

Management Plan: Cackling Canada Goose



Adopted September 2016



PACIFIC FLYWAY COUNCIL

Cover photograph: Cackling Canada goose, © 2016 Kelly Warren, Wild Spirit Resources.

This management plan is one of a series of cooperatively developed plans for managing various populations of migratory birds in 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, Division of Migratory Bird Management, 1211 SE Cardinal Court, Suite 100, Vancouver, Washington 98683-9684. Information regarding the Pacific Flyway Council and management plans can be found on the Internet at PacificFlyway.gov.

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MANAGEMENT PLAN
FOR THE
CAACKLING CANADA GOOSE

Prepared for the

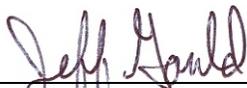
Pacific Flyway Council
U.S. Fish and Wildlife Service
Canadian Wildlife Service
Direccion General de Conservacion Ecologica de Recursos Naturales

by the

Cackling Canada Goose Subcommittee
of the
Pacific Flyway Study Committee

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Approved by



Chairperson, Pacific Flyway Council

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Date

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PREFACE

The Pacific Flyway Council is an administrative body that forges cooperation among public wildlife agencies for the purpose of protecting and conserving migratory birds in western North America. The Council is composed of the director or an appointee from the public wildlife agency in each state, province, and territory in the western United States, Canada, and Mexico. Migratory birds use four major migratory routes (Pacific, Central, Mississippi, and Atlantic flyways) in North America. Because of the unique biological characteristics and relative number of hunters in these regions, state and federal wildlife agencies adopted the flyway structure for administering migratory bird resources within the United States. Each flyway has its own Council.

Management plans are developed by Council technical committees and include biologists from state, federal, and provincial wildlife and land-management agencies, universities, and others. Management plans typically focus on populations, which are the primary unit of management, but may be specific to species or subspecies. Management plans identify issues, goals, and actions for the cooperative management of migratory birds among State and Federal agencies to protect and conserve these birds in North America. Management of some migratory birds requires coordinated action by more than one flyway. Plans identify common goals and objectives, establish priority of management actions and responsibility for them, coordinate collection and analysis of biological data, foster collaborative efforts across geo-political boundaries, document agreements on harvest strategies, and emphasize research needed to improve conservation and management. Population sustainability is the first consideration, followed by equitable recreational and subsistence harvest opportunities. Management plans generally have a 5-year planning horizon, with revisions as necessary to provide current guidance on coordinated management. Management strategies are recommendations and do not commit agencies to specific actions or schedules. Fiscal, legislative, and priority constraints influence the level and timing of management activities.

Management plans are not intended as an exhaustive compendium of information available, research needed, and management actions. Plans include summaries of historical data and information from recent surveys and research that help identify: (1) the current state of the resource (i.e., population and associated habitat), (2) desired future condition of the resource (i.e., population goals and objectives), (3) immediate management issues managers face, and (4) management actions necessary and assignment of responsibilities to achieve the desired future condition, including harvest strategies and monitoring to evaluate population status and management progress.

The first Pacific Flyway management plan for the cackling Canada goose was adopted in July 1986. This document is the third revision of that plan. It was developed by the Cackling Canada Goose Subcommittee of the Pacific Flyway Study Committee.

MANAGEMENT PLAN FOR THE CAKCLING CANADA GOOSE

INTRODUCTION

The purpose of this plan is to establish guidelines for cooperative management of the cackling Canada goose subspecies (*Branta hutchinsii minima*), here after referred to as “cackler”. The cackler is the smallest subspecies of Canada goose (Palmer 1976). The entire population of

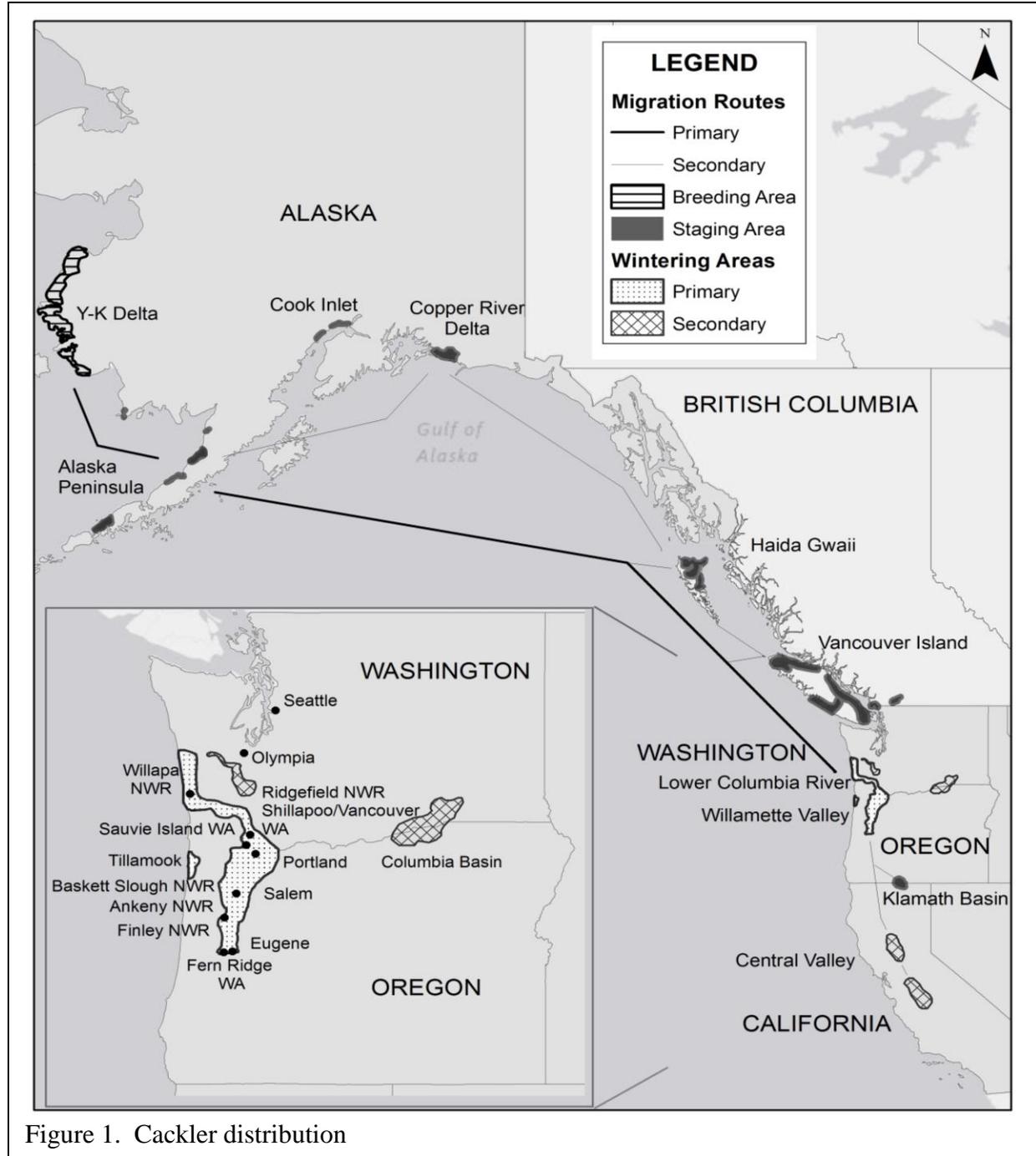


Figure 1. Cackler distribution

cacklers nests on the Yukon-Kuskokwim Delta (Y-K Delta) of Alaska (Figure 1). Historically, nearly all cacklers staged in the Klamath Basin during spring and fall, and wintered in the Central Valley of California. Since the early 1990s, almost all cacklers have wintered in northwest Oregon and southwestern Washington (Trost and Harb 1995). Appendix A describes key use areas for cacklers throughout their range.

The population status of the cackler has been of concern to wildlife managers in the Pacific Flyway for many years. Peak counts of cacklers from fall aerial surveys of the Klamath Basin documented a decline from 385,000 birds in the late 1960s to less than 50,000 by the early 1980s (O'Neill 1979; Raveling 1984). Coordinated fall surveys in California and Oregon indicated a record low count of 25,800 cacklers in 1984 (Appendix B).

The steady decline of the population from the late 1960s to mid-1980s likely resulted from the combined effects of spring subsistence hunting in Alaska and fall harvest, primarily in California. Although harvest restrictions were implemented to protect cacklers in 1979, concerted flyway-wide restoration efforts were not implemented until 1983. The Y-K Delta Goose Management Plan guided harvest strategies and conservation efforts for cacklers beginning in 1984. Coordination among interested parties has ensured consistency between Pacific Flyway management plans and the Y-K Delta Goose Management Plan. By the late 1990s, these cooperative conservation efforts restored the cackler population to the objective level of 250,000, established in previous versions of these plans.

The dramatic increase of all Canada geese in northwest Oregon and southwest Washington since the 1990s, resulted in greatly increased crop depredation concerns on private lands in these areas. Goose depredation has caused economic damage and has been a significant management problem, primarily in northwest Oregon (Pacific Flyway Council 1998).

GOAL AND OBJECTIVES

The goal is to manage the cackler population to ensure efficient, sustainable subsistence harvest and key ecological functions on breeding grounds; and manage habitat and distribution to minimize adverse effects to agricultural activities in wintering areas; while optimizing recreational uses in all areas.

The goal statement was developed at two stakeholder workshops hosted by the Pacific Flyway Council in 2015 (Peterson and DeWeber 2016).

Objectives:

- A. Maintain a population of 250,000 as measured by the 3-year average index of total indicated birds expanded to approximate fall population size.

A population objective of 250,000 was established in the mid-1980s when cacklers wintered primarily in California, after the population had declined from 385,000 to 25,800. The objective was reaffirmed in the 1999 revision of this plan, following the increase and shift of the population to Oregon and Washington in the 1990s. After consideration of input from all stakeholders at the 2015 workshops hosted by the Pacific

Flyway Council, the subcommittee decided to maintain the population objective of 250,000 to meet the goal developed at the workshops. This objective balances subsistence needs and ecological considerations in Alaska with agricultural interests in Oregon and Washington.

- B. Maintain, manage, and enhance nesting, migration, and wintering habitats in sufficient quantity and quality to meet population objectives and public use goals.
- C. Manage wintering habitats, harvest, and goose distribution to minimize agricultural depredation caused by cacklers in Oregon and Washington.

STATUS

A. Taxonomy

Prior to 2004, cacklers were classified as *Branta canadensis minima*. Mitochondrial DNA studies have shown that cacklers are associated with a group of small-bodied forms of Canada geese that developed west and north of the Alaska Range (Shields and Wilson 1987). Based on this work and other genetic studies, the American Ornithologists' Union (AOU) divided North American Canada geese into two species in 2004, with large-bodied subspecies in the species *canadensis* (Canada goose) and small-bodied forms in the species *hutchinsii* (cackling goose; Banks et al. 2004). At lower taxonomic levels, the AOU continues to reference Delacour (1954); thus, cacklers are classified as *B. hutchinsii minima*. This plan uses the designation "cackler" to represent the *minima* subspecies of *B. hutchinsii*. In Canada, management of geese occurs at the species level, and no specific management programs exist for *B. h. minima*.

B. Abundance

Information on all surveys used to estimate cackler abundance is presented in Appendix B. From 1965 to 1978, the cackler population was estimated from peak fall counts of small Canada geese (Taverner's and cacklers) in the Klamath Basin (O'Neill 1979, J. Hainline pers. comm). These counts were partitioned to subspecies based on ground observations. The highest count for cacklers occurred during the first year of the survey, when 385,000 were observed in the Klamath Basin. Based on this survey, the population of cacklers began a steep decline in the late 1960s.

From 1979 to 1984, fall surveys were expanded to the Sacramento Valley and the Willamette Valley-Lower Columbia River region of Oregon and Washington, where cacklers were starting to occur. Based on the fall surveys, numbers of cacklers declined from about 400,000 in the late 1960s to 26,000 in 1984.

After 1986, the fall index of cacklers began to increase at a rapid rate. Concurrent with this increase, the number of cacklers tallied during the fall surveys illustrated a dramatic shift in fall and winter distribution, particularly after 1993. After this time, almost all cacklers began to winter in the Willamette Valley-Lower Columbia River region of Oregon and Washington, which also wintered six other subspecies of Canada geese: Aleutian (*B.h. leucopareia*), dusky (*B.c. occidentalis*), lesser (*B.c. parvipes*), Taverner (*B.h. taverneri*), Vancouver (*B.c. fulva*), and

western (*B.c. moffitti*). Mixing of cacklers with other Canada geese, coupled with operational problems (e.g., extended periods of inclement weather) confounded the ability to obtain reliable counts of cacklers from this region during fall and winter.

In 1985, a special aerial transect survey was initiated to quantify the number and distribution of breeding geese in the coastal region of the Y-K Delta (Butler et al. 1995b). This survey, the Y-K Delta Coastal Zone Survey, covers nearly the entire cackler nesting range and has documented the steady increase in this population (Stehn 1998, Appendix B).

A cooperative study of the number and distribution of cacklers during winter based on observation of neck-banded birds was initiated during winter 1982 (Raveling and Zezulak 1988, Raveling et al. 1992). This program became an operational effort under the direction of the Council and USFWS in 1989 and continued through 2003.

Starting in 1998, due to difficulties encountered with the fall survey, the Pacific Flyway Council adopted the Y-K Delta Coastal Zone Survey, expanded by a constant factor to estimate fall population size, as the official annual assessment of population status. The mark-resight program was reinstated during 2011–2013. Indirect population estimates, derived from mark-resight methods (Raveling and Zezulak 1988, Drut and Trost 1999), were consistent with direct population estimates from breeding ground and fall surveys. The expansion factor applied to the Y-K Delta Coastal Zone Survey is derived from the average relationship between total indicated birds and fall abundance estimates using mark-resight surveys for the period 1989–2003 and 2011–2013 (Sanders 2016, Figure 2, Appendix B).

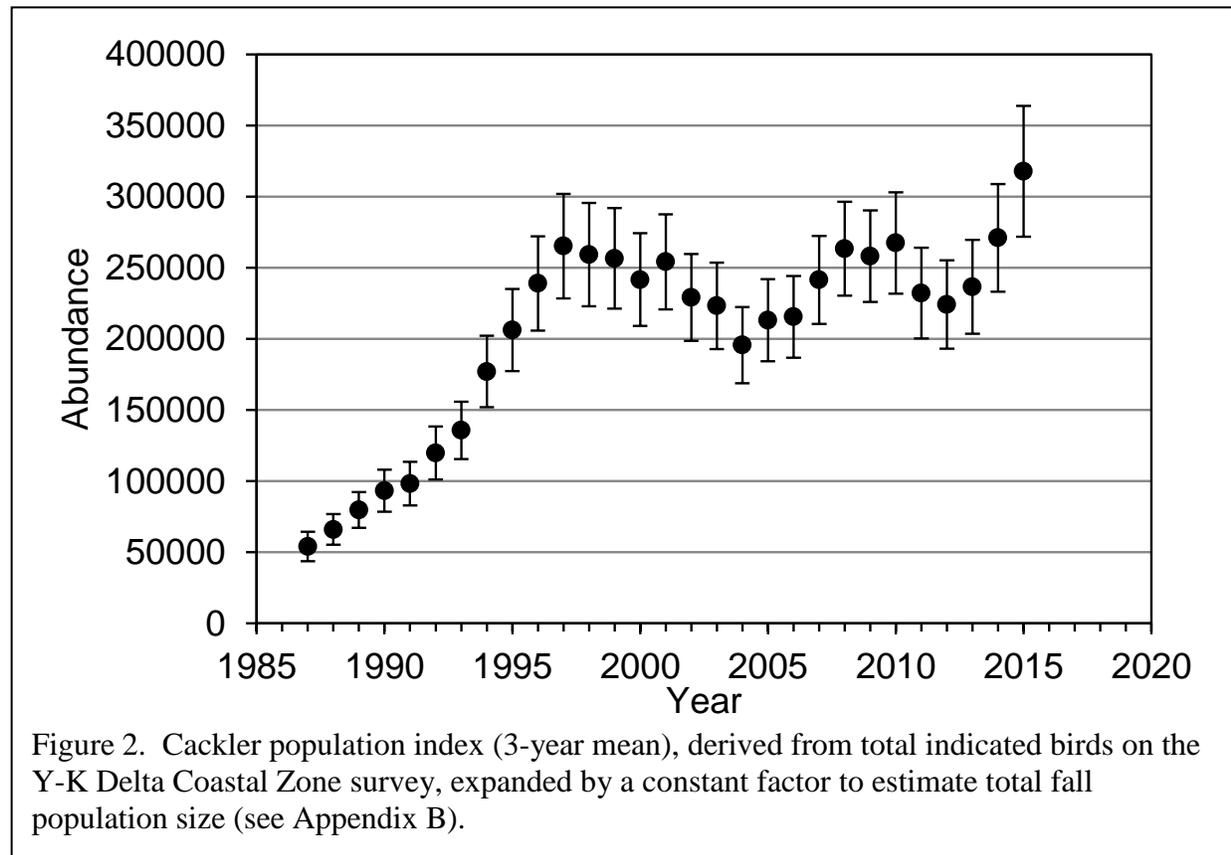


Figure 2. Cackler population index (3-year mean), derived from total indicated birds on the Y-K Delta Coastal Zone survey, expanded by a constant factor to estimate total fall population size (see Appendix B).

C. Productivity

Random plot ground surveys on the Y-K Delta were initiated in 1985 to gather information on nest densities, distribution, and success for geese and other waterbirds (Stehn 1986). Data and trends from ground plot surveys are summarized by Fischer and Stehn (2015). Since 1985, total cackler nests increased approximately 3-fold (Appendix C). From 2005 to 2014 the percent of nests active in late incubation averaged 86%, and clutch size averaged about 4.25. Mean hatch dates have become earlier during the 30 years of the survey.

D. Distribution and Migration

Breeding Distribution.— Historically, the breeding range of cacklers may have included the Bering Sea coast from Wainwright to the Alaska Peninsula (Nelson 1887; Gabrielson and Lincoln 1959), but the former range cannot be reliably determined (Palmer 1976; Bellrose 1980). Cacklers currently breed only within the coastal fringe of the Y-K Delta (King and Lensink 1971; Figure 1). This region was described by Spencer et al. (1951) as “America’s greatest goose-brant nesting area”. Aerial surveys flown for breeding geese since 1985, as part of the Y-K Delta Coastal Zone Survey (Butler et al. 1988), indicate nearly all cacklers nest within 30 km of the coast, but their density and distribution have changed between 1985 and the early 1990s, concurrent with the population increase (Butler et al. 1995a). The breeding range of Taverner’s Canada geese slightly overlaps cackler nesting, with scattered nests within 30 km of the coast; Taverner’s are predominant on inland portions of the delta (King and Lensink 1971) and Nunivak Island, and throughout much of western Alaska. Habitat preferences of the two subspecies differ, but specific isolating mechanisms are unknown.

Fall Migration.— In fall, cacklers stage on Nunivak Island and the Y-K Delta from early September until their departure in mid-October. The Alaska Peninsula is an important region for fall staging cacklers, and is used from September through late October (Nelson and Hansen 1959, Bollinger and Sedinger 1985), with peak abundance in early October. Bollinger and Sedinger (1985) documented that nearly the entire cackler population used the Alaska Peninsula as a fall migration staging area. In particular, Ugashik Bay near Pilot Point and Cinder River were the primary feeding and roosting areas in the 1980s and 1990s; about 70% of the birds used the Cinder River area (Gill et al. 1986). Some evidence indicates annual fidelity to these fall staging areas is high (Gill et al. 1997). Today, most cacklers use the Izembek Lagoon region.

Based on departure and arrival dates, most cacklers probably fly nonstop from the Alaska Peninsula to the Willamette Valley-Lower Columbia River region, with some continuing on to the Klamath Basin in Oregon and California on their way to the historical wintering areas in central California. During fall migration, cacklers are regularly sighted on Haida Gwaii (formerly known as the Queen Charlotte Islands) and on Vancouver Island in British Columbia. They are also found in northern Puget Sound (Skagit Flats), the northern Olympic Peninsula, and eastern Washington. The first major arrivals to wintering areas in southwest Washington and northwest Oregon occur in late September, with peak populations arriving between mid- to late October.

Wintering Distribution.— Prior to the 1980s, most cacklers wintered in the Central Valley of California, composed of the Sacramento and San Joaquin Valleys and the Sacramento-San

Joaquin River Delta (Nelson and Hansen 1959, King and Lensink 1971, Raveling 1984). This area now winters approximately 5% of the population, based on band encounter distribution. Areas in the Sacramento Valley with cackler use include the Sacramento, Delevan, Sutter, and Colusa National Wildlife Refuges (NWRs). Public and private lands in the Butte Sink, Llano Seco Ranch, Vina Plains, Colusa Trough and foothill regions west of the towns of Willows and Maxwell historically also held large numbers of birds. Traditional use areas within the San Joaquin Valley are still used by cacklers. Most use occurs on San Joaquin River NWR and Modesto Waste Water Treatment pasture lands, where cacklers mix with Aleutian Canada geese.

The winter distribution shifted northward from California in the mid-1990s, and since 1993 the vast majority of cacklers have wintered in northwest Oregon and southwest Washington, particularly in the Willamette Valley (Figure 1). Causes of the wintering ground shift are unknown. Harvest distribution of cacklers banded on breeding areas shows the most recoveries of cacklers in Oregon and Washington, mainly in the Willamette Valley (Figure 3). Collar observations also suggest an increase in cackler distribution throughout the Willamette Valley (Mini 2012). Major use areas for cacklers in Oregon are centered around William Finley, Ankeny, and Baskett Slough NWRs, Fern Ridge Reservoir, Sauvie Island, and the city of Salem.

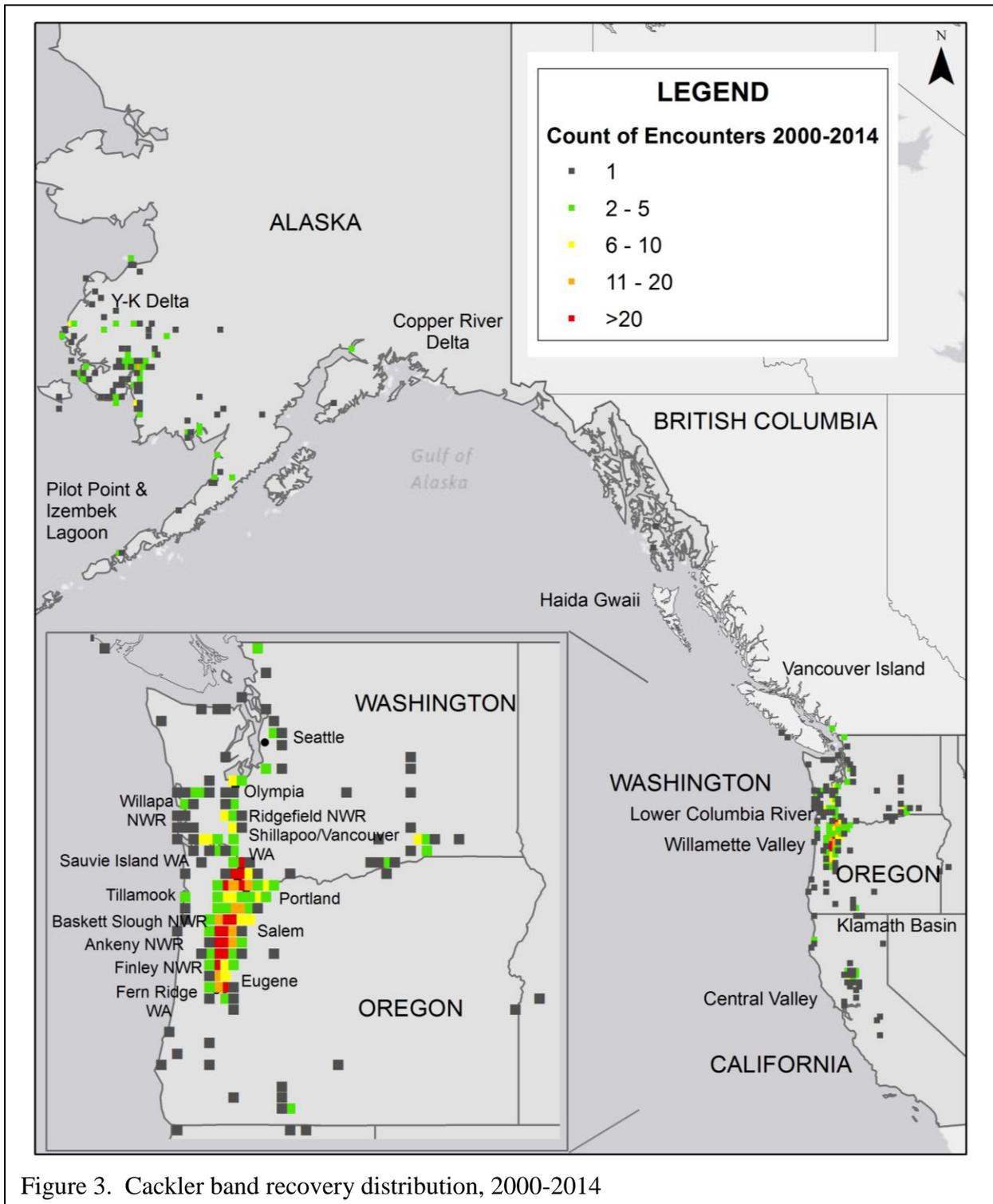
A small but possibly increasing proportion of the cackler population is wintering east of the Cascade Mountains in the Columbia Basin region of Oregon and Washington. From 2010 to 2014, harvest from this region accounted for about 5% of bands reported by hunters, up from 1% in 1994 to 2009.

Primary winter areas used in southwest Washington include the Ridgefield NWR and surrounding private lands, Vancouver Lowlands, Woodland Bottoms, Willow Grove, Puget Island, Willapa Bay, and Grays Harbor. Use of other areas in Washington is low.

Cacklers winter in small numbers in British Columbia, primarily in the Fraser River Valley, on the east and west coasts of Vancouver Island, and sometimes on Haida Gwaii.

Spring Migration.— Historically, migration from the San Joaquin and Sacramento valleys began in February and continued through mid-April (Johnson and Raveling 1983, 1984, Raveling et al. 1985). Stopover areas included the Pit River floodplain between Adin and Fall River Mills in northeastern California, where Big Valley received the greatest use. Historical observations summarized by Timm (1982) indicated major movements of cacklers through the Klamath Basin at the end of April.

The majority of cacklers wintering in the Willamette Valley-Lower Columbia River region of Washington and Oregon begin their migration northward in late April. Although most cacklers have departed Oregon and Washington by the beginning of May, flocks of several thousand can still be found during the first two weeks of the month. Subsequent sightings have been made on the coast of British Columbia and the Gulf of Alaska. Cacklers generally pass by the Copper River Delta on their way to Cook Inlet, although small flocks have been sighted there since the population expansion in the early 1990s (W.E. Eldridge, S. Babler, T.C. Rothe, ADFG pers. comm).



Most cacklers appear to fly directly to Cook Inlet near Anchorage, arriving during the last week of April; abundance peaks in early May. Annual cackler abundance is variable, and the entire population does not use the area at one time. Rather, individual birds use the area for short periods, early migrants leave before others arrive, and some may bypass the area entirely (Butler and Gill 1987, Campbell and Rothe 1985).

Cacklers depart Cook Inlet in small flocks which head overland through passes in the Alaska Range on their way to the Y-K Delta. Substantial numbers of cacklers stop at Whitefish and Pike Lakes on the edge of the Y-K Delta plain, and on sandbars of the Yukon River below Holy Cross before proceeding to their coastal nesting grounds (J. Morgart, M. Rearden, pers. comm.). Some cacklers reach the Bering Sea south of the Y-K Delta and follow the coast northward to the nesting grounds (C. Ely, USGS-ASC pers. comm.).

The first cacklers usually reach the Kuskokwim River near Bethel during the third or fourth week of April (B. J. McCaffery, USFWS-YDNWR pers. comm.). Cacklers often stay in the Kuskokwim area until early May, when snowmelt opens tundra habitats along the Yukon Delta. Peak arrival on nesting grounds usually occurs by the second week of May (Raveling 1978; Dau and Mickelson 1979; Ely et al. 1996).

E. Habitat Use and Management

Alaska.— Cacklers depend on intertidal coastal marshes of Cook Inlet as a primary spring stopover to accumulate energy reserves for breeding (Raveling 1979a, b). Cacklers feed intensively in association with snow geese on the outer marsh zone, containing alkaligrass (*Puccinellia spp.*) and arrowgrass (*Triglochin spp.*) as well as sedge (*Carex ramenskii*) meadows of the inner marsh as they become available. During years of heavy snow cover in coastal marshes, cacklers also use pasture, grain stubble and other agricultural fields near Palmer, which are generally snow-free earlier. Nearly all of the primary spring habitats in Cook Inlet are within protected state wildlife areas, including Palmer Hay Flats, Goose Bay, Susitna Flats, and Trading Bay State Game Refuges, and the Redoubt Bay Critical Habitat Area. Some cacklers also forage on grass fields within the Municipality of Anchorage.

Cacklers prefer to nest in the extensive pond and meadow mosaic habitats of the outer Y-K Delta (Mickelson 1975; Ely et al. 1996). During brood-rearing, cackler families use pond edges with sedge (*C. mackenziei* and *C. subspathacea*), arrowgrass (*T. palustris*), and alkaligrass (*P. phryganodes*). Cacklers also make extensive use of wet tundra and river/slough bank sedge meadows (*C. ramenskii* and *C. rariflora*; Babcock and Ely 1994). These areas are maintained by goose grazing each year (Sedinger and Raveling 1984, Sedinger 1988). The majority of this habitat is administered by Yukon Delta NWR, although significant acreage is owned by Native village corporations.

Cacklers provide important ecological benefits for a variety of species on the Y-K Delta, including enhancement of grazing habitat for other geese (e.g., emperor, brant). In addition, cacklers benefit other species (spectacled eider, geese) by providing an alternate prey source for predators using the same habitats (B. J. McCaffery, pers comm.).

Intertidal marshes and coastal wetlands on the north side of the Alaska Peninsula are vital fall staging habitats where cacklers add substantial body mass for migration. Cacklers feed intensively on pond shorelines with alkaligrass and arrowgrass, as well as tide flats where alkaligrass and mare's tail (*Hippuris*) dominate. Exposed intertidal bars are used extensively for roosting (Gill et al. 1986; Sedinger and Bollinger 1987). Most of the primary use area at Ugashik Bay is protected in the Pilot Point State Critical Habitat Area, and a portion of cackler habitats are within Cinder River State Critical Habitat Area. Most of the primary use area at

Izembek is protected in the Izembek State Game Refuge and the Izembek NWR.

Oregon / Washington.— Cacklers and other geese make extensive use of agricultural crops, including ryegrass, other grass seed production varieties, winter wheat, and clover grown for seed in the Willamette Valley. Winter wheat, pasture (clover, alfalfa, perennial grasses), and specialty crops are used in the lower Columbia River areas (Pacific Flyway Council 1998). Cacklers prefer to forage on young grass throughout the winter (Mini 2012), but favor corn stubble fields (e.g., sweet and silage corn) after arrival and then shift to grass seed farms (e.g., perennial rye, fescue, annual rye) as the winter progresses (M. Naughton, pers. comm.). Permanent wetlands (e.g., rivers, reservoirs, lakes, and ponds), as well as temporary field sheetwater areas, provide important habitat components for geese throughout the wintering area. Conversion of bottomland pastures and other agricultural lands along the Columbia and Willamette rivers to other uses, including commercial and residential development and crops not beneficial to wintering geese, has reduced goose foraging habitat (Sleeter et al. 2012).

National Wildlife Refuges and state wildlife areas are critical wintering areas for cacklers (see Appendix A). USFWS administers approximately 60,000 acres within SW Washington and NW Oregon, including 11 NWRs (Ankeny, Baskett Slough, Grays Harbor, Julia B. Hansen, Lewis and Clark, Nestucca Bay, Ridgefield, Steigerwald Lake, Tualatin River, Wapato Lake, and William L. Finley). Three ODFW wildlife areas (E.E. Wilson, Fern Ridge, and Sauvie Island), and two WDFW wildlife areas (Shillapoo and Vancouver Lake) lie within the primary cackler wintering area in northwest Oregon and southwest Washington, totaling approximately 20,000 acres.

Mini (2012) estimated that public lands provided an average 135% of cackler energy needs in early winter, 73% in mid-winter, and 69% in late winter; and an additional 36,000 acres of public lands managed for geese were required to support all subspecies wintering in this region. Habitat management and public use programs on public lands are mandated by established policies and/or approved area management plans. These areas provide considerable goose foraging habitat and human activity (disturbance) is usually regulated, but areas are managed for a variety of uses. Goose habitat management efforts (dependent upon personnel and funding) are geared to maximize food production in many areas. Ongoing refuge practices include creating, enhancing or restoring wetlands to provide natural (moist soil) vegetation, planting and flooding of managed areas, and providing agricultural crops and pastures. In addition, portions of these areas provide sanctuary from human disturbance. Sanctuaries on public lands that provide food and roosting areas free from human disturbance are essential for successful cackler management and help alleviate depredation on private lands. Sanctuary benefits are attained through a combination of spatial and temporal closures that are free from all human disturbances, including hunting, vehicle and foot traffic, viewing, and management activities. However, recent flock and collar observations have noted expansion of flocks into more urban areas of the Willamette Valley suggesting some habituation to higher disturbance habitats.

California.— Areas used in the San Joaquin Valley historically included the East Grasslands, San Joaquin River NWR, Merced NWR, and the eastern foothills of Merced, Stanislaus, and Madera counties. In current use areas in the Central Valley of California, cacklers feed primarily in agricultural fields (e.g., rice, corn, beans, wheat) and short grass uplands. Roosting occurs on seasonally flooded marshes and vernal pools on refuges and other shallow water habitats on private lands (e.g., seasonally flooded wetlands, flooded agricultural lands, stock ponds and

vernal pools). Geese feed on privately owned agricultural (e.g., rice, corn, beans, wheat) fields and short grass uplands on and near these refuges. The majority of suitable cackler habitat in California occurs on private lands. Key public and private lands for cacklers are shown in Appendix A.

Marsh management, the planting of agricultural crops, prescribed burning, and livestock grazing, are used to enhance habitat at some federal (e.g., Sacramento NWR and San Luis NWR complexes) and state-managed areas (e.g., Los Banos and Ash Creek Wildlife Areas). Land use practices on some private lands enhance cackler use (e.g., maintaining winter grazing areas, enhancing these areas by burning and fertilization). Some livestock ranches with annual grasslands, managed pastures, alkali meadows, and vernal pools have been incorporated into state and federal refuges and easements, and management of these short-grass habitats continues.

F. Agricultural Depredation

The dramatic increase of Canada geese in Washington and Oregon since the 1990s has resulted in increasing crop depredation complaints on private lands. Goose depredation has caused economic damage and has been a recurrent management problem and concern on wintering areas, primarily in northwest Oregon (Pacific Flyway Council 1998).

Strategies to address the collective effects of seven goose populations on agricultural lands were developed in the NW Oregon/SW Washington Canada Goose Agricultural Depredation Control Plan (Depredation Plan) (Pacific Flyway Council 1998). The Depredation Plan reviewed research on crop depredation and provided guidance for management of goose habitats on private and public lands, as well as approaches to managing hunt programs to mitigate crop damage. Due to lack of funding, many portions of the depredation plan have not been implemented. The stakeholder workshops hosted by Council in 2015 provided important input for updating this plan.

Economic loss and spatial extent of agricultural depredation is poorly quantified. Based on a survey of Oregon agricultural producers, crop damage by geese was estimated to be almost \$15 million in 1997 with over a third of that loss to grass seed crops (Oregon Dept. of Agriculture 1998). In response to studies differing on the extent and impact of geese foraging on agricultural crops, Borman et al. (2002) developed protocols to verify and measure effects of goose grazing on grain yields. We are unaware of any quantitative assessment using these protocols.

The Oregon Goose Control Task Force was created by the Oregon State Legislature in 2009 to study ways to address agricultural crop losses created by current goose populations in the state. Council addressed six of the 12 recommendations provided by the Task Force (Pacific Flyway Council 2010).

G. Harvest

Harvest of cacklers has been difficult to measure in the flyway, although a variety of methods have been used. There is little historic information on subsistence harvest of cacklers or other geese in western Alaska, and early harvest surveys suffered from inadequate sampling of the Y-K Delta region (Copp 1985). State and federal harvest surveys have not provided reliable

information on the harvest of Canada geese by subspecies. Most historical data on the harvest of cacklers has come from analyses of band recoveries and check station data (Rienecker 1983; Raveling 1983).

Alaska.— Cacklers on the Y-K Delta are one of the most important species for rural residents, who have a long history of subsistence use for food and maintaining traditional cultural values. Early efforts to monitor subsistence waterfowl harvests in western Alaska have provided only crude insights on the harvest of cacklers. Klein (1966) reported that a total of about 83,000 geese were taken on the Y-K Delta during 1964, and that the spring harvest included about 20,000 Canada geese (all subspecies). By 1980, Copp and Smith (1981) estimated a spring harvest of 6,100 cacklers. In 1985, systematic, stratified subsistence harvest surveys were initiated in a sample of villages on the Y-K Delta (Copp and Roy 1986). Results of these surveys from 1985–1997 are summarized by Wentworth and Seim (1996, 1998). Reported subsistence harvest of cacklers on the Y-K Delta averaged 7,845 birds from 1985 to 1997, with a peak harvest of nearly 15,000 in 1996 (Appendix D). About half of the Y-K Delta subsistence harvest occurs in spring. Supplemental village surveys of the Bristol Bay-Alaska Peninsula region have indicated harvests of 900 cacklers in 1996 and 1,100 cacklers in 1998 (Seim and Wentworth 1996, 1998). More recent reports from subsistence harvest surveys (2004–2011) included combined estimates for Canada and cacklers; average estimates were 23,000 for the Y-K Delta region and 3,800 for the Bristol Bay-Alaska Peninsula region (Appendix D).

Historically, the most significant fall harvest of cacklers in Alaska has occurred on the Alaska Peninsula near Pilot Point (Ugashik Bay) and the Cinder River Delta. Although harvest was not recorded by subspecies, D.E. Timm (pers. comm.) estimated that 90% of an average 1,800 Canada geese taken from this area during 1974–1981 were cacklers.

The Canada goose limit in Alaska fall hunting seasons was reduced to 1-bird daily on the central Alaska Peninsula (Game Management Unit 9E) in 1982, and 2 daily in Units 9E and 18 (Y-K Delta) in 1983. Canada goose hunting was closed in both units from 1984 through 1993, in accordance with the Y-K Delta Goose Management Plan and the flyway cackler plan. Hunting was re-opened in these units in 1994, with Canada goose daily bag and possession limits of 1-bird each. Canada goose bag limits were increased to 3 and 6 in 1998. In western Alaska, Canada goose limits were increased to 6 and 18 in 2011.

British Columbia.—In Canada, cacklers are not specifically identified in hunting regulations. The Canadian Wildlife Service National Harvest Survey separates “large” from “small” Canada geese, but the extent to which this separation captures the harvest of the species cackling goose and Canada goose is unknown.

Oregon and Washington.— As in other areas, cacklers were closed to harvest beginning in 1984 and reopened to harvest in 1994. Canada goose hunting seasons were dramatically restricted in southwest Washington and northwest Oregon beginning in 1985 to protect dusky Canada geese. Since 1985, all hunters have been required to receive training on goose identification, including differentiation of dusks, cacklers, Taverner’s, lessers, westerns, Vancouvers, and Aleutians. From 1985–1997 many area closures existed on both public and private lands to minimize the harvest of dusky geese. Since the late 1990s, most areas in Oregon have been open to goose hunting except NWRs (excluding federal lands on the Lower Columbia River) and State Wildlife Areas. Seasons in the main cackler wintering range have at times been very restrictive and

variable because of the status of dusky Canada geese, and cackler bag limits have also been variable in response to their population status (Appendix E). In Oregon, restrictions on cacklers and white-fronted geese (*Anser albifrons*) were implemented in Lake and Klamath counties in 1979. Canada goose season length in southwest Washington was 93 days prior to 1984, and few cacklers were harvested. From 1984 to 1994 during the cackler closure, the SW Washington regular season ranged from 2–24 days between mid-October and January 31, with season length determined by attainment of dusky Canada goose quotas. A special late agricultural damage hunt occurred in southwest Washington during February and March from 1996 to 2014, but was discontinued when the regular season was extended into March starting with the 2015–16 season.

Intensive harvest monitoring at check stations in NW Oregon and SW Washington from 1984 to 2015 yielded data on harvest of cacklers in their current primary winter range (Appendix F). In Oregon, the recorded harvest at check stations during 1994-2014 averaged 5,074 per season (range 1,220–7,302). During the 2014–15 season, cacklers composed 73% of the Canada goose harvest in the NW Oregon Permit Zone, the highest percentage ever recorded. In SW Washington, cackler harvest averaged 1,200 per season during 1994-2014. The percentage of cacklers increased steadily after 1994 and comprised 62% of SW Washington’s Canada goose bag in the 2014-15 season. Check stations in NW Oregon and SW Washington were discontinued after the 2014-15 season, and cackler harvests after that time were estimated using a combination of limited field checks and hunter self-reporting of subspecies harvest.

California.— Historically, the distribution of band recoveries indicated that northeastern California, Sacramento Valley and San Joaquin Valley accounted for the majority of recoveries from in-season banding at Tule Lake (Rienecker 1983). Distribution of band recoveries in California changed significantly after the 1950s, most noticeably through reductions in northeastern California and increases in Sacramento Valley (Rienecker 1983). Band recoveries in California declined rapidly in the 1990s, particularly in the San Joaquin Valley where recoveries fell to near 0% of total recoveries. Declines in the Sacramento Valley during this time fell from near 40% to 11% and in SONEC recoveries declined from 25% to 10%. Band recoveries continued to decline into the 2000’s and by 2010 band recoveries comprised about 5% of total recoveries.

In 1975, cacklers, lessers and westerns became unintentional beneficiaries of zone closures in the Sacramento Valley and San Joaquin Valley that were established to protect endangered Aleutian geese. Cackler harvest declined significantly from the mid-1960s to the mid-1970s. During 1975–1978, when Aleutian goose closures were in effect, the harvest declined by 78% in the Central Valley to less than 500 cacklers (Raveling 1984, Pamplin 1986). In 1979, additional restrictions were imposed on the taking of cacklers and white-fronted geese in the Northeastern and Balance-of-State zones in California. Cackler harvest in the Klamath Basin declined by 51% between the periods 1970–1978 and 1979–1982 (Raveling 1984).

H. Survival

Cackler survival rates have mainly been estimated through neck collar studies, representing the population of marked geese. Because neck collars have been increasingly sought after by hunters, these estimates are likely lower than for unmarked geese. Raveling et al. (1992) estimated annual survival rates of cacklers at 81% from population and production data for the

period 1985-86. This estimate was derived from an annual neck band re-observation rate of 61% and inference that neck band loss rates were approximately 25%. A large number of factors that could influence the accuracy and interpretation of these estimates are discussed by Raveling et al. (1992). An annual neck band loss rate of 1.9% was subsequently estimated from breeding ground recaptures (Schmutz et al. 1994). When re-observation rates by Raveling et al. (1992) are adjusted for this factor, survival rates may have been only 62% during the period 1985-86.

Annual and periodic survival rates from neck band observations were also estimated by Drut and Trost (1999). The average estimated survival rate for the 1990 to 1997 period was 73%. Considering an annual neck band loss rate of 1.9%, average annual survival was approximately 75% during this period. Numerous factors such as potential changes in neck band loss rates, differing observational efforts, and the accuracy by which all of the parameters can be estimated make rigorous comparisons of the above two studies difficult.

Sanders (2014) analyzed mark-resight data from 2011 to 2013 and estimated a juvenile survival rate of 0.418 (SE = 0.083, 95% CI = 0.269–0.584) and an adult survival rate of 0.749 (SE = 0.024, 95% CI = 0.699–0.793). Sanders (2014) also noted that these estimates are apparent survival rates, given the observed mark-resight data and true survival probabilities may be higher for marked geese.

I. Other Public Uses

Cacklers are of particular interest to the public because of their diminutive size, gregarious behavior, and local abundance. State and federal areas along the Columbia River and in the Willamette Valley host thousands of visitors to view or photograph geese. Students and teachers from universities, colleges, and public schools use these areas for environmental education.

MANAGEMENT ISSUES

The major challenge for cackler management is maintaining the population at levels to support subsistence harvest needs and key ecological functions on the breeding grounds while minimizing adverse effects to agricultural activities in wintering areas. Specific issues include:

- A. Crop depredation remains a significant concern because of the current numbers of cacklers and other geese in northwest Oregon and southwest Washington.
- B. There is insufficient goose forage on public lands in northwest Oregon and southwest Washington to ameliorate conflicts with agricultural interests and provide for long-term winter foraging needs.
- C. Changing land use patterns result in loss of wintering habitat in cackler use areas, which concentrate geese on remaining lands and increase depredation concerns, especially near roosting areas.

- D. Additional information is needed to improve estimates of abundance, survival rates, harvest, and distribution to understand effects of management actions on population dynamics.

MANAGEMENT STRATEGIES

The following recommended management strategies by the agencies involved will be influenced by fiscal and legislative constraints. Tasks which specifically lead to progress on the management issues are given the highest priority. Whenever possible, management procedures in this plan should be coordinated with and incorporated into those recommended in other management plans, including the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (Pacific Flyway Council 1998).

A. Habitat

1. Identify and protect cackler use areas through fee title acquisition or easement programs. Priority areas include areas of the Willamette and Columbia River floodplains in Oregon and Washington, and in the East Grasslands of California.

Lead Agencies: USFWS, ODFW, WDFW, and CDFW
Participating: Central Valley, Pacific Bird Habitat, Intermountain West JVs
Priority: 1
Schedule: Ongoing

2. Encourage land use and management practices on public lands and cooperatively managed private lands in wintering areas to benefit cacklers.

Lead Agencies: USFWS, ODFW, WDFW, and CDFW
Priority: 1
Schedule: Ongoing

B. Monitoring

1. Conduct the annual Y-K Delta Coastal Zone Survey as the basis for the cackler population index.

Lead Agencies: USFWS – Region 7
Priority: 1
Schedule: Ongoing

2. Leg band 1,000 cacklers on the Y-K Delta and wintering grounds to support estimation of abundance, survival rates, harvest rates, and distribution.

Lead Agencies: USFWS
Participating: USGS-BRD, ADFG, CDFW, ODFW, WDFW, CWS
Priority: 2
Schedule: Ongoing

3. Continue the random nest plot survey on the Y-K Delta to monitor density and distribution of breeding birds, develop air-ground comparison data, and monitor annual production.

Lead Agencies: USFWS
Participating: USGS
Priority: 1
Schedule: Ongoing

4. In British Columbia, conduct periodic surveys of dark geese (including cacklers) to determine distribution and abundance.

Lead Agencies: CWS
Participating: BC
Priority: 3
Schedule: Ongoing

C. Harvest Management

1. Assess and revise (if needed) sport harvest surveys, including mail, telephone, and parts collection surveys, to provide estimates of magnitude and distribution of sport harvest.

Lead Agencies: ODFW, WDFW
Participating: USFWS, CWS
Priority: 3
Schedule: Ongoing

2. Continue village harvest surveys in Alaska to estimate seasonal subsistence harvest on breeding and staging areas.

Lead Agencies: USFWS
Participating: ADFG
Priority: 1
Schedule: Ongoing

3. Continue coordination with the AMBCC and AVCP to benefit cacklers and other Y-K Delta goose populations through cooperative management planning, information exchange, and implementation of conservation measures in the Y-K Delta Goose Management Plan.

Lead Agencies: AMBCC, AVCP
Participating: USFWS, ADFG, WDFW, ODFW, CDFW
Priority: 1
Schedule: Ongoing

D. Research and Education

1. Develop methods to estimate aerial detection rates (e.g., breeding vs. flocked birds) using the relationship between cackler aerial counts and nests on the Y-K Delta.

Lead Agencies: USFWS
Participating: USGS
Priority: 2
Schedule: 2017

2. Continue education programs to facilitate dissemination of population information, basic biological concepts on migratory waterfowl, and management program with hunters and Alaska Native groups to foster support and understanding among user groups.

Lead Agencies: USFWS
Participating: ADFG, CDFW, ODFW, WDFW
Cooperating: AVCP
Priority: 3
Schedule: Ongoing

3. Evaluate movement of birds (GPS/GSM markers) during migration and throughout the wintering period to document when and where depredation control measures are most beneficial, as well as current roosting sites.

Lead Agencies: ODFW, WDFW
Participating: USFWS, USGS
Priority: 2
Schedule: 2017

E. Crop Depredation Control

1. Update and pursue funding for the Northwest Oregon/Southwest Washington Canada Goose Agricultural Depredation Control Plan (Pacific Flyway Council 1998).

Lead Agencies: USFWS, ODFW, WDFW
Participating: USDA-WS, Farm Bureaus, ADFG, AMBCC, AVCP
Priority: 1
Schedule: Ongoing

2. Determine distribution, timing, and magnitude of crop depredation as it relates to abundance of cacklers in wintering areas. Reconsider the cackler population objective following the completion of a landowner survey designed to evaluate these factors, developed cooperatively among all stakeholders.

Lead Agencies: USFWS, ODFW, WDFW
Participating: USDA-WS, Farm Bureaus, ADFG, AMBCC, AVCP, OSU
Priority: 1
Schedule: 2016

F. Plan Implementation and Review

The Subcommittee shall meet at least once annually or as needed to review progress toward achieving the goal and objectives of this plan and to recommend actions and revisions. 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 cacklers. This Subcommittee shall coordinate management activities with those for lessers/Taverner's, westerns, and Aleutians.

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 goal, objectives, and management strategies 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. 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.

HARVEST STRATEGY

Experience over the past 45 years has illustrated that harvest (adult mortality) is an important factor regulating the size of the cackler population. Excessive harvest from the 1960s to the 1980s throughout their range caused a serious population decline that necessitated 30 years of restoration effort. Given the importance of harvest management in regulating the cackler population, the Council has established the following harvest guidelines, in cooperation with resource users throughout the flyway:

1. The harvest strategy seeks to maintain a population of 250,000 \pm 10%, as measured by the 3-year average index of total indicated birds expanded to approximate fall population size.
2. If the 3-year average population index is greater than 10% above or 10% below the objective, implement regulatory actions to regain the objective. When the population is within 10% of the objective, adjustments to regulations can be made to maintain the population within 10% of the objective.
3. If the 3-year average population index drops below 80,000 geese, all hunting should be closed throughout the flyway.
4. After a closure and when the population increases above a 3-year average index of 110,000, limited hunting may be considered.

In Canada, First Nations harvest is not regulated by the Canadian Federal Government. Under Aboriginal common law and under land claim treaties, First Nation individuals can harvest migratory birds throughout the year with no bag or possession limit. From a sport harvest perspective, Canada follows the AOU classification of the cackling goose species and does not recognize the cackler as a distinctly managed subspecies. The Canadian hunting regulations contain no regulatory provisions for the cackler subspecies covered by this plan. Therefore, this harvest strategy does not apply to Canadian aboriginal and sport harvest.

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APPENDIX A. Important use areas for cacklers throughout their range.

AREA	TYPE OF USE	OCCURRENCE OF CACKLERS	HABITAT CONDITION AND THREATS
Alaska			
Yukon-Kuskokwim Delta	Nesting, molting, staging	95+% of population	Federal refuge with private inholdings. Conflicting land uses around communities and human activity may impact nesting areas.
Nunivak Island	Molting, fall staging	Several thousand	Federal refuge; some private lands. Reindeer grazing may affect habitat.
Ugashik Bay/Cinder Lagoon areas	Summer / Fall staging	Historically high proportion of population	Major portions designated by State Critical Habitat Areas. However, only about a third of geese recorded at these areas occur on protected upland/tundra. Use of unprotected areas may become increasingly important if the population continues to increase.
Izembek Lagoon	Spring/Fall staging	High proportion of population	National Wildlife Refuge and State Critical Habitat Area
Redoubt and Trading Bays	Spring migration	10,000 +	Trading Bay is a state game refuge and Redoubt Bay is a State Critical Habitat Area. Offshore and onshore oil and gas production, Cook Inlet tanker traffic, and human activity pose threats.
Susitna Flats	Spring migration	Several thousand	Designated as a state game refuge. Oil and gas production and human activity pose threats.
Copper/Bering River Deltas, Prince William Sound	Spring migration	Widely scattered	Managed under state-federal cooperative agreement. USFS and BLM lands and state Critical Habitat Area. Oil transportation, other resource development, and human activity pose risks.
Southeastern Alaska	Spring migration	Widely scattered with major use on Stikine River Delta	National Forest uplands; state-owned tidelands.
British Columbia			
Haida Gwaii Vancouver Island	Fall migration	Low thousands	Agricultural lands and grassy coastal areas (parks, golf courses etc.).
Washington			
Ridgefield NWR Complex (Ridgefield and Steigerwald Lake	Fall, winter, spring	High use	This 5,149-acre refuge complex provides a wintering area for migratory waterfowl, especially dusky Canada geese. Farming on the refuge is through a cooperative farming program and limited cattle grazing occurs on the area. Steigerwald Lake NWR is a 900-acre winter waterfowl area that provides approximately 150 acres of goose foraging habitat. No farming program exists for this refuge; public use is managed to protect waterfowl. Major public use activities on Ridgefield NWR include waterfowl hunting, wildlife observation and photography and environmental education. Public entry onto the refuge varies by management units (River S, Roth, Bachelor and Bridgeport Dairy). Portions of the River S unit are closed to all public use from October 1 - April 15. The remaining portion is open to hunting only on waterfowl hunt days. The Bridgeport Dairy and Bachelor units are closed year-round

			to all public use, with the exception of vehicle use along the Lower River Road. Public use on Steigerwald Lake NWR is prohibited except for group tours conducted by refuge staff.
Lower Columbia River NWRs (Julia Butler Hansen and Lewis and Clark NWRs)	Fall, winter, spring	Low use	The Julia Butler Hansen NWR encompasses approximately 5,516 acres. This refuge was established for the protection of the endangered Columbia white-tailed deer. The 38,214-acre Lewis and Clark NWR was established to provide habitat for migratory birds, primarily waterfowl. Currently, the farming and grazing programs on the two refuges are geared towards providing green forage for white-tailed deer and wintering waterfowl.
Shillapoo and Vancouver Lake Wildlife Areas	Fall, Winter, Spring	Moderate use	Shillapoo and Vancouver Lake Wildlife Areas are located in Clark County in southwest Washington. The combined 1,549-acre area, established in 1952, extends along the Columbia River floodplain from the city of Vancouver to the mouth of the Lewis River. WDFW has recently been expanding these areas through an extensive acquisition program in the Vancouver Lowlands in cooperation with Bonneville Power Administration (BPA) and the Washington Wildlife and Recreation Program. Approximately 880 acres of food crops and green forage are provided for wintering waterfowl through sharecropping agreements with local farmers. Like the Sauvie Island Wildlife Area, the Shillapoo and Vancouver Lake Wildlife Areas are very popular due to their proximity to the metropolitan areas.
Woodland Bottoms	Fall, winter, spring	Moderate use	Mix of private lands pasture, winter wheat, specialty crops. Threats include land use conversion, crops not beneficial to geese.
Willow Grove, Puget Island, Willapa Bay, Grays Harbor	Fall, winter, spring	Low use	Most use on private pasture and forage crops. Threats of conversion to crops not beneficial to geese.
N. Olympic Peninsula, Skagit, South Puget Sound, eastern Washington	Fall, winter, spring	Low use	Use of green forage, grain stubble. Threats of land use conversion to residential/commercial uses in western Washington.
Oregon			
Willamette Valley NWR Complex (Ankeny, Baskett Slough, and William L. Finley)	Fall, Winter, Spring	150,000+	Initially established in the mid-1960s to provide wintering habitat for the dusky Canada goose. These refuges encompass approximately 10,613 acres, of which over 5,000 acres are farmed to provide winter food for geese. Under the cooperative farming program, farmers plant grass, pasture and grains and then harvest all of the grass seed. All of the forage provided by these crops is available to wintering waterfowl during the fall-spring period. Farmers harvest grass seed and hay from these areas during the summer, after the geese have migrated north to their breeding grounds. Cooperative farming agreements on these refuges are similar to other refuges and allow the farmer to remove a significant portion (75%) of the crop while leaving a small portion (25%) of the harvest behind for foraging geese. In recent years, these refuges have also developed several hundred acres of moist soil units, which are heavily used by geese. Wildlife observation, photography, hiking, hunting, interpretation and environmental education are the major public use activities on these refuges. Large portions of the refuges are closed to public access when geese

			arrive in the fall and remain closed until April 1. Refuge management and farming activities are also minimized during the winter to reduce disturbance to geese. Waterfowl hunting on the complex is prohibited (except September Canada geese and September youth waterfowl weekend at Baskett Slough) to reduce disturbance to wintering geese.
Tualatin River NWR Complex (Tualatin River and Wapato Lake)	Fall, Winter, Spring	Moderate use	Located in the north end of the Willamette Valley, these three refuges currently total 2,217 acres, with an approved future boundary of 7,370 acres. Tualatin River was established in 1992, and Wapato Lake was established in 2013, both to conserve and protect fish and wildlife resources, including migratory birds. Although small and largely undeveloped for refuge purposes, these two refuges could provide significant wintering goose habitat in future years. All hunting is prohibited at the complex, except for limited youth waterfowl hunting opportunities at the Riverboat Unit of Tualatin River. Portions of Tualatin River are closed to public access during the winter to provide sanctuary for migratory birds. Wapato Lake is completely closed to public use.
E.E. Wilson Wildlife Area	Fall, Winter, Spring	Minimal use	E.E. Wilson Wildlife Area is a 1,683 acre area acquired by ODFW from the U.S. Army in 1948. Hunting for waterfowl, upland birds, rabbits and doves occurs on the area from September 1 through February 28, with upland bird hunting constituting a majority (60%) of the hunter visits. E.E. Wilson has limited agricultural land dedicated to goose forage and provides limited benefit to wintering cacklers.
Fern Ridge Wildlife Area	Fall, Winter, Spring	High use	Fern Ridge Wildlife Area is located adjacent to the Fern Ridge Reservoir near Eugene. This 5,794-acre area has approximately 150 acres of cropland that are annually planted and 450 acres of moist soil impoundments are actively managed for waterfowl forage. Seasonal restrictions (Early October - April 30) restrict public access to benefit wintering waterfowl. Currently, goose hunting during the fall-winter season is prohibited in an attempt to encourage wintering geese to forage on the wildlife area.
Sauvie Island Wildlife Area	Fall, Winter, Spring	High use	Established in 1947 as a wintering waterfowl area, the Sauvie Island Wildlife Area on the north half of Sauvie Island is located at the confluence of the Columbia and Willamette Rivers in Oregon. This 11,643-acre area is located 10 miles from downtown Portland and approximately 4,359 acres are currently available for goose food production. Currently, goose hunting during the fall-winter season is restricted to light geese only, in an attempt to encourage wintering Canada geese to forage on the wildlife area. Located close to the Portland metropolitan area, the Sauvie Island Wildlife Area is very popular with the public for outdoor-related activities. Public access restrictions vary among management units, but generally call for areas to be closed to public access from October 1 through April 15. To reduce disturbance to cacklers, the seasonal closure was extended to May 1 on the Eastside Units in recent years.
Klamath Wildlife Area	Spring migration	Minimal in recent years	State wildlife management area. Managed pastures extremely important grazing areas for cacklers during spring stopover migration.

California			
Tule Lake/Lower Klamath	Fall staging	20,000 decreasing	Federal refuge and private croplands; land use changes and changes in cropping patterns (especially winter wheat and alfalfa) on private lands pose threat.
Big Valley	Spring staging	10,000	Important native marsh area in Big Valley purchased by State.
Fall River Valley, Canby, Modoc NWR, Devil's Garden, Goose Lake	Spring staging	Minimal in recent years	Private livestock ranches are (were) extremely important cackler grazing areas.
Sacramento Valley Sacramento NWR complex: Colusa, Delevan, Butte Sink, Llano Seco Ranch, Vina Plains, Gray Lodge WA	Wintering	10,000 Cacklers mix with Aleutians in Colusa/ Butte Sink area, and with abundant white-fronts and white geese	Wetlands consisting of private duck clubs have increased in recent years, with CVJV implementation. Flooded rice sanctuary areas also increasing. Conversion to cotton reduces goose habitat. Some recent losses of grassland, pasture and winter wheat. Active habitat protection in-progress on Vina Plains and Lassen Foothills. Little pastureland remains in Sacramento Valley, but cereal grains are important in early
Sacramento/San Joaquin Delta	Wintering	Scattered	No significant changes or threats affecting habitat have occurred in recent years. Most habitat is irrigated cropland which is often flooded during the winter months.
San Joaquin Valley San Luis complex, San Joaquin River, Merced NWRs; East Grasslands, east Merced County, Southern Sierra Foothills	Wintering, early spring	Most cacklers on San Joaquin River NWR with Aleutian geese. Still present April 1; shift to East Grasslands in early spring and migrate out through 3rd week April.	Threat of grassland/ vernal pool conversion to urban uses, and other agriculture (orchards, vineyards, row crops, poultry). Changes in grazing reducing suitable pasture. Some public and private areas converted to managed marshes for ducks. Federal acquisition and easement programs are preserving goose foraging and roost habitats in East Grasslands, and Merced and Stanislaus Counties.

APPENDIX B. Population indices of cacklers in the Pacific Flyway

Year	Klamath Fall Survey	Pacific Flyway Fall Survey			Mark-resight Survey	Y-K Delta Coastal Zone Survey				Population Index		Population Index (3-yr mean)	
		OR-WA	CA-Other	Total		TBB*	SE(TBB)	TIB**	SE(TIB)	Fall	SE(Fall)	Fall	SE(Fall)
1965	384,000												
1966	351,000												
1967	322,400												
1968	376,100												
1969	143,000												
1970	314,000												
1971	289,000												
1972	234,400												
1973	244,800												
1974	136,300												
1975	217,900												
1976	212,300												
1977	62,000												
1978	118,300												
1979	60,200	200	63,900	64,100									
1980	123,800	200	127,200	127,400									
1981	98,700	1,100	86,000	98,700									
1982	35,500	0	54,100	54,100									
1983	26,200	0	26,200	26,200									
1984	19,500	4,000	21,800	25,800									
1985	19,200	7,400	24,700	32,100		10,313	1,378	13,963	1,605	47,793	5,791		
1986	38,800	12,000	39,400	51,400		10,770	854	13,502	1,013	46,215	3,891		
1987	30,100	11,000	43,800	54,800		14,367	967	19,921	1,390	68,186	5,424	54,065	5,102
1988	48,000	19,100	50,800	69,900		16,290	1,009	24,467	1,507	83,747	6,068	66,049	5,208
1989	51,000	13,000	63,800	76,800	92,062	21,168	1,330	25,475	1,567	87,197	6,312	79,710	5,947
1990	70,200	34,700	75,500	110,200	94,237	20,330	1,341	31,759	2,166	108,706	8,497	93,217	7,044
1991		27,900	76,700	104,600	148,628	22,405	1,290	28,843	1,688	98,725	6,897	98,209	7,294
1992		60,700	88,600	149,300	149,542	28,443	1,697	44,356	2,632	151,824	10,711	119,752	8,841

Year	Klamath Fall Survey	Pacific Flyway Fall Survey			Mark-resight Survey	Y-K Delta Coastal Zone Survey				Population Index		Population Index (3-yr mean)	
		OR-WA	CA-Other	Total		TBB*	SE(TBB)	TIB**	SE(TIB)	Fall	SE(Fall)	Fall	SE(Fall)
1993		65,700	98,600	164,300	184,844	33,781	1,828	45,749	2,534	156,592	10,532	135,713	9,543
1994		75,900	76,600	152,500	198,558	41,200	2,135	65,021	3,181	222,557	13,806	176,991	11,779
1995		114,000	47,400	161,400	202,969	49,354	2,872	69,888	3,756	239,216	15,766	206,121	13,541
1996		123,600	11,000	134,600*	193,531	39,543	2,371	74,574	4,008	255,255	16,824	239,009	15,516
1997		188,900	16,200	205,100	256,715	49,254	2,570	88,018	4,359	301,272	18,832	265,247	17,188
1998		139,000	9,600	148,600*	215,644	46,372	2,896	64,601	3,701	221,119	15,221	259,215	17,023
1999					306,065	49,556	2,401	72,173	3,509	247,037	15,265	256,476	16,526
2000					273,108	52,855	2,428	74,992	3,352	256,686	15,081	241,614	15,189
2001					206,249	49,665	2,451	75,620	3,734	258,835	16,150	254,186	15,506
2002					177,794	41,982	2,033	50,187	2,487	171,782	10,742	229,101	14,185
2003					251,594	40,993	2,058	69,867	3,482	239,144	15,008	223,254	14,159
2004						40,848	2,219	51,390	2,691	175,900	11,396	195,609	12,523
2005						44,018	2,220	65,484	3,091	224,141	13,602	213,062	13,418
2006						47,500	2,293	71,985	3,291	246,393	14,669	215,478	13,292
2007						51,194	2,345	74,152	3,138	253,811	14,458	241,448	14,250
2008						52,368	2,444	84,699	3,517	289,911	16,343	263,372	15,180
2009						52,368	2,328	67,434	2,909	230,816	13,289	258,179	14,750
2010						50,232	2,200	82,192	4,755	281,330	19,497	267,353	16,571
2011					242,467	42,361	1,796	53,799	2,137	184,146	10,139	232,097	14,827
2012					272,493	51,729	2,349	60,395	2,663	206,723	12,051	224,066	14,470
2013					259,323	67,328	3,512	93,200	5,202	319,009	21,568	236,626	15,419
2014						55,733	2,736	83,970	4,225	287,416	18,147	271,049	17,699
2015						55,937	2,732	101,408	6,144	347,104	24,854	317,843	21,697
1. *TBB=Total Breeding Birds (2*singles + paired birds) **TIB=Total Indicated Birds (2*singles + paired birds + flocked)													
2. The ratio of (estimated abundance from fall mark-resight) to (TIB) is 3.422843 (SE = 0.161651).													
3. Fall projected abundance (N) is calculated based on $N = TIB * \text{ratio}$, and the variance is calculated as $SE(N) = \text{square root}(\text{ratio}^2 * TIB^2 + SE_TIB^2 * SE_Ratio^2 + TIB^2 * SE_Ratio^2)$													

APPENDIX C. Annual estimates of density and number of cackler nests and eggs on the Yukon Delta, Alaska, 1985-2014. Estimates from a ground sampled area (716 km²) are expanded to the total Y-K Delta coastal zone (12,832 km²) using the ratio of aerial indicated pair observations within the ground sampled area and outside the ground sampled area from Fischer and Stehn (2015)

Year	# Plots	Sampled Area (km ²)	Core Nesting Area (716 km ²)								Total Coastal Zone Y-K Delta (12,832 km ²)			
			Nests	SE	Active nests	SE	Percent nests active	Eggs	SE	Clutch Size (eggs/active nests)	Total nests	SE	Total eggs	SE
1985	49	24.57	16,149	2,091	6,807	1,196	42.20%	26,635	5,028	3.91	48,365	6,676	79,771	13,748
1986	46	22.16	12,467	1,633	7,619	1,219	61.10%	37,259	6,100	4.89	30,469	3,818	91,057	13,116
1987	37	12.67	17,319	3,277	16,243	3,201	93.80%	83,216	16,700	5.12	43,007	6,544	206,640	32,996
1988	32	10.48	10,749	2,361	6,766	1,475	62.90%	30,611	6,908	4.52	25,770	4,315	73,386	12,590
1989	23	7.45	18,390	4,013	14,081	3,597	76.60%	68,295	16,445	4.85	42,185	6,998	156,666	28,379
1990	33	10.7	21,997	4,708	16,219	3,423	73.70%	73,824	15,350	4.55	49,812	8,200	167,174	26,847
1991	36	11.66	26,414	4,516	21,675	3,663	82.10%	100,499	16,440	4.64	67,442	9,355	256,599	34,366
1992	42	13.39	30,098	5,560	27,502	5,292	91.40%	132,683	25,605	4.82	65,402	9,342	288,319	42,749
1993	47	15.23	26,323	3,429	22,619	2,837	85.90%	101,954	13,085	4.51	54,646	5,626	211,650	21,529
1994	41	13.27	32,051	3,660	25,746	3,232	80.30%	117,836	14,278	4.58	66,978	6,242	246,251	24,019
1995	50	22.56	51,015	6,286	43,242	5,341	84.80%	192,812	23,686	4.46	104,985	10,605	396,791	39,987
1996	54	19.44	46,617	5,796	41,581	5,442	89.20%	186,905	24,464	4.49	91,532	9,373	366,991	39,062
1997	72	23.31	43,550	5,176	34,406	4,523	79.00%	138,723	18,510	4.03	90,167	8,526	287,214	29,832
1998	64	20.71	64,403	7,764	59,539	7,450	92.40%	266,227	33,603	4.47	134,479	12,779	555,904	54,837
1999	53	16.97	55,508	6,675	47,126	5,927	84.90%	183,346	22,252	3.89	124,582	11,784	411,500	39,220
2000	80	25.86	53,165	4,414	50,059	4,262	94.20%	225,468	19,037	4.5	120,706	8,677	511,906	37,225
2001	81	26.23	40,799	5,157	22,532	3,278	55.20%	81,982	11,530	3.64	93,815	9,398	188,511	20,630
2002	84	27.15	47,948	4,822	39,720	4,157	82.80%	175,462	17,935	4.42	119,467	10,248	437,177	37,942
2003	83	26.87	33,071	3,447	20,093	2,691	60.80%	79,650	10,217	3.96	73,859	6,179	177,886	17,640
2004	81	26.22	41,818	3,458	35,541	3,241	85.00%	167,748	15,579	4.72	98,515	7,627	395,182	32,856
2005	83	26.87	40,898	3,655	34,816	3,433	85.10%	148,541	14,219	4.27	88,035	6,772	319,740	25,799
2006	75	24.28	41,706	4,400	34,280	3,847	82.20%	151,916	17,236	4.43	97,914	8,389	356,660	32,362
2007	79	25.58	53,492	5,888	49,069	5,588	91.70%	225,858	26,136	4.6	121,590	10,680	513,382	46,953
2008	82	26.55	50,846	4,753	37,847	3,887	74.40%	153,515	15,417	4.06	120,745	9,473	364,555	30,167
2009	81	26.24	71,807	5,194	65,166	5,033	90.80%	282,581	21,651	4.34	163,860	10,753	644,838	43,884
2010	66	21.37	60,861	6,946	52,601	6,337	86.40%	221,493	26,391	4.21	158,354	15,223	576,305	57,226
2011	82	26.55	52,806	4,224	48,526	3,912	91.90%	211,289	17,484	4.35	124,791	8,938	499,323	36,558
2012	77	24.94	59,828	4,928	55,267	4,590	92.40%	225,335	18,824	4.08	153,752	11,650	579,085	44,267
2013	59	19.12	50,144	5,060	42,119	4,553	84.00%	162,528	17,515	3.86	146,253	13,465	474,041	45,629
2014	76	24.56	41,174	3,582	34,211	3,313	83.10%	145,336	13,993	4.25	116,906	9,548	412,653	35,976

APPENDIX D. Alaska regional subsistence harvest estimates for Canada/cackling geese, 2004-2014

From Naves (2015)

Region	Canada/cackling goose harvest estimates (number birds/year)										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Gulf of Alaska–Cook Inlet	68	*	*	-	-	-	*	-	-	-	-
Kodiak Archipelago	-	-	*	-	-	-	19	-	-	-	-
Aleutian-Pribilof Islands	-	*	-	*	996	-	-	-	-	-	-
Bristol Bay	*	3,472	*	2,584	6,085	-	-	2,903	-	-	-
Yukon-Kuskokwim Delta	19,813	23,756	26,143	27,634	17,716	39,856	15,269	17,192	-	*	-

Note in 2004-2009, Canada/cackling geese were listed separately in surveys as lesser and cackling Canada geese. In 2010-2014, a combined Canada/cackling geese category was used. The estimates for these species were combined in this table for 2004-2009.

-: Region not surveyed

*: Less than 75% of region households were represented in the sample; region harvest estimates not produced

Appendix E. Canada goose seasons and bag limits in Oregon and SW Washington

Overall Canada goose bag limits, cackler bag limits, and open goose hunting days in areas of Oregon and Washington important for cacklers, 1994 – 2015.

Zone		Hunting Season																					
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NW OR Permit	Overall Canada Goose Bag Limit	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Cackling Goose Bag Limit	1	2	2	2	4	4	4	4	4	4	4	2	2	2	2	2	2	3	3	3	4	4
	Open Goose Days	34	23	27	39	39	40	43	55	53	43	43	42	44	46	45	45	71	68	69	70	76	97
NW OR General* merged with Permit in 2015	Overall Canada Goose Bag Limit	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Cackling Goose Bag Limit	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	4	*
	Open Goose Days	93	93	93	93	93	100	95	94	93	93	97	99	96	98	97	97	97	96	97	97	97	97
Southern OR	Overall Canada Goose Bag Limit	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Cackling Goose Bag Limit	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	4	4
	Open Goose Days	100	100	100	99	99	100	98	98	98	98	98	99	90	88	87	86	85	83	89	100	100	100
SW WA Permit	Overall Canada Goose Bag Limit	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Cackling Goose Bag Limit	1	2	2	2	4	4	4	4	4	4	4	2	2	2	2	2	2	3	3	3	4	4
	Open Goose Days	24	33	40	45	59	59	52	52	44	31	35	40	42	42	41	41	40	40	40	40	42	45

APPENDIX F. Subspecies composition and estimated harvest of Canada geese from check station data in Northwest Oregon and Southwest Washington.

Northwest Oregon Harvest											
Season	Aleutian	Cackler	Dusky	Lesser	Taverner	Vancouver	Western	Other ¹	Total	% Cackler	% Dusky
1984-85		0	603	0	641	0	0	21	1,265	0.0%	47.7%
1985-86		8	157	257	1,156	2	95	0	1,675	0.5%	9.4%
1986-87		19	134	103	1,157	0	0	127	1,540	1.2%	8.7%
1987-88		54	118	235	2,524	3	258	1	3,193	1.7%	3.7%
1988-89		26	142	273	3,067	3	415	0	3,926	0.7%	3.6%
1989-90		16	79	346	2,563	5	1,623	2	4,634	0.3%	1.7%
1990-91		18	177	572	2,684	6	1,846	0	5,303	0.3%	3.3%
1991-92		42	121	378	2,287	9	1,091	0	3,928	1.1%	3.1%
1992-93	1	36	147	422	2,294	8	1,333	0	4,241	0.8%	3.5%
1993-94	0	72	188	748	2,699	41	1,348	4	5,100	1.4%	3.7%
1994-95	1	1,220	142	447	2,669	9	1,415	10	5,913	20.6%	2.4%
1995-96	1	1,758	83	462	1,885	10	598	2	4,799	36.6%	1.7%
1996-97	1	2,503	87	809	1,773	9	1,110	0	6,292	39.8%	1.4%
1997-98	0	3,113	112	853	2,439	26	1,448	11	8,002	38.9%	1.4%
1998-99	0	5,641	127	751	3,266	40	1,513	6	11,344	49.7%	1.1%
1999-00	1	7,302	93	418	3,002	8	1,525	2	12,351	59.1%	0.8%
2000-01	0	4,972	70	385	3,259	28	1,319	2	10,035	49.5%	0.7%
2001-02	0	3,676	51	306	1,335	19	1,161	10	6,558	56.1%	0.8%
2002-03	0	5,113	42	225	1,732	18	1,293	2	8,425	60.7%	0.5%
2003-04	0	3,631	43	343	1,459	129	1,128	2	6,735	53.9%	0.6%
2004-05	0	6,789	34	552	2,018	26	1,250	3	10,672	63.6%	0.3%
2005-06	3	4,734	36	525	1,959	9	1,222	1	8,489	55.8%	0.4%
2006-07	1	5,497	24	347	1,908	25	1,253	7	9,062	60.7%	0.3%
2007-08	33	5,899	34	446	1,982	30	1,311	35	9,770	60.4%	0.3%
2008-09	35	6,221	43	467	2,414	44	1,429	18	10,671	58.3%	0.4%
2009-10	81	6,400	26	373	2,157	18	1,233	11	10,299	62.1%	0.3%
2010-11	58	5,807	31	485	1,676	9	1,251	16	9,333	62.2%	0.3%
2011-12	118	6,929	26	441	1,437	3	1,155	17	10,126	68.4%	0.3%
2012-13	113	6,332	15	249	1,068	3	1,236	7	9,023	70.2%	0.2%
2013-14	92	5,833	19	231	1,197	4	1,365	11	8,752	66.6%	0.2%
2014-15	98	7,191	26	196	957	1	1,305	19	9,793	73.4%	0.3%

Southwest Washington Harvest

Season	Aleutian	Cackler	Dusky	Lesser	Taverner	Vancouver	Western	Other ¹	Total	% Cackler	% Dusky
1984-85		0	37	0	63	0	20	0	120	0.0%	30.8%
1985-86		11	66	116	113	0	67	25	398	2.8%	16.6%
1986-87		8	36	51	172	0	241	0	508	1.6%	7.1%
1987-88		7	45	225	478	4	224	35	1,018	0.7%	4.4%
1988-89		17	43	136	617	0	763	7	1,583	1.1%	2.7%
1989-90		37	52	92	455	9	391	0	1,036	3.6%	5.0%
1990-91		28	65	165	555	20	383	3	1,219	2.3%	5.3%
1991-92		39	88	295	675	14	483	15	1,609	2.4%	5.5%
1992-93		84	91	270	1,340	25	722	2	2,534	3.3%	3.6%
1993-94		93	90	299	944	8	697	4	2,135	4.4%	4.2%
1994-95		422	77	246	1,011	31	704	6	2,497	16.9%	3.1%
1995-96		334	59	144	862	12	536	1	1,948	17.1%	3.0%
1996-97		1,030	35	475	1,705	18	932	3	4,198	24.5%	0.8%
1997-98		1,311	58	392	2,197	33	742	5	4,738	27.7%	1.2%
1998-99		1,820	46	306	1,877	34	833	9	4,925	37.0%	0.9%
1999-00		1,455	27	209	1,265	155	623	33	3,767	38.6%	0.7%
2000-01		1,450	32	235	1,242	95	687	35	3,776	38.4%	0.8%
2001-02		758	23	130	644	112	496	11	2,174	34.9%	1.1%
2002-03		1,291	38	153	896	93	591	61	3,123	41.3%	1.2%
2003-04		674	28	104	483	78	413	19	1,799	37.5%	1.6%
2004-05		1,079	25	123	597	122	461	53	2,460	43.9%	1.0%
2005-06		1,037	31	157	863	108	584	32	2,812	36.9%	1.1%
2006-07	8	1,212	27	143	628	124	450	45	2,637	46.0%	1.0%
2007-08	2	1,282	22	113	729	125	323	51	2,647	48.4%	0.8%
2008-09	4	1,723	45	158	946	198	458	41	3,573	48.2%	1.3%
2009-10	13	1,412	32	76	736	87	383	42	2,781	50.8%	1.2%
2010-11	5	1,345	20	94	547	59	322	37	2,429	55.4%	0.8%
2011-12	1	1,304	28	125	525	38	223	21	2,265	57.6%	1.2%
2012-13	16	1,293	17	102	526	38	264	1	2,257	57.3%	0.8%
2013-14	4	1,407	20	97	269	29	341	8	2,175	64.7%	0.9%
2014-15	16	1,579	45	138	445	23	292	14	2,552	61.9%	1.8%

Oregon-Washington
Total Harvest

Season	Aleutian	Cackler	Dusky	Lesser	Taverner	Vancouver	Western	Other ¹	Total	% Cackler	% Dusky
1984-85	0	0	640	0	704	0	20	21	1,385	0.0%	46.2%
1985-86	0	19	223	373	1,269	2	162	25	2,073	0.9%	10.8%
1986-87	0	27	170	154	1,329	0	241	127	2,048	1.3%	8.3%
1987-88	0	61	163	460	3,002	7	482	36	4,211	1.4%	3.9%
1988-89	0	43	185	409	3,684	3	1,178	7	5,509	0.8%	3.4%
1989-90	0	53	131	438	3,018	14	2,014	2	5,670	0.9%	2.3%
1990-91	0	46	242	737	3,239	26	2,229	3	6,522	0.7%	3.7%
1991-92	0	81	209	673	2,962	23	1,574	15	5,537	1.5%	3.8%
1992-93	1	120	238	692	3,634	33	2,055	2	6,775	1.8%	3.5%
1993-94	0	165	278	1,047	3,643	49	2,045	8	7,235	2.3%	3.8%
1994-95	1	1,642	219	693	3,680	40	2,119	16	8,410	19.5%	2.6%
1995-96	1	2,092	142	606	2,747	22	1,134	3	6,747	31.0%	2.1%
1996-97	1	3,533	122	1,284	3,478	27	2,042	3	10,490	33.7%	1.2%
1997-98	0	4,424	170	1,245	4,636	59	2,190	16	12,740	34.7%	1.3%
1998-99	0	7,461	173	1,057	5,143	74	2,346	15	16,269	45.9%	1.1%
1999-00	1	8,757	120	627	4,267	163	2,148	35	16,118	54.3%	0.7%
2000-01	0	6,422	102	620	4,501	123	2,006	37	13,811	46.5%	0.7%
2001-02	0	4,434	74	436	1,979	131	1,657	21	8,732	50.8%	0.8%
2002-03	0	6,404	80	378	2,628	111	1,884	63	11,548	55.5%	0.7%
2003-04	0	4,305	71	447	1,942	207	1,541	21	8,534	50.4%	0.8%
2004-05	0	7,868	59	675	2,615	148	1,711	56	13,132	59.9%	0.4%
2005-06	3	5,771	67	682	2,822	117	1,806	33	11,301	51.1%	0.6%
2006-07	9	6,709	51	490	2,536	149	1,703	52	11,699	57.3%	0.4%
2007-08	35	7,181	56	559	2,711	155	1,634	86	12,417	57.8%	0.5%
2008-09	39	7,944	88	625	3,360	242	1,887	59	14,244	55.8%	0.6%
2009-10	94	7,812	58	449	2,893	105	1,616	53	13,080	59.7%	0.4%
2010-11	63	7,152	51	579	2,223	68	1,573	53	11,762	60.8%	0.4%
2011-12	119	8,233	54	566	1,962	41	1,378	38	12,391	66.4%	0.4%
2012-13	129	7,625	32	351	1,594	41	1,500	8	11,280	67.6%	0.3%
2013-14	96	7,240	39	328	1,466	33	1,706	19	10,927	66.3%	0.4%
2014-15	114	8,770	71	334	1,402	24	1,597	33	12,345	71.0%	0.6%

¹ Other includes domestic x Canada hybrids, resident dark Canada geese, and unidentified geese