Padilla, Samish, and Fidalgo bays, Washington (Reed et al. 1989a), but WHA brant have subsequently been documented in Boundary Bay and Roberts Bank, BC.

During the period 1953-1970, the average number of brant in Padilla, Samish, and Fidalgo bays during the midwinter survey was 12,200, a decrease from levels recorded prior to 1950. These brant were possibly a mixture of WHA and black brant, however the proportions were unmeasured. The population declined significantly during 1971-1980 to an average of 5,600 birds. Considering the past 20 years (1981-2000), the population index (9,100) is 25% below the 1953-70 average and 5% below the 1953-2000 average of 9,600 (Appendix B).

1. Breeding Grounds

Brant nesting on the YKD was once described as a large colony extending 100 miles along the coast (Spencer et al. 1951). Although there are some dispersed breeding brant, much of that nesting area is now unoccupied and the most brant are found at major colonies. Ground strip surveys at Kokechik Bay, Tutakoke River, and Kigigak Island colonies indicated 20,750 brant pairs in 1981; 12,000 pairs in 1982; and 8,550 pairs in 1986 (Appendix E). The significance of this 60% decline in nests on those three colonies is not fully understood. During this period, all YKD breeding colonies were not monitored and average January indices of the entire black brant population declined by only 14% during the same period.

Ground surveys of colonies were replaced by standardized aerial videographic surveys in 1993 to improve estimates of nest densities and production at primary colonies (Anthony 2001). These surveys were expanded to include colonies at Baird Inlet and Baird Peninsula. During 1993-2000, counts on the five colonies have averaged about 19,900 nests (Appendix C).

Flooding of colonies, predation, and subsistence harvest are likely the key factors in the decline of brant on the YKD during the 1980s (Sedinger et al.1993, Raveling 1984, King and Derksen 1986, Lensink 1987, Anthony and Sedinger 1987). During the period 1982-1985, high numbers of Arctic foxes (*Alopex lagopus)* reduced the number and success of nesting brant on the YKD (Appendix E). High populations of arctic foxes for this length of time are unprecedented in other parts of the Arctic (Summers and Underline 1991). Fox predation was again high in 2001 (J. Sedinger pers.comm.) Because brant nesting populations on the YKD have not returned to pre-1982 levels, another extended period of predation may prevent population growth. Experimental removal of arctic foxes was shown to be a viable tool in reducing nest predation on colonies and increasing productivity (Anthony et al. 1991). There is no annual survey to estimate post-nesting productivity of brant throughout the YKD, but some brood size data are available (Appendix F).

Elsewhere in Alaska, an estimated 200 brant nest from the Seward Peninsula to Kasegaluk Lagoon, along the Chukchi Sea coast. Over 3,000 breeding brant are estimated along the Beaufort Sea coast east to the Canning River, with the largest colonies of several hundred nests on the Colville River Delta and several colonies within the Prudhoe Bay-Kuparuk oilfields (Stickney and Ritchie 1996).

Black brant breed in the low arctic of northwest Canada on Banks and Victoria Islands and at several mainland locations east to Queen Maud Gulf (Reed et al. 1998) (Appendix A). Barry (1961a) estimated that two-thirds of the brant in Queen Maud Gulf region were Pacific Brant and one-third was Atlantic brant. On both Banks and Victoria Islands brant nest in small, scattered

colonies primarily along the coast but in some cases up to 60 miles inland. Manning et al. (1956) estimated 80,000 brant for the whole of Banks Island, while Barry (1961b) estimated 9,000 for the areas roughly corresponding to the two migratory bird sanctuaries on the island. Aerial surveys over most of Banks Island in 1992 and 1993 indicated about 10,000 brant in June, including 1,900 breeding pairs (Cotter et al. 1993, 1994). For Victoria Island, Barry (1960) estimated 3,000 brant in the southeast part of the island; Cornish and Dickson (1996) found 900-1,200 in the northwest and 200 in the southwest parts of the island.

There are few trend data for black brant in other areas of the western Canadian arctic (see Barry 1956, 1967; Alexander and Hawkings 1987; Alexander et al. 1988). The density of brant nests at the Anderson River colony (T. Barry, in litt.) declined 67 percent from an average of 1,220 nests/mi^2 during 1973-77 (range 718 to 2,124) to 403 nests/mi^2 during 1978-82. It is unclear if this represents a decline in the population or simply a shift in local or regional distribution. Anderson River now may have less than 500 breeding pairs (J. Hines pers. comm.). Recent surveys of brant on mainland areas west of Anderson River (Inuvialuit Settlement Region) provide estimates of nearly 6,000 brant (600 breeding pairs) from Smoke River and Campbell Island through the Mackenzie River Delta (Wiebe and Hines 1998).

The WHA population breeds on Melville, Prince Patrick, and Eglinton Islands of the Parry Islands (Appendix A). The most extensive work done on the breeding area of WHA brant was accomplished by Maltby-Prevett et al. (1975) and Boyd and Maltby (1979), and included habitat mapping, surveys of distribution and abundance, and banding. Breeding brant were observed throughout a series of islands in the region, but band returns indicated that those molting on western Melville, Prince Patrick, and Eglinton Islands showed a strong affinity for wintering in the north Puget Sound area. Brant from the eastern part of Melville Island and Bathurst Island were recovered in Ireland.

Additional work on banding and plumage characteristics by Reed et al. (1989) suggested a distinct range for the WHA population. Combined estimates of color composition from molt captures indicate an average of 74% gray-bellied brant (Munsell 10YR color 4-8) in the population (from Boyd and Maltby 1979, Reed et al. 1989a) (Appendix G).

Black brant breed in Russia at several mainland locations from Bering Strait west to the Lena River Delta, the New Siberian Islands and Wrangel Island (Dementiev and Gladkov 1951-54) (Appendix A). The historic population may have numbered up to several thousand breeding pairs (Dementiev and Gladkov 1951-54; Portenko 1981), 2,000 alone on Wrangel Island (Uspenski 1965). Currently Wrangel Island is believed to support fewer than 100 pairs and breeding is sporadic (Stishov et al. 1991;Ward et al. 1993a). Trends at other breeding sites are unknown.

2. Molting and Fall Migration

Black brant molt in large numbers on freshwater lakes north and east of Teshekpuk Lake on the Arctic Coastal Plain (ACP) of Alaska (Hansen 1957). Black brant from the Canadian Arctic (i.e. the Mackenzie River and Anderson River deltas, and Banks Island), the YKD and Chukotka,

Russia use this area (King and Hodges 1979). An estimated 25,000, in flocks of 50 to 1,500, were present on these lakes during July and early August (King 1970). Up to 25 percent of the PFBP has used the Teshekpuk area during molt with an average of 13.1 percent (Appendix H)(King and Hodges 1979, Derksen et al. 1979, King and Derksen 1986, King 1987, E. Mallek pers. comm.). There is a tendency for the number of molting brant at Teshekpuk to increase when nesting success is lower on theYKD (Appendix F).

The Teshekpuk Lake molting population includes failed and non-breeding components of the various geographic populations, which undertake a molt migration in June and July as well as local breeders (Derksen et al. 1982). Elsewhere on the ACP, up to 8,500 molting brant have been recorded at scattered locations (Ritchie and Wildman 2000). Several thousand molting brant also occur at various locations throughout the western Canadian Arctic where annual numbers vary dramatically (Alexander et al. 1988).

Wrangel Island is the most important molting area for black brant in Russia (Ward et al. 1993a). Historically a molting population of 10,000 birds was estimated (Uspenski 1964) which declined to an estimated 4,200 by 1990 (Ward et al. 1993a). Banding information indicates brant movement between Russia, Alaska and Canada.

Molting flocks of WHA brant averaged 140 birds with some over 1,000 in 1974 when no breeding took place, while in a year of good breeding (1973) flocks averaged only 58 birds with a maximum of 120 (Boyd and Maltby 1979).

Brant depart Arctic molting areas from late August through early September, staging near Icy Cape (Lehnhausen and Quinlan 1982). Johnson (1993) estimated that up to 49% of the entire population used Kasegaluk Lagoon near Icy Cape in August to September. Brant also stage in Mechigmenskiy Bay and along the Chukotka Peninsula of Russia. Safety Lagoon at Nome is near the northern extent of eelgrass (*Zostera marina*) on the west coast of North America and is used in fall. Chagvan Bay and Nanvak Bay, near Cape Newenham are important spring and fall staging areas.

Arctic brant, along with subarctic molters, migrate to Izembek Lagoon near Cold Bay, Alaska. Brant from the YKD arrive first, followed by birds from Russia, northern Alaska, the western Canadian low arctic, and finally the WHA and Victoria Island (Reed et al. 1989b). Most WHA brant utilize Moffett Point, Moffett Lagoon, and Neumann Island in the northern part of Izembek Lagoon (Dau 1996). Essentially all of the PFBP uses the Izembek area for up to six weeks in fall and for up to four weeks in spring.

The Izembek Lagoon area provides staging brant resources necessary to complete migration. In fall, over 90 percent of PFBP migrates essentially nonstop for an estimated 54 hours along a 5,300-km route from Izembek to Mexico (Dau 1992). Some sporadic landfalls occur in coastal areas of southern British Columbia, Washington, Oregon, and northern California, but the vast majority (>80%) apparently fly directly to coastal lagoons of Baja California and the west coast of mainland Mexico, where they winter. Significant numbers of WHA brant begin arriving in north Puget Sound wintering areas usually during late October and early November (Dau 1992).

3. Winter

Since annual winter surveys in Alaska began in 1981, an average of 7,951 brant have wintered at Izembek Lagoon (Dau and Ward 2000; Appendix A). It is unknown whether WHA brant are present in the Alaska wintering population.

Black brant have increased on the Fraser River Delta of BC in the last two decades, from virtually none in the 1980s to almost 1,500 in 2001. Major use areas include Boundary Bay and Roberts Bank, and another 400-500 brant winter in the Queen Charlotte Islands (Masset area). A small number (200-250) of WHA brant currently winter in the Fraser River Delta. These comprised 3 % of wintering brant in 1994-1995, increasing to 18% in 1999-2000.

Black brant wintering in Washington declined significantly from pre-1960 levels but have increased since the 1970s (Appendix B). Major use areas include Willapa, Dungeness, Birch, and Lummi Bays, and Hood Canal. Black brant in these areas originate from Alaska or other western Canadian Arctic stocks (Reed et al. 1989a).

A relatively stable number of WHA brant winters from mid-December through January primarily in Padilla, Samish, and Fidalgo bays of Washington. Use areas for WHA brant have expanded in Padilla/Samish/Fidalgo bays since Jewett et al. (1953) described Smith Island as the primary wintering site. In Padilla/Samish/ Fidalgo Bays; primary gritting and loafing sites include Swinomish Spit, Bayview, and Samish Spit. Brant typically utilize these areas on moderate ebb tides (generally 5 ft. below mean sea level). Brant have increased in Washington areas north of Padilla bay, but few to no gray-bellied brant have been observed.

Productivity estimates of brant in Padilla, Samish, and Fidalgo Bays have been conducted since 1980 (Appendix I), and separated by color composition since 1994. During the period 1994-2000, the juvenile percentage of gray-bellied brant has averaged 14.8% (n = 9,595).

Observations in the Padilla/Samish/Fidalgo bay area indicate that a number of black brant from various breeding locations migrate through the area in late November and early December. Reed et al (1989a) believed that all of the brant wintering in Padilla, Samish and Fidalgo bays, Washington were WHA brant. However, based on color composition surveys and annual variation in population levels, it is probable that some non-WHA populations winter in Padilla/Samish/Fidalgo bays during particular years. From recent surveys, a shift in color composition from predominantly dark-bellied brant to predominantly gray-bellied brant has been documented during the first two weeks of December. The color composition of the wintering population (mid-December through January) exhibits wide annual variation, but the average percentage of gray-bellied brant (72%) during 1994-2000 resembled that of WHA brant on the breeding grounds (74% gray-bellied) documented by Boyd and Maltby (1979) and Reed et al. (1989a) (Appendix G).

Black brant wintering in Oregon have declined significantly from pre-1950's levels. From 1960 through the early 1990's, 10-year averages of wintering brant remained relatively stable at 1,000-1,800. Wintering brant numbers declined by nearly 50% in 1994 and have remained low. An

average of 625 brant have wintered in Oregon since then (Appendix B).

In a 1995-1998 study, 75% of marked brant wintering in Yaquina Bay were from mainland breeding sites near Liverpool Bay, Northwest Territories. At Netarts Bay, marked wintering brant included 50% from the Liverpool Bay areas and 50% from breeding colonies near Prudhoe Bay, Alaska (Pitkin 2000). Very strong site fidelity was exhibited by brant wintering at Yaquina Bay and Netarts Bay, and most wintering brant appeared to be sedentary from mid-November through March on Oregon estuaries (Pitkin 2000).

Black brant that wintered in California apparently declined even more dramatically than those in Washington (Appendix B). Due to the inconsistent timing of surveys prior to 1960 and an inability to differentiate between wintering brant and migrants, an accurate assessment of long-term trends in both the wintering and migratory brant population in California is impossible. Important historic wintering sites in California were Humboldt, Bodega, Tomales, and Morro Bays. Limited use also occurs in Mission and San Diego bays.

Humboldt Bay is the most important wintering and migration site in California where since 1991, brant banded on the YKD, the Alaska North Slope, Wrangel Island, Banks Island and Victoria Island have been observed. Peak counts of spring staging brant at Humboldt Bay were 20,000-40,000 from 1950-77, declined to 10,000-15,000 in the 1980's, but have increased to 20-25,000 in the late 1990's. Population trends at other California sites are thought to be proportionally similar to that observed at Humboldt Bay.

Embayments of Baja California are primary wintering sites of black brant, supporting >80% of the population (Nelson 1921, Leopold and Smith 1953, B. Conant pers. comm.). Less than 10 color-marked WHA brant per year have been observed as far south as San Quintin Bay, Mexico (D. Ward pers. comm.), 8,400 km from the breeding grounds. Population estimates of brant wintering in Mexico have varied widely but exhibit a slight downward trend since 1965. Brant occur in the four major bays on the Pacific coast of Baja California as well as the five northernmost bays/lagoons of the "mainland" west coast, nearly all of which contain substantial beds of eelgrass. Brant have not been recorded south of Bahia Santa Maria, which also is believed to be the southern limit of eelgrass (Kramer and Migoya 1989).

One of the most important sites for brant in Mexico is San Quintin Bay. It serves as both a primary wintering area and a key staging area during fall and spring migration (Ward et al. 1993b). The importance of San Quintin Bay to brant was made even more evident during the "El Niño" winter of 1997-98 when brant numbers were reduced at all major wintering sites in Mexico except San Quintin Bay. This small (43.5-km^2) bay hosted over 60,000 brant or >50% of the black brant population.

4. Spring Migration

Spring migration differs from fall with respect to duration and habitat use. In spring brant make comparatively short migration flights from late January through April, stopping at the same areas used in fall and winter. The exception may be that a large segment of the population flies

nonstop approximately 2,500 km from Washington and British Columbia to the Alaska Peninsula.

In California, Oregon and Washington migrant brant congregate in the same estuaries identified as fall and winter use areas. Of these, Humboldt, Tomales and Bodega bays in California and Willapa Bay in Washington support the largest numbers. In western Washington, peak annual population counts typically occur in late April when brant are widely distributed throughout coastal and Puget Sound waters. In 1993, the peak spring count was 37,500. Most brant usually leave Washington by early May. Staging areas for WHA brant are unknown north of Washington.

The three main areas of brant use in British Columbia are the east coast of the Queen Charlotte Islands, the southeast coast of Vancouver Island, and the Fraser River Delta foreshore and the adjacent bay (Appendix A). Observations of color-banded brant have shown that early March migrants are composed of birds that have wintered in British Columbia (67%) Mexico (25%), Washington (5%), and California (3%). A minimum of 18% of brant wintering in Mexico pass through the Strait of Georgia (Nygren 1990), and, based on resighting data of banded birds, up to 85,000 brant might be stopping in the Strait of Georgia in the spring (McKelvey et al. 1992 – Unpubl. CWS Report).

Spring migrants begin arriving at Izembek and adjacent lagoons in April and linger for 3 to 6 weeks prior to continuing their migration to breeding sites. Peak numbers, exceeding 90,000, are present from 25 April-5 May. Nanvak and Chagvan Bays support about 50,000 brant prior to movements on to the YKD and northern breeding areas.

B. Habitat Use

Coastal habitats of highest importance to Pacific brant are listed in Table 2.

Table 2. Major use areas of Pacific brant and subjective assessment of threats.

AREA	TYPE OF USE	% OF PF POPULATION			CUMULATIVE THREATS
		Nest	Stage	Winter	
YKD	Nest/Molt	~80	-	-	Medium
Mexican estuaries	Staging/Winter	-	~80	~80	High
Izembek Lagoon area	Staging/Winter	-	100	8-10	Medium
BC/Washington estuaries	Staging/Winter	-	>80 PFBP 100WHA	~10PFBP 100WHA	High
Oregon estuaries	Staging/Winter	-	< 1	<1	High
California estuaries	Staging/Winter	-	~50-60	~2	High
Teshekpuk Lake area	Nest/Molt	< 1	~10	-	High
Alaska North Slope	Nest/Molt	~4	~15	-	Medium
Arctic Canada	Nest/Molt	15	~20	-	Medium
Russian Far East	Nest/Molt	1	~10	-	Medium

1. Breeding and Molting Areas

Brant nesting and brood rearing habitat on the YKD is within the Yukon Delta National Wildlife Refuge. About 50 percent of the refuge is owned by Alaska Natives. Management of Native owned land and potential future uses is uncertain. For example, increasing use of all-terrain vehicles, especially in the Kokechik Bay area, is damaging both Native and Refuge lands.

Nesting and brood rearing habitats on the YKD are subject to physical changes such as erosion caused by tidal surges. In addition, dynamic interactions exist between brant and plant foods necessary for gosling growth. Grazing is required to maintain these plants in form and availability for goslings. Ongoing research suggests that years of poor nest success and the resulting lower number of grazing geese, result in temporary reversion of grazing lawns to a form not used by broods (J. Sedinger pers. comm.). Such changes temporarily reduce carrying capacity on the breeding grounds.

Brant also nest in small colonies scattered along the Arctic Coastal Plain east to the Canning River. Preferred nesting habitats include river delta islands that are above storm surge effects and islands in freshwater lake basins near the coast. Areas of salt marsh that are relatively uncommon along the Beaufort Sea are particularly important to brant during brood-rearing (Kiera 1982) and fall staging. Extensive petroleum exploration and development has occurred in the central coast region between the Colville and Canning Rivers, presenting threats of habitat degradation, oil spills, industrial disturbance, and artificially elevated predator populations (Sedinger and Stickney 2000). Recent oil development in the Colville River Delta could affect the largest colonies on the Alaska north coast.

Large lakes and meadow habitats north and east of Teshekpuk Lake, within the National Petroleum Reserve - Alaska (NPR-A), are used annually by an average of about 13 percent of the entire black brant population during molt. In addition, there are some small nesting colonies in the region. The Bureau of Land Management (BLM) recently included this area in a land use plan for the Northeast Planning Area, which proposed authorization of oil and gas exploration (USDOI-BLM/MMS 1998). The final EIS deferred leasing in the goose molting area, but provides for reconsideration in the near future. The critical issues remain potential damage to unique habitats (Derksen et al. 1982) that are vital to molting brant, and potential effects of disturbance on large aggregations of flightless geese (Simpson et. al 1980, Derksen et al. 1988; McKnight and Taylor 1989). BLM is beginning development of a Northwest NPR-A land use plan in 2002.

Black brant nest and molt in widely separated coastal areas of the Yukon and Northwest Territories east to Paulatuk (Appendix A). Nesting habitat appears to be a limiting factor in Canada, more so than in Alaska. Nesting is in colonies in low-lying areas, typically river deltas, small offshore islands, islands in ponds and lakes adjacent to the coast, and occasionally gravel spits (Hawkings 1987, Alexander et al. 1988, Alexander and Hawkings 1987, Cotter et al. 1993, 1994, Wiebe and Hines 1998). Brood rearing is in areas of salt marsh vegetation (typically *Puccinellia* sp., various halophytic *Carex* spp., e.g. *C. subspathacea, C. ursina, C. ramenskii).* Brant nesting on Victoria and Banks Islands occur as isolated pairs or in small colonies, as far as 60 miles inland from the coast (Manning et al. 1956, Parmalee et al. 1967, Wiebe and Hines 1998).

Some nesting and much available feeding habitat is susceptible to inundation by storm tides and hence is susceptible to spills by petroleum exploration and development. Local developments may also create disturbance effects on breeding and molting brant (Gollop et al. 1974). Many important brant habitats in the western Canadian Arctic are designated as Migratory Bird Sanctuaries (Kendall Island, Anderson River, Banks Island No. 1 and No. 2, and Queen Maud Gulf).

WHA brant on Melville, Prince Patrick, Eglinton, and associated smaller islands appear to be restricted to coastal areas (Boyd and Maltby 1979). Only 2% of the area of these islands are suitable for nesting, and the scarcity of vegetation likely limits abundance and distribution. Ponds, lakes, and river deltas with suitable islands for secure colonial nesting are rare, and brant nest as widely dispersed solitary pairs, often well away from water. During molting and brood-rearing, however, they are rarely found more than 0.5 km from the security of lakes, ponds, or the seacoast. Main predators include arctic foxes and wolves (*Canis lupus),* and caribou (*Rangifer tarandus*) and muskoxen (*Ovibos moschatus*) compete for limited vegetation.

The potential for habitat in Canada to support significantly larger numbers of brant appears to be limited and is much less than that in Alaska. The topography of many areas precludes ice and snow melt early enough to support nesting brant. Large land areas are needed to support a relatively small number of birds. Some of the nesting habitat and much of the feeding habitat used by brant are periodically inundated by storm tides.

Oil exploration and development pose the major threat to brant habitat in Arctic Canada. To date, both offshore and near-shore drilling have resulted in no major spills. However, if a major spill or blow-out occurs, especially in broken ice or ice-free periods, considerable brant nesting and feeding habitat in the path of the spill could be rendered unusable for many years. Many known and potential WHA brant habitats in the western Canadian Arctic are designated as Migratory Bird Sanctuaries, including the Queen Maud Gulf.

Wrangel Island in northeast Russia is important to nesting and molting black brant and was established as a State Nature Reserve in 1976. No habitat threats are anticipated. Mainland river deltas and coastal habitats are threatened by impacts from petroleum development, mining and industrial pollution. Reindeer herding may occur and cause damage to some brant habitats.

2. Migration and Wintering Areas

The reliance of brant on eelgrass during the non-breeding period makes them highly vulnerable to fluctuations in quality of this habitat. Recent studies have indicated that brant numbers are highly correlated with eelgrass availability and abundance (Wilson and Atkinson 1995, Ward et al. 1999). Although Atlantic brant (*Branta hrota*) have used upland habitats for foraging (Smith et al. 1985), this option is not generally available to black brant, especially at the key wintering area at San Quintin Bay.

Some losses of eelgrass habitat have been recorded in Baja California (Ward et al. 2001), Southern California and parts of Washington (Wilson and Atkinson 1995). Habitat maps and trends in eelgrass distribution have been produced for Izembek Lagoon (Ward et al. 1997), San Quintin Bay (Ward unpubl. data) and Padilla Bay (T. Mumford pers. comm.), but there are no rangewide inventories and trend analyses for eelgrass on brant wintering areas.

It is currently unknown whether genetic attributes of seagrasses exacerbate degradation due to other anthropogenic factors. Concern for further losses of coastal habitat has prompted research to examine genetic diversity among eelgrass populations. Preliminary results indicate substantial genetic differences among populations from northern (Alaska) and southern (Mexico) sites. In addition, northern populations had a higher incidence of inbreeding and cloniality than southern populations (Talbot et al. 2001).

Beyond abundance of the eelgrass are the questions of fluctuation in nutritional value and the presence of potential contaminants. Data on variation in nutritional value exist for Izembek Lagoon in Alaska (McRoy 1966, 1970; Ward and Stehn 1989) and San Ignacio Lagoon in Baja California, Mexico, (Ward 1983) but are lacking elsewhere. There is some evidence to suggest that habitat quality on the wintering grounds influences breeding performance of individuals, which may in turn affect population dynamics. Adult female brant wintering in San Quintin Bay were more likely to breed than those wintering in more southerly sites in Baja California (Ojo de Liebre and San Ignacio lagoons) (Schamber 2001). San Quintin Bay contains higher densities of eelgrass and it is more available than at southern sites. Recent shifts in the winter distribution of brant to northern areas may be related to higher breeding success and recruitment among birds that winter there. Heavy metals have been reported in eelgrass beds at Izembek Lagoon and

lagoons in Baja California (Morales-Ramirez et al. 2001), but it is unclear whether there are health effects on brant.

Human activities which have the greatest potential for physically degrading migration and wintering habitats include: petroleum storage and transport, dredging and filling, salt production, aquaculture, recreation and coastal development, siltation from logging and upstream development, and pollution. Degradation and loss of wetland habitats have occurred at migration and wintering areas in British Columbia, Washington, Oregon, and California (Einarsen 1965, Zedler and Nordby 1986, Barnhart et al. 1992, Wilson and Atkinson 1995). Probably the greatest threat to brant migration and wintering habitat is the likelihood of proposed developments near key wintering areas (especially Baja California, Mexico).

Even where healthy eelgrass habitats are available, brant may be displaced or excluded due to human disturbance (Einarsen 1965, Kramer 1976, Henry 1980, Ward and Stehn 1989). Disturbance factors include increased boating, jet skis, wind surfers, kayakers, commercial and residential development, recreational and commercial shellfish harvest, fishing, and trail developments.

Coastal embayments of Baja California, Sonora, and Sinaloa have remained relatively free of human encroachment; however, human activities are steadily increasing in Mexico at key brant wintering areas (e.g., San Quintin Bay). Ojo de Liebre and San Ignacio Lagoons are included in the Viscaino Biosphere Reserve, which provides some protection from development. However, a salt mining project has been proposed in San Ignacio Lagoon. Brant are sensitive to a variety of human activities and levels of disturbance at San Quintin Bay are the highest recorded among the lagoons in Baja California. Brant response to stimuli range from brief alert behaviors to immediate departure from a site. Excessive disturbances that interrupt foraging time are a concern because they can prevent birds from obtaining necessary resources for migration and egg-laying and thus lower reproductive performance.

Kasegaluk Lagoon in northwest Alaska is a major staging for nearly half the population; it is one of the world's largest lagoon systems but does not carry any protected designation. Of brant habitats in Alaska, Izembek Lagoon and adjacent bays and lagoons are of critical importance since essentially the entire PFBP is present during spring and fall migration, and increasing numbers are overwintering. Izembek Lagoon is a state-owned tideland within the Izembek State Game Refuge, which is within the boundary of the Izembek National Wildlife Refuge. Jointly these refuges have been designated as Wetlands of International Importance (especially as waterfowl habitat) via the RAMSAR Convention of 1971. Important adjacent tidelands in Kinzarof Lagoon, Morzhovoi Bay and Bechevin Bays are not afforded special protection under state or federal designations.

Periodically, offshore petroleum exploration and related development has been proposed near Izembek Lagoon. If such projects are implemented, impacts could include exposure to oil spills and disturbance from increased aircraft traffic (Ward and Stehn 1989). Proposed expansion of transportation infrastructure could affect coastal habitats and activity adjacent to brant use areas

(USFWS 1997). Increasing boating, mostly associated with guided waterfowl hunting, may significantly affect brant during fall staging.

WHA brant utilizing north Puget Sound wintering habitats in Washington and British Columbia are linked to coastal estuaries with sufficient quantities of eelgrass (*Zostera* spp.) and sea lettuce (*Ulva* spp.), as well as adequate haul-out and grit access sites. Numbers of brant utilizing migration and wintering habitats in Washington have been related to trends in the size of eelgrass beds that have been reduced in some areas (Wilson and Atkinson 1995). The Padilla Bay National Estuarine Research Reserve completed an extensive inventory of eelgrass meadows in Padilla, Samish, and Fidalgo Bays in 1990 and by the Washington Department of Natural Resources in 1996, but no trends were evident during this period (T. Mumford pers. comm.).

Upper intertidal areas in the north Puget Sound area have been invaded by an introduced seagrass (*Zostera japonica*), which may have increased the food base for waterfowl relative to the native eelgrass (Baldwin and Lovvorn 1994). An introduced cordgrass (*Spartina anglica*) is present in the south part of Padilla Bay, and poses some threat to current brant use areas by displacement of *Z. marina and Z. japonica*. Sea lettuce appears to be increasing in the North Puget Sound area (T. Mumford pers. comm.), and brant are known to utilize this species during winter.

In coastal British Columbia, eelgrass meadows vary in size from small isolated patches of less than one meter in diameter to a continuous distribution of plants that can extend many square kilometers in area. Significant areas (40.2 sq. km.) of eelgrass have been mapped in Boundary Bay and Robert's Bank (Ward et al. 1992). There are other large eelgrass habitats in other parts of the Strait and the rest of the province, but the extent of these is currently unknown. Other data on eelgrass beds in British Columbia are available through fish habitat references collected by the Department of Fisheries and Oceans for the Strait of Georgia and from 10 to 15 seabed Imaging and Mapping System (SIMS) projects in the Strait of Georgia ecoregion. These contain classification of eelgrass habitat as well as nearshore algae (J. Harper pers. comm.).

The recent loss of coastal habitat has been estimated at 58% in Puget Sound and 18% in the Georgia Strait (British Columbia/Washington Marine Science Panel 1994), with dredging and filling associated with the construction of harbors and ports being the major cause of this decline (levings and Thorn 1994). Habitat threats in the Padilla Bay area have been reduced since the Padilla Bay National Estuarine Research Reserve was created in the early 1980's, which has prevented habitat degradation through acquisition of most of the intertidal habitat of Padilla Bay. However, several major oil refineries exist in the north Puget Sound area located in critical key wintering areas, including Padilla Bay. Even a small oil spill during the critical wintering period could have significant impacts on the WHA population.

Loss or degradation of key coastal habitats in Mexico would be extremely detrimental to brant in the face of the lack of quality wintering areas in the U.S. and Canada. Other subspecies of brant wintering along the east coast of North America (*B. bernicla hrota*) and in Europe (*B. bernicla bernicla*) have successfully switched from reliance on marine habitats to terrestrial ones (e.g., agricultural lands). The equivalent switch is unlikely to occur in black brant because only arid habitats surround their primary wintering areas in Mexico.

IV. PUBLIC USES

A. Harvest Management

In a response to a long-term decline in the PFBP, as well as substantially diminished numbers of brant wintering north of Mexico, a variety of restrictions to brant hunting regulations have been implemented in the Pacific Flyway since the late 1970s. Significant declines in YKD breeding colony counts in the mid-1980s heightened concerns about the effects of harvest. Beginning in 1983, the Pacific Flyway wildlife agencies, Alaska Natives, and other public interest groups cooperatively developed flyway wide harvest guidelines and strategies for brant and other geese as part of the Yukon-Kuskokwim Delta Goose Management Plan.

Although spring and summer subsistence hunting of brant in Alaska has been illegal by treaty since 1918, traditional harvest of birds and eggs continued with no practical means of regulation. Amendments to the migratory bird treaties between the United States, Canada and Mexico were implemented in 1997 to provide a basis for regulation and cooperative management of subsistence harvests. In spring of 2000, a system of regional committees and a statewide council was established in Alaska to involve rural subsistence hunters in the management of migratory birds and to develop spring and summer hunting regulations. The system will be administered through the Alaska Migratory Bird Comanagement Council (AMBCC), which will establish links among local communities, rural regions, the flyway councils and the USFWS. Regional committees and the AMBCC are expected to become active in the management of species, such as brant, and may develop proposed spring hunting regulations in the near future.

Nearly all available harvest data for PFBP north of the Fraser River Delta in British Columbia represent aggregate harvest of black and WHA brant. Brant are harvested for subsistence purposes during spring, summer, and fall in western and northern Alaska, and northwestern Canada; they are harvested during fall and winter or early spring from Alaska to Mexico.

B. Subsistence Harvests

Estimates of subsistence harvests of Pacific brant are summarized in Appendix J. The first estimate of subsistence harvest of the PFBP was from the YKD where Klein (1966) estimated that 8,000 were taken during spring and summer of 1964. Because of concern over the impacts of subsistence harvest of nesting and molting brant in this key region, the USFWS has conducted village harvest surveys since 1980 (Copp 1985; Wentworth and Seim 1996; Wentworth 1998, 2001). Brant are harvested primarily during spring on the YKD, with recent harvests occasionally exceeding 4,000 birds. Village harvest surveys, conducted in the Alaska Peninsula/Bristol Bay region since the mid-1990s (Wong and Wentworth 1999), indicate annual spring and summer harvests from 700 to over 1,800 brant (Appendix J).

Subsistence harvest data for northwestern and northern Alaska are incomplete and composed of unknown proportions of both black and WHA brant. Wolfe and Paige (1995) summarized subsistence harvest of brant by region of Alaska from many sources for the early 1990s. The most important harvest regions, other than the YKD, were North Slope - 3,000; Seward

Peninsula and Northwest Arctic - 2,700; Eastern Aleutian Islands - 1,200; Bristol Bay - 300. Their estimate of statewide subsistence harvest of brant was nearly 11,000.

Native peoples of northwest Canada harvest brant regularly for subsistence. T.W. Barry (in litt.) provided early estimates of the harvest in the Inuvialuit Settlement Region, which includes the communities of Aklavik, Inuvik, Tuktoyaktuk, Paulatuk, Sachs Harbor, and Holman. These estimates were 243 in fall and 1,438 in spring (annual total 1,681) for 1967 and 1968, and 1,523 in spring 1977. The Inuvialuit Harvest Study (based on interviews) has estimated harvest in this region since 1986 (Fabijan 1991a,b,c; 1992; 1993). Recent data suggest that the annual brant harvest has declined dramatically in this region from about 1,100 during 1986-1987 to an average of 489 during 1988-1997 (J. Hines pers. comm.). However, field data collected directly from hunt camps indicate these interview-based data may give a very low estimate of actual harvest (R. Bromley pers. comm.). Brant harvest occurs primarily in early spring (May and June). In western Canada, brant are primarily harvested near Tuktoyaktuk, but the residents of communities further east (Coppermine, Cambridge Bay, Spence Bay, and Gjoa Haven) may take small numbers of brant.

C. Recreational Harvests

Estimates of fall and winter brant harvests are shown in Appendices K and L. Hunting regulations in the Pacific Flyway are summarized in Appendix M.

Alaska--. Most fall harvest of brant in Alaska occurs at Izembek Lagoon where retrieved harvest is estimated at 200-600 (Izembek NWR files). Only a few brant are taken in the Cook Inlet, Kodiak and Gulf of Alaska coastal regions because the Trans-Pacific migration of from Izembek avoids most of southern Alaska. Brant regulations have been stable and conservative in Alaska; bag limits were reduced from 4 to 2 daily in 1983 along with other Pacific Flyway states. Harvest data were collected through the state mail questionnaire survey through 1997. Since 1998, brant have been included as a separate sample stratum in the national Harvest Information Program (HIP) survey for Alaska.

British Columbia--. Historically there has been a substantial harvest of brant in British Columbia. Prior to 1971, the open season extended from December to March, and annual harvest was often several thousand brant. Declines in PFBP in the 1970s and 1980s prompted flyway-wide changes in harvest regulations, including British Columbia. In 1971, the brant season on Vancouver Island was reduced to 10 days in early March, then closed completely in 1979. The season on the Queen Charlotte Islands was reduced to 32 days in 1984, and then closed in 1985.

In 1977, the season in Boundary Bay and Roberts Bank was reduced to 10 days in early March and bag limits were reduced from 4/8 to 3/6; limits were reduced to 2/4 in 1985. In 1993, the last major land-based hunt was closed in Boundary Bay and, in 1995; the no-hunting area was increased from 165 to 430 ha. The Boundary Bay-Roberts Bank hunt is currently the only brant hunt in the province.

During the 1990s, brant harvest in British Columbia was estimated roughly at 150-200 birds per year (Appendix K). An intensive assessment of the most recent hunt in spring 2001 indicated that 160-170 brant were taken (including 144 black brant and 10 WHA brant). It is believed that WHA brant are recent additions to birds on the Fraser River Delta (S. Boyd and A. Breault unpubl. data).

Washington--. Harvest of brant in Padilla/Samish/Fidalgo bays has declined significantly since the 1970s (Appendix K). Due to population declines, Washington brant hunting regulations were first restricted in 1976, when daily bag/possession limits were lowered from 4/8 to 3/6. Hunting has been prohibited from unsecured boats or other floating objects in Padilla/Samish/Fidalgo Bays since the late 1970s. In the 1980-81 through 1982-83 seasons, decreasing hunt days from 49 to 18 further restricted brant season. During the period 1975-83, the average harvest in Padilla/Samish/Fidalgo Bays was approximately 1,800. Due to low wintering counts, Washington closed the brant season for four years from 1983-86. Two wintering reserves were established for brant in Padilla Bay during the mid-1980s, which are closed to all hunting from mid-November through March. Since 1987, the Padilla/Samish/Fidalgo bay harvest has averaged approximately 800 birds (measured by mandatory permit and harvest report since 1990), with a season length from 5 to 11 days in December or January. Only one county in north Puget Sound, Skagit County (including Padilla/Samish/Fidalgo Bays), is open to brant hunting. Beginning with the 1996-97 season, Washington has maintained a winter inventory threshold of 6,000 in Skagit County to trigger an emergency closure. The season was closed in January 2001 when the index fell below the threshold. The 2001-2002 season was split into two segments occurring in November and January.

The color composition of the Padilla/Samish/Fidalgo Bay harvest averaged 56% gray-bellied brant from 1974-83 (n = 674), although a standardized chart was not used to measure color. Recent color composition measurements using methods developed by Boyd and Maltby (1979) have shown that the color composition of the harvest (79% gray, n = 177) resembles that of WHA brant on the breeding grounds documented by Boyd and Maltby (1979) and Reed et al. (1989a) (Appendix G). However, the breeding ground origin of the dark-bellied brant in this harvest is unknown; both WHA and black brant may be present.

Oregon--. Brant season structure has varied in Oregon including some periods of total hunting closures. Seasons historically occurred late in the winter, primarily in December and January. These seasons targeted both local wintering brant and migrants moving farther south or returning from more southern wintering grounds. Harvest was primarily limited to three northern coastal bays (Tillamook, Netarts, and Yaquina).

In the late 1990s hunting seasons were significantly altered in an attempt to bolster wintering brant numbers along the coast. Hunting season lengths were slightly shortened and moved into early November, with the goals of reducing harvest and disturbance on brant that winter in Oregon and reducing hunter participation, primarily from nonresident hunters. Hunting seasons in Oregon and California overlap somewhat and reduce the opportunities for California hunters to participate. Brant harvest is presently extremely conservative with approximately 25 birds taken annually.

In recent years, a separate permitting process has been required for all brant hunters. With the implementation of HIP in 1995, a separate validation on a hunting license is required. A telephone survey is conducted by the state for hunters with validations to derive an annual harvest estimate. Hunting locations are also recorded.

California--. Brant harvest in California has declined precipitously since the 1970s, when the hunting season occurred in late January and February. Beginning in 1983, the hunting season was moved to November (Appendix M). This action was implemented to increase the number of brant in California bays during the winter and to reduce the number of adult birds in the harvest (Henry 1980). Season lengths were reduced from about 40 days to 30 days, and bag limits were reduced from four per day (eight in possession) to two per day (four in possession). Additionally, area-specific closures were established in Humboldt and Morro Bays.

By establishing hunting seasons in the fall during migration, when brant use of California bays is lower and less predictable, hunter participation has been reduced. Harvest estimates are derived from field reports and interviews with the diminished number of brant hunters. In the 1970s, average annual brant harvest was about 3,700, whereas since 1983, average annual brant harvest has averaged about 500 birds (Appendix L).

Mexico--. Brant harvest has not been monitored on a regular or complete basis in Mexico, but periodic studies and surveys have provided harvest estimates found in Appendix L (Kramer 1976, Kramer et al. 1979, Eldridge and Kramer 1985, Kramer 1988, D. Ward unpubl. data). The majority of black brant harvest in Mexico takes place at San Quintin Bay in Baja. About 95% of brant hunters are from the United States (over 90% from California) (Kramer et al. 1979). Harvest of brant at San Quintin Bay has ranged from 823 to 2,875 and averaged 1,400 birds per year over the past 30 years (Appendix L).

The number of brant and hunting activity has declined in other bays on the Baja Peninsula (Kramer 1988; D. Ward pers. comm.). Less than 300 brant are taken from areas other than San Quintin (Appendix L). Lower levels of hunting and harvest in the region during the 1990s likely result from a lack of outfitters outside of San Quintin Bay and an increase in vehicle and permit inspections on the roads (Mexican government crackdown on arms trafficking). Hunting in the protected reserves of Ojo de Liebre and San Ignacio lagoons has been negligible or nonexistent since 1997-98. Hunting pressure at other areas in Baja California has been minimal, with most activity occurring at three locations: Bahia Magdalena, Estero Coyote/Bahia Ballenas, and Laguna Manuela.

Currently, brant hunting occurs only at a limited number of sites on the mainland west coast of Mexico, primarily through local outfitters. In Sonora and Sinaloa, 3-5 outfitters offer brant hunts and they are knowledgeable about current and previous brant harvest in their areas. Periodic hunter surveys of mainland Mexico suggest that there has been an increase in brant harvest in Sonora, primarily in the Canal del Infiernillo/Bahia Kino area. Brant harvest increased there in 1997-98 from about 5-50 to 200-300 birds annually. Harvest in other parts of Sonora and in Sinaloa likely has remained low and similar to estimates in 1984-85 (Eldridge and Kramer 1985).

Changes in hunting regulations and other conditions that affect hunter participation likely are the most important factors in year-to-year variation of brant harvest in Mexico. For example, restrictions on licensing and gun permits in 1990 resulted in a general boycott of brant hunting and low harvests in the 1990 and 1991 seasons (Appendix L). Since the 1970s, restrictions have been applied to brant seasons, bag limits and other regulations related to importing firearms and hunting in Mexico. In the 1980 season, brant hunting was reduced from 4 days per week to 3. In 1984, shooting hours were reduced from all day to morning only (dawn - noon). Procedures for obtaining gun permits were tightened in January 1985 and again in 1990. In 2000, the system of Unidades de Manejo Ambiental (UMA) was implemented in Mexico, establishing local management of brant hunting on estuaries. This new paradigm is likely to have important ramifications for brant hunting and harvest in the future.

D. Harvest Guidelines for Black Brant

1. Harvest strategies should allow the population to increase to 150,000 brant based on winter surveys. When combined with WHA brant, with a population objective of 12,000, the objective for Pacific Flyway brant in the January survey is 162,000.

2. Prescriptive harvest strategies are established as follows:

Harvest Strategy	Midwinter (3-yr)	Harvest Level
Closure	<90,000[1]	No Harvest
Very Restrictive	90-110,000	-50%
Restrictive	110-135,000	Current
Moderate	>135,000	2X

[1] Harvest closure is prescribed if the 3-year average midwinter survey is less than 90,000 and the videography index of major colonies on the Yukon-Kuskokwim Delta is 50% below the 1993-2000 average of 19,863 nests.

E. Harvest Guidelines for WHA Brant

Harvest strategies for WHA brant will be developed pending collection of information to assess the winter range of WHA brant, the color composition of WHA brant on the breeding grounds and the breeding origin of dark-bellied brant in Padilla, Samish, and Fidalgo Bays. The harvest strategy will be designed to meet the population objective of 12,000 WHA brant.

F. Non-consumptive Uses

Brant are of interest to the public wherever they occur, and brant are of special interest to the public because of their relative rarity and ecological specialization. An annual “Brant Festival” in British Columbia attracts many participants for a 3 day event that includes several communities. As a measure of the importance of wildlife viewing use, non-consumptive use in California, state wildlife areas increased from 53,966 visits in 1973-74 (Calliga 1983) to 223,000

in 1994 (T. Blankinship, pers. comm.). Visits elsewhere are known to occur, but are not measured.

V. MANAGEMENT ISSUES

A. Population Assessment

1. Midwinter surveys for WHA and black brant have unquantified sources of variation (survey timing, climatic events, etc.).

2. The delineation of WHA brant breeding range, staging areas, and migration routes is uncertain.

3. Genetic samples have been insufficient to determine the distinctiveness of WHA brant.

4. There is a need to evaluate means to integrate videography of nesting colonies and aerial population surveys on the YKD to provide a more thorough assessment of numbers and trends in breeding black brant.
5. The abundance and distribution of breeding black brant is not well documented on the northern Alaska and northwest Canada coasts.

6. Movements and affiliations of brant from different breeding areas need to be documented at migration and wintering areas.

7. Estimates of recruitment, survival and harvest rates need to be improved for the population modeling of black brant and developed for a model of the WHA brant population.

B. Harvest Assessment and Management

1. Subsistence harvest estimates throughout Alaska need to be improved, in conjunction with the Alaska Migratory Bird Co-management Council.

2. More complete harvest data are needed from Arctic Canada, Russia and Mexico.

3. Fall and winter harvest estimates need to be improved through CWS surveys in British Columbia, HIP, and permit reports.

4. Derivation of harvest from breeding areas is poorly known.

5. The effects of season timing on the composition of harvest from specific breeding areas is poorly known.

6. The precision of color composition in the brant harvest of Washington and British Columbia needs to be improved.

C. Habitat

1. Data are insufficient on the historical and current extent and quality of eelgrass habitats at major staging and wintering sites.

2. Carrying capacity of primary staging and wintering sites and the effects on brant distribution are poorly known.

3. Habitat loss from coastal development and associated disturbance at primary brant staging and wintering sites is not quantified. Conservation measures currently do not adequately protect these areas. Coordination with Pacific Coast joint ventures is necessary to secure brant habitats.

4. The effects of contaminants on eelgrass and brant are unknown.

D. Research and Outreach

1. There is a need to establish a program of long-term monitoring of chemical, physical, biological and anthropogenic parameters at Izembek Lagoon.
2. Additional research is needed on the relationships among quantity and quality of forage, winter distribution of brant, brant body condition and reproductive performance.

3. A thorough assessment of mark/resighting data for brant is needed.

4. Coordination of management activities needs to be developed and strengthened with Mexico and Russia.

5. Data are lacking on the effects of chronic discharge of petroleum and other pollutants on brant throughout their range.

6. Potential displacement of breeding or molting brant from competition with other geese should be investigated on the YKD.

VI. RECOMMENDED MANAGEMENT PROCEDURES

The following recommended actions are intended to guide cooperative efforts to meet the stated objectives of this plan. 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 geese.

A. Population Assessment

1. Continue both the Midwinter and Izembek surveys. These surveys provide important population and habitat information necessary for management. The midwinter survey is a principal management index for the PFBP.

Responsibility:	USFWS, WA, OR, CA
Timetable:	Ongoing
Priority:	1

2. Continue marking and re-sighting efforts, on a 3- or 5-year schedule, to determine the relative contribution of specific nesting and molting areas of black brant to populations at major staging and/or wintering areas.

Responsibility:	USFWS, USGS, CWS, BC, WDFW, ODFW, CDFG, Mexico, Russia, cooperators (Univ. Nev. Reno)
Timetable:	Ongoing
Priority:	2

3. Continue to develop the existing Black Brant Population Model and improve or verify input parameter estimates as possible. Continue to verify the model performance. Employ the model to assess various approaches to harvest management.

Responsibility:	USFWS, Cooperators (Univ. Nev. Reno)
Timetable:	Ongoing
Priority:	2

4. Continue aerial survey of key molting areas at Teshekpuk Lake

Responsibility:	USFWS
Timetable:	Ongoing
Priority:	2

5 Continue videographic surveys to provide reliable estimates of black brant nesting and annual production at major colonies on the YKD. This survey is a principal management index for black brant.

Responsibility:	USFWS, USGS
Timetable:	Continuing
Priority:	1

6 Continue to estimate annual fall age ratios and numbers of black and WHA brant wintering at Izembek Lagoon. Determine the statistical precision, the effect of survey timing and consistency between years.

Responsibility:	USFWS R-7
Timetable:	Ongoing
Priority:	1

7 Conduct coordinated population surveys for WHA brant in north Puget Sound and Fraser Estuary in British Columbia during November through March, including the midwinter survey. Evaluate additional survey methods to determine the best alternative to monitor winter status and obtain variance estimates for population indices. Utilize color composition information to develop separate population estimates.

Responsibility:	WA, CWS
Timetable:	Ongoing
Priority:	1

8 Investigate potential use of wintering sites in British Columbia by WHA brant.

Responsibility:	CWS, BC, USFWS
Schedule:	2002
Priority:	3

9 Determine the relative contribution of specific nesting and molting areas of brant occurring in north Puget Sound and BC, habitat use patterns, and distribution during winter.

Responsibility:	WA, CWS, BC
Timetable:	Ongoing
Priority:	2

10 Conduct coordinated age-ratio and color composition surveys in north Puget Sound from November through March, in conjunction with aerial surveys. Develop minimum sample sizes and variance estimates for age-ratio and color composition surveys.

Responsibility:	WA, CWS
Timetable:	Ongoing
Priority:	1

11 Expand surveys of nesting colonies in Alaska (other than YKD) and Canada to develop an operational breeding index.

Responsibility:	USFWS, CWS
Timetable:	As possible
Priority:	2

B. Harvest Assessment and Management

1. Continue to implement the Yukon-Kuskokwim Delta Goose Management Plan including harvest strategies, harvest assessment, enforcement procedures, and education programs.

   Responsibility: USFWS, AK, WA, OR, CA, cooperators
   Timetable Ongoing
   Priority: 1

2. Cooperate and coordinate with the Alaska Migratory Bird Co-management Council to develop recommendations for spring and summer hunting regulations and harvest data collection programs throughout Alaska.

   Responsibility: USFWS, AK, AMBCC, PF Council
   Timetable Ongoing
   Priority: 1

3. Continue to obtain and improve estimates of fall/winter harvest through HIP and permit reports in the U.S. and through CWS-BC hunter survey in Canada.

   Responsibility: USFWS, AK, WA, OR, CA, CWS, BC
   Timetable: Ongoing
   Priority: 1

4. Assess the derivation of harvest from breeding stocks as determined from banding and marking.

   Responsibility: USFWS, CWS, AK, NWT, YT, BC, WA, OR, CA
   Timetable: Ongoing
   Priority: 2

5. Continue to maintain existing reserves (closed to hunting) in Padilla Bay to protect critical use areas.

   Responsibility: WA
   Timetable: Ongoing
   Priority: 1

6. Collect information on color composition, age, and sex of harvested birds in north Puget Sound and with bag checks in British Columbia.

   Responsibility: WA, BC, CWS
   Timetable: Ongoing
   Priority: 2

7. Cooperate with Mexico to develop and implement a standardized, periodic, quantitative harvest survey.

Responsibility:	USFWS, CWS, Mexico
Timetable:	2003
Priority:	1

8. Assess the effects of harvest in relation to movement of stocks and season timing.

Responsibility:	States, BC, USFWS, CWS, USGS
Timetable:	2004
Priority:	2

9. Determine the magnitude and distribution of subsistence harvests in arctic Alaska, Canada and Russia.

Responsibility:	USFWS, AK, CWS, Yukon, NWT, Russia
Timetable:	2004
Priority:	2

C. Habitat Management

1. Identify and describe existing protective measures for coastal nesting, molting, staging, and wintering areas for black and WHA brant.

Responsibility:	All States, USFWS, CWS, Yukon, NWT, BC, Mexico
Timetable:	2007
Priority:	1

2. Improve coordination of habitat management activities with Mexico (via the Tri-lateral Committee) and Russia (via AREA V Agreement).

Responsibility:	USFWS, CWS, Mexico, Pacific Flyway Council
Schedule:	Ongoing
Priority:	1

3. Continue to protect critical habitats and pursue mitigation for impacts, including loss or degradation of eelgrass beds, grit and loafing sites; disturbance of wintering flocks; and exclusion of brant from traditional use sites. Develop recommendations for protection or acquisition of critical habitats through coordination with NAWMP joint ventures or other habitat initiatives.

Responsibility:	USFWS, CWS, AK, BC, WA, OR, CA, Mexico
Schedule:	Ongoing
Priority:	1

4. Develop and implement standardized, periodic surveys to quantitatively assess distribution and quality of eelgrass on key staging and wintering areas over time.

Responsibility:	USFWS, USGS, CWS, AK, BC, WA, OR, CA, Mexico
Schedule:	New
Priority:	1

D. Research

1. Quantify vital rate impacts of human activity on breeding, molting, staging, and wintering brant, including impacts associated with development, boats, aircraft or other forms of anthropogenic disturbance.

Responsibility:	USFWS, USGS, States, CWS, Yukon, BC, Mexico, Russia,
Cooperators:	Univ. Nevada Reno, Humboldt State Univ.
Timetable:	Ongoing
Priority:	3

2. Complete analysis of temporal/spatial distribution, recruitment and survival rates of PF brant based on all years of banding/marking data.

Responsibility:	USGS, CWS, cooperators
Timetable:	2003
Priority:	1

3. Develop an integrated ecosystem research and monitoring program on the health and dynamics of brant and their habitats within Izembek Lagoon.

Responsibility:	USFWS, USGS, AK
Timetable:	Open
Priority:	2

4. Develop procedures and estimate carrying capacity of primary staging/wintering sites for brant. Use data obtained to evaluate staging/wintering population distribution goals.

   Responsibility: USGS, USFWS, CWS, States, cooperators
   Schedule: Open
   Priority: 3

5. Develop research to assess the effects of winter and spring forage quantity and quality on reproductive performance and population dynamics.

   Responsibility: USGS, USFWS, CWS
   Timetable: Open
   Priority: 2

6. Assess the potential for contaminants and/or genetic factors to adversely impact eelgrass health, distribution or abundance.

   Responsibility: USGS, USFWS, CWS
   Timetable: Open
   Priority: 3

7. Initiate research to further evaluate genetic distinctiveness of WHA brant in relation to other brant stocks.

   Responsibility: CWS, WDFW, USFWS, USGS
   Timetable: 2002-2003
   Priority: 1

8. Initiate a new marking program on WHA breeding areas to delineate the breeding range, determine migration chronology, mortality rates, and any additional wintering areas.

   Responsibility: CWS, WDFW
   Timetable: 2002-2003
   Priority: 1

9. Develop a population model for WHA brant to predict and evaluate the effects of management actions.

   Responsibility: CWS, WA
   Timetable: 2003-2004
   Priority: 3

E. Outreach

1. Continue flyway-wide education internet site and associated programs to facilitate dissemination of information on population status, basic biological concepts of migratory waterfowl, factors affecting production and survival, and the needs of various users.

Responsibility:	University of Nevada-Reno, All States, USFWS, CWS, USGS, Mexico
Timetable:	Ongoing
Priority:	3

VII. PLAN IMPLEMENTATION AND REVIEW

The Brant Subcommittee shall meet twice annually or as needed to review progress toward achieving the goal and objectives of this plan and to recommend actions and revisions. Developing and maintaining international cooperation will be particularly important to ensure that this plan is effective and relevant to management agencies. The Subcommittee shall report to the Pacific Flyway Council, through the Pacific Flyway Study Committee, on accomplishments and shortcomings of management efforts, and shall share its findings with parties responsible for or interested in Pacific Flyway brant.

The Subcommittee shall be comprised of one representative from each federal and state agency having management responsibility for this population. It shall be the responsibility of those members to assure that the objectives and procedures of this plan are integrated and coordinated with those plans and activities of the various wildlife and land management agencies and local planning systems within their agency's purview. Chairmanship shall be appointed biannually and rotated among member agencies. The Subcommittee may invite *ex officio* participation by individuals, groups, and agencies whose expertise, counsel or managerial capacity is required for the coordination and implementation of management programs.

Lead Group: Subcommittee
Priority: 1
Meetings: Twice annually, at the March and July meetings of the Pacific Flyway Study Committee.

Schedule for rotation of the chair, beginning October 1:
2001 - California
2003 - Alaska
2005 - Oregon
2007 – Washington
2009 – USFWS Region 7

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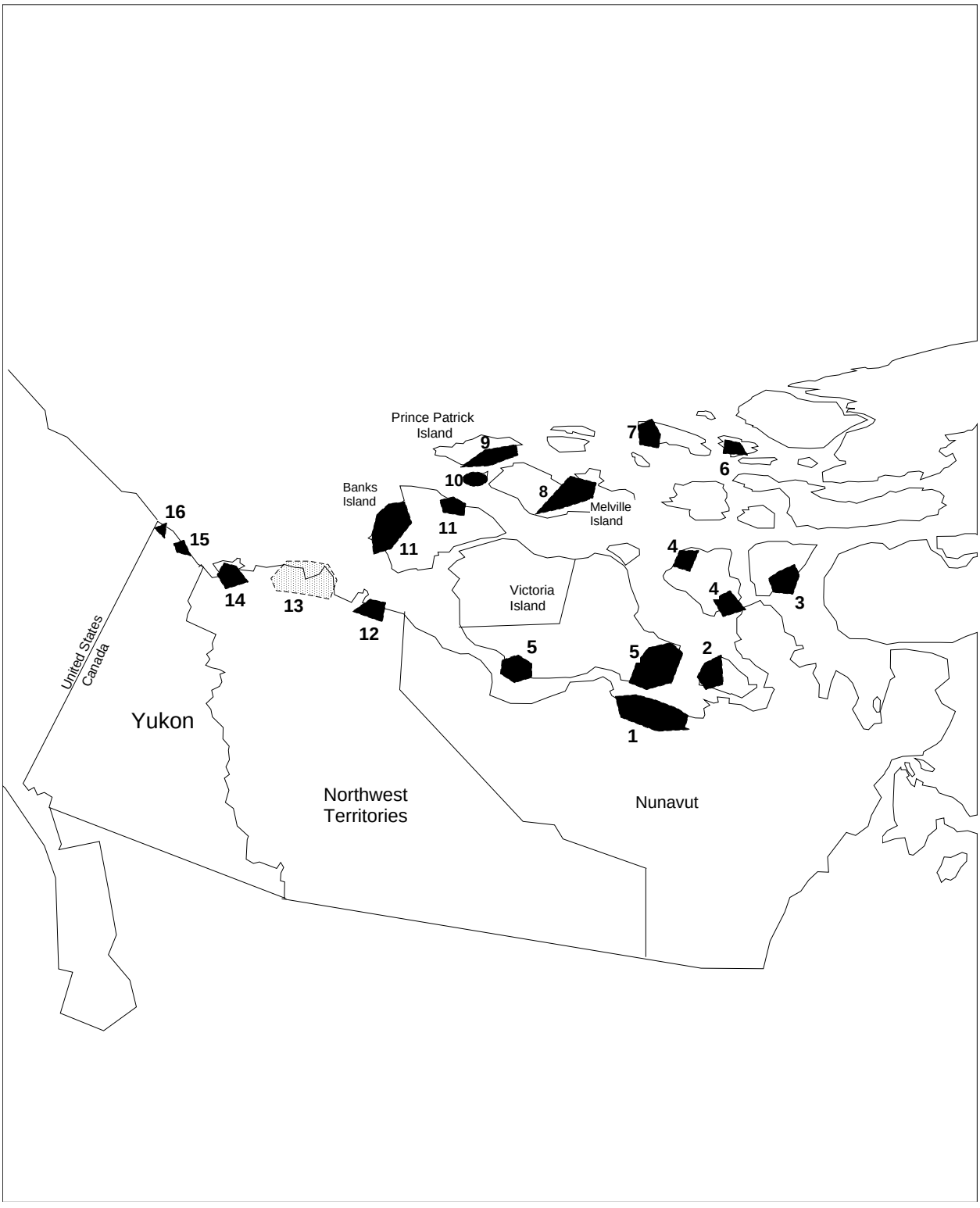
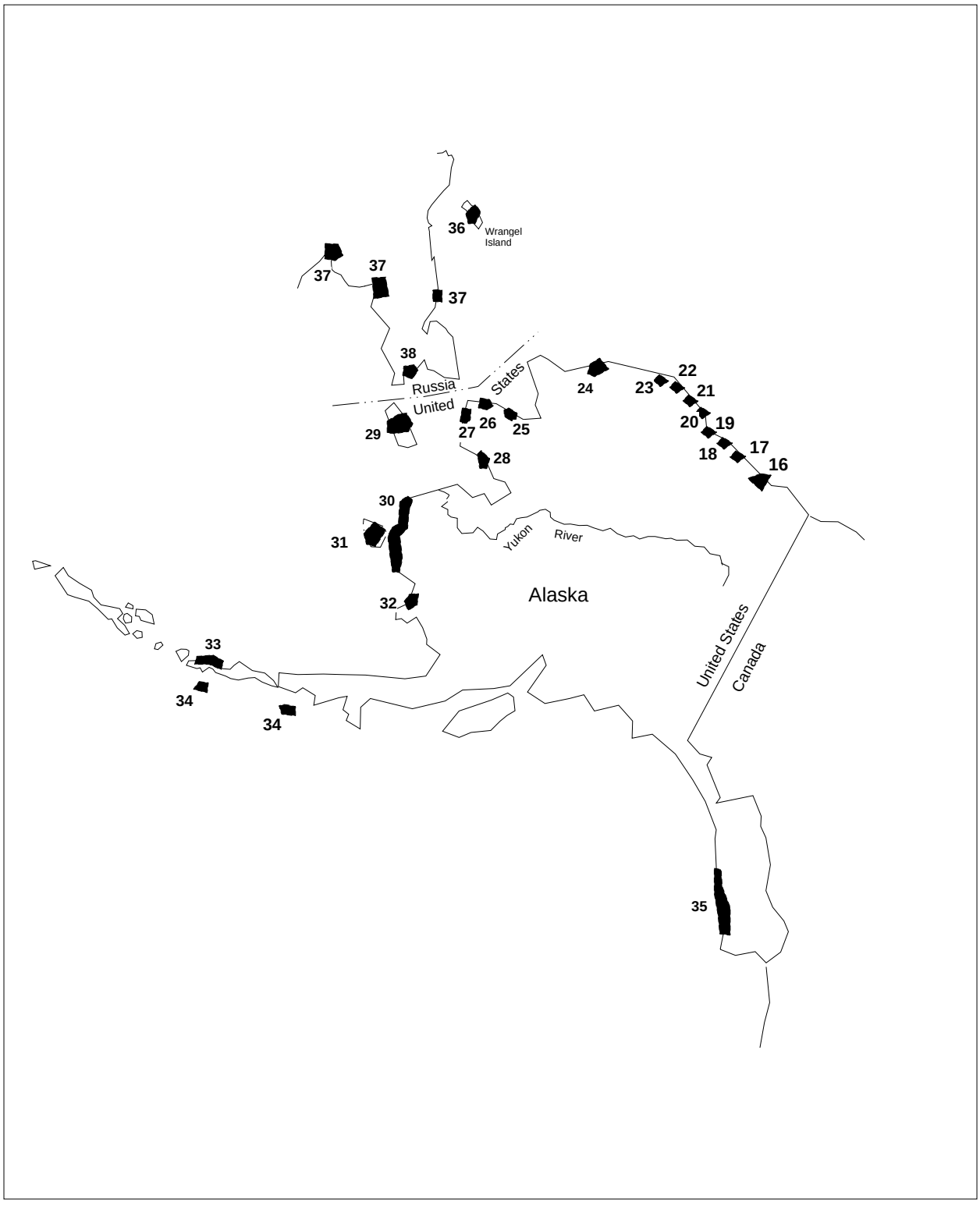
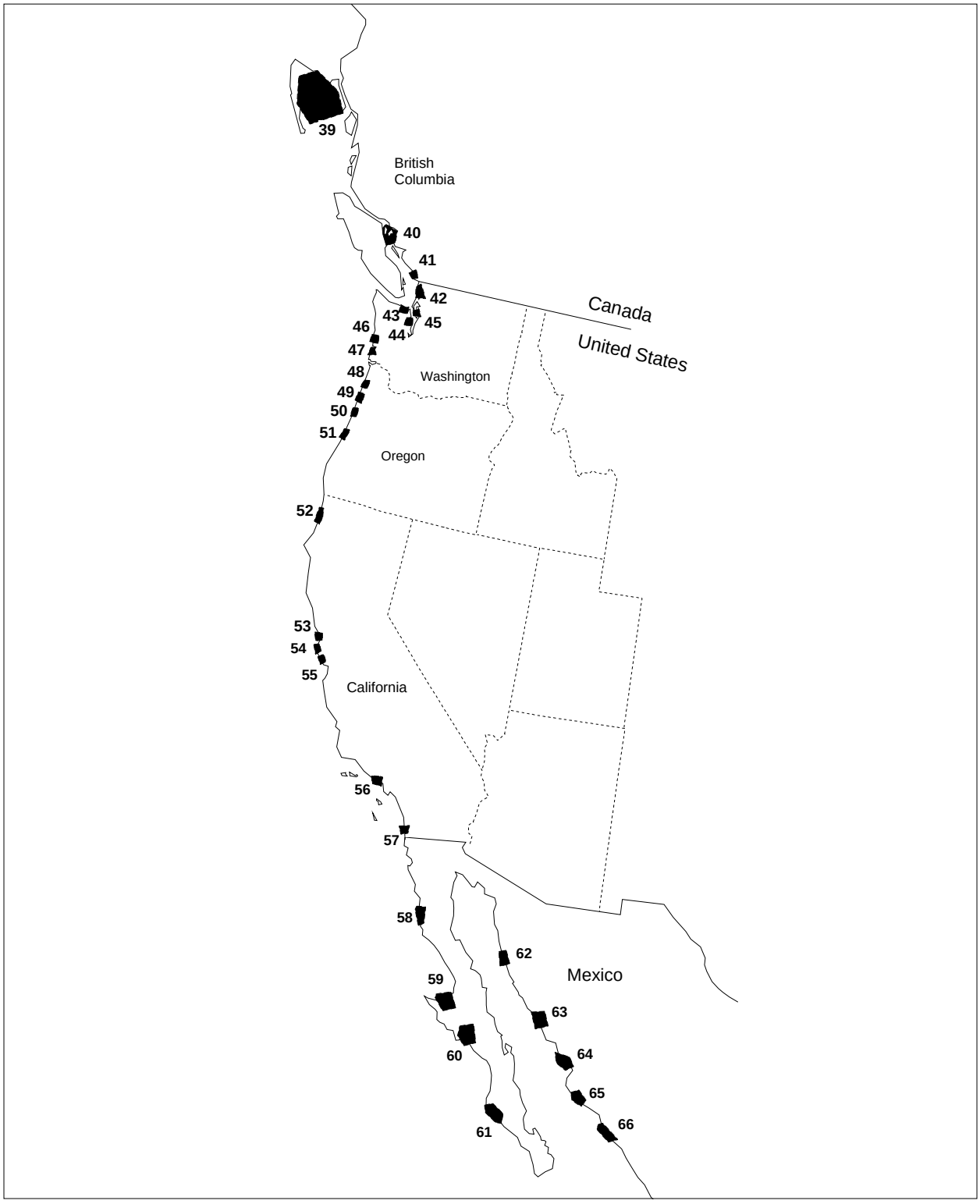
APPENDICES



Appendix A. Pacific Flyway brant use areas in Canada (see table for listed numbered locations).



Appendix A. Pacific Flyway brant use areas in Alaska and Russia (see table for listed numbered locations).



Appendix A. Pacific Flyway brant use areas in British Columbia, the United States, and Mexico (see table for listed numbered locations).

APPENDIX A. Pacific Brant use areas.

AREA	MAP REF.	TYPE OF USE	BRANT USE
NORTHWEST TERRITORIES			
Queen Maud Gulf Bird Sanctuary	1	Nesting Nest/molt	5,000 birds (1960) 10,000-15,000 (1990-91)
King William Island	2	Nesting Molting	2,000 birds (1960) 75 birds (1975)
Somerset Island/Creswell Bay	3	Nesting	Unknown
Prince of Wales Island Smith Bay/Suillemard Bay	4	Nesting Molting	Unknown
Victoria Island Albert Edward Bay Simpson-Austin Bays	5	Nesting Molting	500 500
Amund Ringnes Island Ellef Ringnes	6 7	Nesting Molting	Unknown
Melville Island North Coast	8	Nesting Molting	1,200 2,500
Prince Patrick Island East Coast	9	Nesting Molting	500 2,500
Eglinton Island South Coast	10	Molting	1,000
Banks Island	11	Nesting Molting	4,000 10,000
Paulatuk-Darnley Area	12	Nesting Molting	200
Liverpool Bay Area Cape Delhouise Mason River Anderson River Kugaluk River	13	Nesting Molting	1,000 8,000
Pelly Island/Kendall Island Bird Sanctuary Area	14	Nesting Molting	200
YUKON TERRITORY			
Shoalwater Bay	15	Nesting Molting	Unknown
Phillips Bay	16	Nesting Molting	Unknown

APPENDIX A. Pacific Brant use areas, continued.

AREA	MAP REF.	TYPE OF USE	BRANT USE
ALASKA			
Shaviovik & Kadleroshilik Deltas	16	Nests	20 in 1990
Howe Island and Duck Islands (Sagavanirktok River Delta)	17	Nests	33 in 1984; 260 in 1993
Prudhoe Bay colonies	18	Nests	85 in 1992
Kuparuk River Delta	18	Nests	250 in 1975; 100 in 1990s
Kuparuk Oilfield	18	Nests	150 in 1990s
Colville River Delta	19	Nests	44 in 1960; 950 in 1993
Teshekpuk Lake Area Harrison Bay Smith Bay	21 20 22	Nests Molting Nests Nests	30 (1960); 191 (1998) See Appendix H 73 (1997) 52 (1994)
Dease Inlet	23	Nests	Est. 25 (1977); 200 (1990s)
Kasegaluk Lagoon	24	Nests Migration	53 (1995) NE in July; 20,000-50,000 fall
Nugnugaluktuk River Delta	25	Nests	<75
Arctic River Delta	26	Nests	20 (1977); 11 (1976)
Lopp, Ikpek, Arctic and Shishmaref Lagoons	27	Migration	Est.up to 60%
Safety Lagoon	28	Migration	Est.10,000+ spring and fall
St. Lawrence Island	29	Migration	Occurs, numbers unknown
Yukon-Kuskokwim Delta (Cape Romanzof to Nelson Island) Near Coastal Yukon-Kuskokwim Delta (Point Romanzof to Mouth of Kuskokwim River)	30	Nests Molting Migration	Est. 87% of all black brant Est.95% of all Brant use at sometime
Nunivak Island Duchikthiuk Bay	31	Nesting Migration	Reported, but questionable Est.10,000+ birds in fall
Chagvan and Nanvak Bays	32	Migration	Est.50,000+ spring and fall
Izembek Lagoon and nearby bays	33	Migration Wintering	Entire population in fall and spring. 6,000 – 18,000
Shumagin and Sanak Islands	34	Wintering	Est.up to 5,000 – 9,000
Southeast Alaska	35	Wintering	Est.up to 300

APPENDIX A. Pacific Brant use areas, continued.

AREA	MAP REF.	TYPE OF USE	BRANT USE
RUSSIA			
Wrangel Island	36	Breeding Molting	1,000-1,500 breeding pairs several thousand molting
Other Areas in Russia	37	Scattered breeding, molting and spring fall use	
Southern boundary of brant nesting in Russia	38		Unknown
BRITISH COLUMBIA			
Queen Charlotte Island	39	Migration Wintering	 100-500 (1990s)
Southeast Coast Vancouver Island	40	Migration Wintering	 10-20 winter
Fraser River Delta	41	Migration Winter	 1,200
WASHINGTON			
Samish, Padilla, Fidalgo Bays	42	Wintering Migration	5,000-17,000 (1990s) 2,000-15,000 (1980s) 3,000-11,000 (1970s)
Dungeness, Sequim Bays	43	Wintering Migration	600-1,700 (1990s) 100-1,400 (1980s) 100-1,300 (1970s)
Hood Canal	44	Migration Wintering	100-400 (1990s) 0-600 (1980s) 300-700 (1970s)
Other Small Puget Sound Areas	45	Migration Wintering	50-100 (1990s)
Grays Harbor	46	Migration	100-300 (1990s)
Willapa Bay	47	Wintering Migration	1,100-3,100 (1990s) 900-4,000 (1980s) 1,200-6,000 (1970s)
OREGON			
Nehalem Bay	48	Migration	200
Tillamook & Netarts Bays	49	Migration Wintering	2,000
Yaquina Bay	50	Migration Wintering	1,000
Coos Bay	51	Migration	650

APPENDIX A. Pacific Brant use areas, continued.

AREA	MAP REF.	TYPE OF USE	BRANT USE
CALIFORNIA			
Humboldt Bay	52	Migration Wintering	Spring Peaks 20,000-25,000 (1990s) 10,000-15,000 (1980s) 10,000-35,000 (1970s) 10,000-40,000 (1960s) 2,000 (1990s) 1,000 (1980s) 500 (1970s)
Tomales Bay	53	Migration Wintering	35,000 Historical Less Than 100
Drakes Estero	54	Migration Wintering	1-3,000 current 25,000 Historical Less than 100
Bolinas Bay	55	Migration Wintering	500
Morro Bay	56	Migration Wintering	12,000 ~400
Mission Bay	57	Wintering	<100
MEXICO			
Bahia San Quintin	58	Migration Wintering	See text and Appendix B
Laguna Scammon	59	Wintering	Unknown
Laguna San Ignacio	60	Wintering	Unknown
Bahia Magdalena	61	Wintering	Unknown
Canal del Infiernillo	62	Wintering	Unknown
Estero Yavaros	63	Wintering	Unknown
Estero Agiabampo	64	Wintering	Unknown
Los Mochis Area (Bahies Estaban, Topolabampo, Novachist)	65	Wintering	Unknown Unknown
Bahia Santa Maria	66	Wintering	Unknown

APPENDIX B. Pacific brant population indices measured during the Midwinter Waterfowl Survey (generally January) and percentage of young birds in the population, as measured by counts during fall at Izembek Lagoon prior to the winter survey. Winter distribution objectives by area and population objectives are at the bottom of the table.

January	West Coast of U.S.					Mexico			Other		Indices Black Brant		Indices Total PFBP		% Yg Prev.
	WA					Mainland				British					
Survey	Other	WHA[a]	OR	CA	TOTAL	Baja	Coast	Subtotal	Alaska	Columbia[b]	Annual	3-yr Avg	Annual	3-yr Avg	Fall
1936	8,202		3,085	19,910											
1937	13,450		5,935	13,460											
1938	24,560		10,475	38,200											
1939	25,595		9,502	16,890											
1940	35,520		5,350	35,050											
1941	24,100		5,000	31,785	60,885										
1942	53,950		6,850	28,983	89,783										
1943	37,000		575	18,000	55,575										
1944	33,950		7,250	20,250	61,450										
1945	32,650		3,000	30,100	65,750										
1946	25,462		55	60,452	85,969										
1947	20,250		8,200	39,640	68,090	No svy	0	Partial svy							
1948	20,660		2,850	32,750	56,260	No svy	0	Partial svy							
1949	20,650		803	66,515	87,968	No svy	No svy	No svy							
1950	15,574		3,600	57,792	76,966	No svy	No svy	No svy							
1951	21,639		2,110	48,131	71,880	93,200[c]	0	Partial svy							
1952	16,578		3,200	43,840	63,618	102,945[c]	0	Partial svy							
1953	13,473	14,000	1,509	37,557	66,539	87,905[c]	0	Partial svy							
1954	9,376	6,000	1,560	28,750	45,686	86,316[c]	0	Partial svy							
1955	4,915	17,000	1,686	34,070	57,671	76,679[c]	0	Partial svy							
1956	6,914	9,000	2,073	38,510	56,497	52,743[c]	0	Partial svy							
1957	13,354	7,347	1,493	35,848	58,042	73,380[c]	0	Partial svy							
1958	9,119	16,100	2,778	26,560	54,557	71,305[c]	4	Partial svy							
1959	1,815	9,000	1,121	10,750	22,686	71,305[c]	1,400	Partial svy							
1960	9,114	8,500	652	3,771	22,037	113,087	1,115	114,202			127,739	--	136,239	--	
1961	7,595	9,080	1,330	6,853	24,858	138,625	4,355	142,980			158,758	--	167,838	--	
1962	9,035	16,780	2,266	23,510	51,591	116,245	2,400	118,645			153,456	146,651	170,236	158,104	
1963	9,042	11,358	2,639	2,388	25,427	101,575	13,240	114,815			128,884	147,033	140,242	159,439	
1964	13,112	21,057	2,000	8,353	44,522	117,470	23,290	140,760			164,225	148,855	185,282	165,253	23.9
1965	6,844	13,094	1,325	3,372	24,635	117,350	24,915	142,265			153,806	148,972	166,900	164,141	25.6
1966	4,797	17,378	798	3,284	26,257	115,601	19,505	135,106			143,985	154,005	161,363	171,182	19.2
1967	3,005	18,230	1,523	3,824	26,582	111,755	41,315	153,070			161,422	153,071	179,652	169,305	41.8
1968	3,164	12,582	865	1,729	18,340	111,600	24,400	136,000			141,758	149,055	154,340	165,118	16.8
1969	1,443	8,620	382	166	10,611	97,400	35,075	132,475			134,466	145,882	143,086	159,026	17.1
1970	3,816	5,100	963	207	10,086	98,200	33,400	131,600			136,586	137,603	141,686	146,371	21.8
1971	2,775	8,140	1,374	130	12,419	105,800	31,000	136,800			141,079	137,377	149,219	144,664	34.1
1972	1,345	2,983	1,047	0	5,375	91,200	28,200	119,400			121,792	133,152	124,775	138,560	28.8
1973	3,256	2,655	2,544	950	9,405	85,500	30,100	115,600			122,350	128,407	125,005	133,000	35.9
1974	2,297	2,680	1,904	470	7,351	96,900	26,400	123,300			127,971	124,038	130,651	126,810	29.4
1975	2,453	3,710	1,507	480	8,150	80,825	34,455	115,280			119,720	123,347	123,430	126,362	4.6
1976	2,550	4,990	1,769	680	9,989	82,783	29,273	112,056			117,055	121,582	122,045	125,375	36.7
1977	3,211	10,900	2,100	0	16,211	86,534	44,222	130,756			136,067	124,281	146,967	130,814	35.3
1978	6,688	11,412	1,110	560	19,770	106,469	36,648	143,117			151,475	134,866	162,887	143,966	31.6
1979	4,878	3,200	1,255	10	9,343	87,860	32,210	120,070			126,213	137,918	129,413	146,422	14.7
1980	2,565	5,100	1,015	135	8,815	89,690	47,860	137,550			141,265	139,651	146,365	146,222	14.7
1981	1,982	8,125	1,790	540	12,437	160,560	21,200	181,760			186,072	151,183	194,197	156,658	25.8
1982	2,481	3,970	706	485	7,642	85,105	28,297	113,402			117,074	148,137	121,044	153,869	18.6
1983	1,008	2,105	718	565	4,396	81,761	23,157	104,918			107,209	136,785	109,314	141,518	9.5
1984	2,047	5,050	930	700	8,727	95,170	29,533	124,703			128,380	117,554	133,430	121,263	24.1
1985	2,953	8,840	641	800	13,234	101,405	30,163	131,568		283	136,245	123,945	145,085	129,276	13.7
1986	2,676	9,350	1,113	706	13,845	92,525	22,200	114,725	7,665	319	127,204	130,610	136,554	138,356	13.7
1987	3,926	10,445	1,133	736	16,240	73,825	13,088	86,913	5,755	205	98,668	120,706	109,113	130,251	15.3
1988	4,511	15,320	1,104	947	21,882	99,066	17,630	116,696	8,385	263	131,906	119,259	147,226	130,964	31.2
1989	4,198	14,340	871	1,033	20,442	89,600	18,121	107,721	7,050	484	121,357	117,310	135,697	130,679	19.3
1990	3,286	10,470	1,399	992	16,147	107,545	22,320	129,865	5,595	406	141,543	131,602	152,013	144,979	23.9
1991	4,031	12,190	1,262	1,340	18,823	88,650	19,905	108,555	4,350	591	120,129	127,676	132,319	140,010	19.2
1992	3,985	9,520	1,397	2,424	17,326	78,280	14,905	93,185	7,200	283	108,474	123,382	117,994	134,109	27.8
1993	2,218	10,840	1,254	9,415	23,727	68,280	24,444	92,724	8,008	219	113,838	114,147	124,678	124,997	16.5
1994	2,355	11,240	666	2,299	16,560	83,130	17,135	100,265	13,221	646	119,452	113,921	130,692	124,455	23.6
1995	3,331	16,900	708	3,987	24,926	74,060	22,755	96,815	11,978	711	117,530	116,940	134,430	129,933	11.6
1996	2,056	4,885	644	2,008	9,593	87,280	20,205	107,485	9,795	1,072	123,060	120,014	127,945	131,022	36.1
1997	3,763	5,990	669	3,598	14,020	108,018	22,720	130,738	13,147	712	152,627	131,072	158,617	140,331	21.7
1998	4,541	6,340	580	6,091	17,552	97,805	14,300	112,105	8,773	1,181	133,271	136,319	139,611	142,058	17.4
1999	6,037	9,215	645	4,296	20,193	84,965	15,795	100,760	8,255	1,046	121,039	135,646	130,254	142,827	25.7
2000	5,944	7,915	523	3,389	17,771	92,020	16,420	108,440	8,833	1,711	128,840	133,944	136,755	135,540	21.6
2001	5,316	4,881	695	4,197	15,089	78,850	13,010	91,860	17,790	1,272	121,130	126,070	126,011	131,007	30.9
2002	4,514	8,964	552	4,092	18,122	93,995	11,055	105,050	13,576	1,744	129,528	125,134	138,492	133,753	7.5
Avg.:															
1936-52	25,282		4,579	35,397											
1953-60	8,510	10,868	1,609	26,977											
1961-70	6,185	13,328	1,409	5,369		112,582	22,190	134,772			147,735	147,903	161,063	161,993	23.7
1971-80	3,202	5,577	1,563	342		91,356	34,037	125,393			130,499	130,462	136,076	136,220	26.6
1981-90	2,907	8,802	1,041	750		98,656	22,571	121,227	6,890	327	129,566	129,709	138,367	137,781	19.5
1991-00	3,826	9,504	835	3,885		86,249	18,858	105,107	9,356	817	123,826	125,306	133,330	134,528	22.1
2001-10	4,915	6,923	624	4,145		86,423	12,033	98,455	15,683	1,508	125,329	125,602	132,252	132,380	19.2
Objectives:	13,000	12,000	3,000	10,000		77,000	30,000	107,000	9,000	8,000		150,000		162,000	

[a] Beginning in 1953, WHA and black brant were counted separately in Washington.

[b] In British Columbia, totals for 1984-91 are Christmas Bird Counts, and from 1992-2000 are from CWS counts.

[c] Incomplete survey in Mexico (weather, refueling problems, etc.)

APPENDIX C. Estimates of brant nests[a] at five major colonies on the Y-K Delta from aerial videography surveys 1992-2004 (Anthony 2004). Standard errors are indicated in shaded boxes below estimates. **Revised August 2004**

	Tutakoke	Kokechik	Kigigak Is.	Baird Inlet	Baird Pen.	TOTAL
1992	4,600	6,134	3,440	3,258	2,157	19,589
	202	295	154	347	151	
1993	4,937	4,667	1,727	4,156	614	16,101
	190	577	90	357	77	
1994	4,807	6,978	2,260	4,461	2,441	20,947
	400	196	92	454	142	
1995	5,596	7,573	2,260	4,720	2,591	22,740 [b]
	297	351		474	184	
1996	No survey					
1997	4,588	9,144	4,776	1,944	2,259	22,711
	554	1,092	595	242	282	
1998	3,448	5,655	3,105	2,747	1,431	16,386
	292	471	238	264	169	
1999	4,100	4,072	3,962	1,777	448	14,359
	96	74	402	80	81	
2000	7,437	8,021	4,286	4,088	1,962	25,794
	584	866	647	324	142	
2001	1,212	3,677	1,721	3,604	421	10,635
	73	215	107	198	36	
2002	4,524	4,634	4,380	3,052	2,708	19,298
	314	362	255	199	147	
2003	1,622	655	2,474	3,202	547	8,500
	79	52	118	135	46	
2004	2,704	1,996	3,284	2,759	1,687	12,430
	153	116	208	160	760	
AVG	4,131	5,267	3,220	3,314	1,606	17,458

[a] Estimates in bold derived from Lincoln-Petersen analysis by two observers; other estimates based on correction factors from ground transects.

[b] Survey incomplete for Kigigak Island; nest numbers assumed the same as 1994 (2,260).

APPENDIX D. Annual production and family group counts of brant at Izembek Lagoon, Alaska by Izembek NWR and USGS-BRD (in Groves and Conant 2001).

YEAR	ADULTS	JUVENILES	TOTAL	% JUV	FAMILIES	JUV	JUV/FAM
1963	3,968	1,243	5,211	23.9	-	-	-
1964	13,324	4,577	17,901	25.6	-	-	-
1965	21,210	5,050	26,260	19.2	-	-	-
1966	9,927	7,134	17,061	41.8	195	557	2.9
1967	15,219	3,081	18,300	16.8	359	926	2.6
1968	15,110	3,117	18,227	17.1	145	377	2.6
1969	12,829	3,577	16,406	21.8	293	780	2.7
1970	12,104	6,256	18,360	34.1	148	476	3.2
1971	4,820	1,953	6,773	28.8	295	716	2.4
1972	6,599	3,698	10,297	35.9	153	416	2.7
1973	12,025	4,999	17,024	29.4	327	938	2.9
1974	13,118	632	13,750	4.6	105	239	2.3
1975	9,396	5,452	14,848	36.7	189	543	2.9
1976	7,962	4,340	12,302	35.3	237	647	2.8
1977	8,856	4,092	12,948	31.6	240	603	2.5
1978	10,696	1,842	12,538	14.7	110	326	3.0
1979	13,674	2,349	16,023	14.7	146	361	2.5
1980	9,618	3,341	12,949	25.8	177	489	2.8
1981	4,109	936	5,045	18.6	154	431	2.8
1982	11,509	1,213	12,722	9.5	89	237	2.7
1983	6,149	1,947	8,096	24.1	173	515	3.0
1984	9,451	1,499	10,950	13.7	192	564	2.9
1985	12,032	1,915	13,947	13.7	624	1538	2.5
1986	15,621	2,823	18,444	15.3	137	352	2.6
1987	17,411	7,882	25,293	31.2	948	2587	2.7
1988	16,138	3,847	19,985	19.3	263	633	2.4
1989	13,654	4,281	17,935	23.9	303	914	3.0
1990	24,215	5,750	29,965	19.2	349	894	2.6
1991	31,432	12,127	43,559	27.8	415	1066	2.6
1992	55,795	11,044	66,839	16.5	404	1127	2.8
1993	103,254	31,942	135,196	23.6	979	2727	2.8
1994	21,371	2,808	24,179	11.6	353	735	2.1
1995	26,964	15,240	42,204	36.1	78	218	2.8
1996	15,148	4,201	19,349	21.7	50	152	3.0
1997	15,216	3,105	18,321	17.0	40	106	2.7
1998	8,214	2,836	11,050	25.7	220	488	2.2
1999	12,500	3,450	15,950	21.6	111	254	2.3
2000	6,669	2,982	9,651	30.9	99	220	2.2
Average	16,508	4,962	21,470	23.1	260	690	2.7

APPENDIX E. Comparative numbers of black brant nesting in three major colonies on the Yukon-Kuskokwim Delta, 1981-1986[a].

	Estimated Numbers of Pairs			Percent Change
Colony	1981	1982	1986	1981-1986
Tutakoke River	7,400	2,800	1,100	-85.1
Kikigak Island	8,350 (6,400)[b]	1,500	1,050	-87.4 (-83.6)
Kokechik Bay	6,950	7,700	6,400	- 7.9
Totals	22,700 (20,750)	12,000	8,550	-62.3 (-58.8)

[a] All colonies censused by V. Byrd in 1981 and 1982, and recensused by J. Sedinger, M. Wege, D. Ward and S. Thompson during 1985 and 1986.

[b] Nests may have been overestimated in 1981 because of error in calculating the colony's size. Adjusted estimates are given in parenthesis.

Appendix F. Black brant nest success, clutch and brood size on the Y-K Delta, Alaska.
Data compiled from varying efforts on colonies by Yukon Delta NWR, USGS Alaska Science Center and University of Alaska - Fairbanks. From Groves and Conant (2001).

	Nest		Clutch		Average Brood Size			
	Success	n	Size	n	Class I	n	Class II	n
AVG 1965-1979	0.63	2,435	3.7	1,457	2.8	2,353		
1980	0.69	16	4.1	196	2.7	269		
1981	0.58	1,016	2.5	1,349	3.0	310		
1982	0.36	4,080	2.9	3,235	2.3	160		
1983	0.53	3,914	3.4	1,194	2.8	454		
1984	0.14	1,321	3	986	2.7	45		
1985	0.37	1,242	3.4	798				
1986	0.52	1,162	3.6	857	4.0	67	2.8	60
1987	0.90	571	4.1	372	3.7	351	3.5	214
1988	0.69	577	3.5	517	2.9	75	2.8	39
1989	0.82	945	3.8	1,529	3.2	329	2.9	124
1990	0.71	406	3.5	544	2.8	179	2.2	39
1991	0.90	332	3.9	227	3.1	59	3.3	10
1992	0.89	396	4.1	877	3.6	355		
1993	0.80	329	3.8	301				
1994	0.71	370	4	112	2.6	60	1.3	65
1995	0.83	139	3.8	144				
1996	0.90	210	3.8	198	3.5	474	3.2	343
1997	0.51	825	3.9	1,467	2.5	271	2.2	101
1998	0.86	1,724	3.8	2,114	3.6	198	3.7	67
1999	0.75	2,417	3.4	2,362				
2000	0.78	2,268	3.9	2,609				
AVG 1980-2000	0.68		3.63		3.06		2.79	

APPENDIX G. Brant color composition estimates - Melville/Prince Patrick and North Puget Sound

area*	period	total	total black (2-3**)	ratio black	total gray (4-8**)	ratio gray	reference
NWT	molt	984	300	0.30	684	0.70	Boyd & Maltby 1980
NWT	molt	431	61	0.14	370	0.86	Reed et al 1989
NWT	total molt	1415	361	0.26	1054	0.74	
WA	harvest (1987-88)	99	25	0.25	74	0.75	Reed et al 1989
WA	harvest (1999-00)	78	13	0.17	65	0.83	Canniff 2000 (unpublished)
WA	total harvest	177	38	0.21	139	0.79	
WA	winter (12/7/94-1/27/95)	2000	230	0.12	1770	0.89	Canniff 1995 (unpublished)
WA	winter (12/16/96-1/3/97)	725	66	0.09	659	0.91	Canniff 1997 (unpublished)
WA	winter (12/10/97-1/31/98)	782	262	0.34	520	0.66	Canniff 1998 (unpublished)
WA	winter (12/11/98-1/22/99)	1571	931	0.59	640	0.41	Canniff 1999 (unpublished)
WA	winter (12/27/99-1/5/00)	435	75	0.17	360	0.83	Canniff 2000 (unpublished)
WA	winter (12/7/00-1/31/01)	1663	199	0.12	1464	0.88	Canniff 2001 (unpublished)
WA	total winter	7176	1763	0.25	5413	0.75	

*NWT=Melville, Prince Patrick, Englinton Islands, NWT; WA=Padilla, Samish, Fidalgo Bays, WA

**Munsell 10YR color

APPENDIX H. Numbers of brant molting in the Teshekpuk Lake area in relation to previous Midwinter Indices.

Year	Molting Brant	Previous Midwinter	% of Previous Midwinter
1976	13,998	119,720	11.3
1977	21,988	117,055	18.0
1978	32,732	136,067	22.3
1982	12,106	186,072	6.2
1983	24,617	117,074	20.3
1984	27,035	107,209	24.7
1985	15,258	128,380	11.4
1986	19,102	136,245	13.2
1987	8,184	127,204	6.0
1988	8,729	98,726	8.0
1989	13,701	131,906	9.3
1990	23,395	121,357	17.3
1991	12,574	141,543	8.3
1992	14,953	120,129	11.4
1993	21,172	108,474	18.0
1994	20,246	113,799	16.3
1995	18,994	119,156	14.6
1996	23,485	117,219	17.6
1997	21,059	122,538	16.6
1998	12,116	152,415	7.7
1999	10,956	132,660	7.9
2000	3,448	120,893	2.7
AVG	17,421	126,482	13.2

APPENDIX I. Brant juvenile percentages in Padilla/Samish/Figalgo Bays, 1980-2001

YEAR	NOV	DEC	JAN	FEB	MAR	APR	MAY
1980-81	28	28	28	26	20	18	0
1981-82	14	30	25	16			
1982-83	10	8				9	
1983-84	28	32					
1984-85	24		27				
1985-86		26		25	11		
1986-87		8		5			
1987-88	31	27					
1988-89		13					
1989-90		11					
1990-91	22						
1991-92			14				
1992-93		11		8			
1993-94		22		29			
1994-95		11(D)	2				
		4(L)					
1995-96		20(D)		6(L)			
1996-97		22(D)	19(L)				
		25(L)					
1997-98		13(D)	8(L)				
		6(L)					
1998-99		19(L)	7(D)				
1999-00		23(L)	22(L)				
			69(DH)				
			45(LH)				
2000-01		17(D)	24(L)	31(L)			
		24(L)					

D=PREDOMINANTLY DARK-BELLIED L=PREDOMINANTLY LIGHT BELLIED

H=% JUV IN HARVEST

1994-2001 GRAY AGE RATIO = 14.8%

APPENDIX J. Estimates of subsistence harvest of Pacific brant in Alaska.

Year	Y-K Delta	Togiak NWR	Bristol Bay	AK Peninsula	TOTAL
1981	1,433	ns	ns		1,433
1982	1,616	ns	ns		1,616
1983	452	ns	ns		452
1984	1,080	ns	ns		1,080
1985	2,168	ns	ns		2,168
1986	1,483	ns	ns		1,483
1987	1,030	ns	ns		1,030
1988	ns	ns	ns		-
1989	2,372	ns	ns		2,372
1990	3,133	ns	ns		3,133
1991	2,258	ns	ns		2,258
1992	2,798	ns	ns		2,798
1993	2,502	ns	ns		2,502
1994	2,326	ns	ns		2,326
1995	4,995	553	421	41	6,010
1996	3,302	331		77	3,710
1997	3,572	432	83	142	4,229
1998	4,100	1,379		150	5,629
1999	2,721	1,384	189	266	4,560
2000	4,002	879		356	5,237
Avg 1990s	3,246	826	231	172	4,476

Y-K Delta data from Copp (1985); Wentworth and Seim (1996); Wentworth (1998, 2001)
Bristol Bay data from Wong and Wentworth (1999)

APPENDIX K. Estimates of Pacific Brant retrieved fall/winter harvest in the U.S. and Canada from best available data.

	A	B	C		D	E
Year	Alaska	Br. Col.	Washington		Oregon	California
			Undifferentiated			
1981	--	255	1,670		241	586
1982	1,767	335	1,100		56	905
1983	1,931	275	closed		closed	565
1984	1,544	208	closed		closed	492
1985	726	559	closed		closed	250
1986	--	281	closed		closed	188
			WHA	*Black*		
1987	328	358	603	0	63	567
1988	608	162	354	0	16	353
1989	417	224	599	39	54	360
1990	463	300	808	73	41	456
1991	--	250	790	55	98	343
1992	392	115	950	27	97	750
1993	309	220	1,347	60	86	550
1994	550	210	825	23	197	680
1995	494	260	918	44	106	500
1996	369	~175	1,493	41	55	500
1997	504	~175	597	59	34	430
1998	--	~175	570	18	0	500
1999	1,400	160	581	86	5	750
2000	400	156	0	108	29	450
Avg 1990s	542	209	807	54	68	537

A. Alaska state harvest surveys except in 1981, 1986, 1991; HIP survey 1999-forward.
B. CWS/MELP data; bag checks in some areas.
C. Washington state harvest survey; permit hunt report data 1990 to present.
D. Oregon state harvest survey and permit hunt report data; HIP implemented in 1996.
E. California data from bag checks and hunter interviews, mostly Humboldt Bay.

APPENDIX L. Hunting seasons, hunter participation and harvest of black brant at San Quintin Bay, Baja California, Mexico.

Hunting Season	Hunt Days	Daily Limit	Possesion Limit	Hunters per Day	Brant per Hunter	No. of Hunters	Estimated Harvest [a]	Illegal Harvest	Total Harvest	Source
1974-75	69	5	15	7.5	2.2	520	1,105	56	1,161	Kramer 1976
1984-85	54	3	9	11.6	2.5	629	1,468	83	1,619	Eldridge and Kramer 1985
1987-88	51	4	12	14.9	3.5	761	2,875	-	2,875	Kramer 1988
1990-91 [b]	51	4	8	4.9	3.4	242	823	-	823	Ward, unpubl. data
1991-92	51	4	8	5.0	3.4	254	864	3	867	
1992-93	51	4	8	8.0	3.8	410	1,558	53	1,611	
1996-97	54	4	11	5.9	3.7	319	1,180	12	1,192	
1997-98	54	4	11	5.1	3.9	276	1,076	285	1,361	
1998-99	54	4	11	6.2	3.6	336	1,210	67	1,277	
1999-00	54	4	11	9.3	3.4	503	1,710	-	1,710	
2000-01 [c,d]	24	5	25	9.4	4.4	225	990	-	990	
Avg	52	4	12	8.0	3.4	407	1,351		1,408	

[a] For seasons 1990 to 2000, estimated harvest = birds/hunter x total hunters.

[b] Price of hunting and gun permits increased dramatically and there was a general boycott of hunting for brant in 1990-91 and 1991-92.

[c] The 2000-01 hunting season was shortened by delays in development of new regulations. Hunting took place from 5 January to 25 February 2001.

[d] UMA (Unidades de Manejo Ambiental) system established for local management of brant hunting on estuaries.

Estimated brant harvest from areas other than San Quintin Bay, based on interviews with residents and outfitters.

Location	1984-85 [a]	1987-88 [b]	2000-01 [c]
Baja California (excluding San Quintin Bay)	125-545	360-545	100-250
Sonora and Sinaloa	75-150	No Survey	400-600
Total	200-695	360-545	500-850

[a] Eldridge and Kramer 1985.

[b] Kramer 1988.

[c] David Ward, unpublished data.

Appendix M. Brant hunting regulations, 1970 - 2001

	Bag/Poss Limits	Season Length	Approximate Season Dates	Other Restrictions
Alaska:				
1970-82	4/8	107 days	9/1 - 1/26	
1983-86	2/4	107 days	9/1 - 1/26	
1987	2/4	50 days	9/1 - 10/20	North Zone
			9/1 - 10/31	Gulf Coast & SE Zones
			10/8 - 1/22	Pribilof-Aleut. & Kodiak Z.
1988	2/4	107 days		
1989-2001	2/4	107 days		
British Columbia:				
Queen Charlotte Is.				
1971-77	4/8	75-80 days	12/21-25 - 3/10	
1978-80	3/6	80 days	12/21 - 3/10	
1981-83	2/4	80 days	12/21 - 3/10	
1984	2/4	32 days	12/21 - 1/21	
1985-86	No open season			
Vancouver Is.				
1971-76	4/8	10 days	3/1 - 3/10	
1977-78	3/6	10 days	3/1 - 3/10	
1978-79	No open season			
Lower Mainland				
1971-76	4/8	93-102 days	11/29 & 12/7 - 3/10	
1977-84	3/6	10 days	3/1 - 3/10	
1985-86	2/4	10 days	3/1 - 3/10	Only in PMU 2-4
Washington:				
1970-79	4/8	93 days	11/20 - 2/20	Only Sat, Sun & Wed
1980-82	3/6	67-72 days	12/16 - 01/21	Only Sat, Sun & Wed & prohibit sculling, etc.
1983-86	No open season			
1987	2/4	7 days	12/8-12/23	Only Skagit & Whatcom Counties
1988-93	2/4	9-11 days	12/5-12/26	Skagit, Whatcom, & Pacific Counties
1994-96	2/4	9-11 days	12/7-12/24	Skagit & Pacific Counties

Appendix M. Brant hunting regulations, 1970 – 2001, continued.

	Bag/Poss Limits	Season Length	Approximate Season Dates	Other Restrictions
Wa. Cont.				
1997-99	2/4	5-9 days	1/8-1/23	Skagit & Pacific Counties
2000	2/4	5 days	1/13-1/21	Pacific County
2001	2/4	10 days	11/17-11/23	Skagit & Pacific Counties
			1/12-1/20	Skagit & Pacific Counties
Oregon:				
1970-79	4/8	93 days	11/20 - 2/20	
1980-82	4/8	37-51 days	12/15 - 2/1 & 1/15 - 2/20	
1983-86	No open season			
1987	2/4	16 days	12/26 - 1/10	
1988	2/4	16 days	12/17-1/1	
1989	2/4	16 days	12/30-1/14	
1990-95	2/4	16 days	1st or 2nd Saturday in Jan.	
1996-97	2/4	16 days	last Satuday in Dec.	
1998-2001	2/4	14 days	1st Saturday in Nov.	
California:				
1970-72	4/8	93 days	11/20 - 2/20	
1973-83	4/8	37 days	1/15 - 2/20 (approx)	
1983-86	2/4	40-42 days	10/20 - 11/30 (approx)	
1987-97	2/4	30 days	11/1 - 11/30	
1998-2001	2/4	30 days	11/10-12/9	
Baja California (Norte)				
1978-79	5/15	119 days	11/1 - 2/28	
1980-85	3/9	119 days	11/1 - 2/28 (approx)	(only Fri- Sun)
1986	3/9	101 days	11/14 - 2/22	(only Fri - Sun)
1987	3/9	115 days	11/13 - 3/6	(only Fri - Sun)
1988	4/12	105 days	11/7 - 2/19	(only Fri - Sun)
1989	4/8	115 days	11/3 - 2/25	(only Fri - Sun)
1990-2000	4/8	54 actual	1st weekend Nov. through last weekend Feb.	(only Fri - Sun)