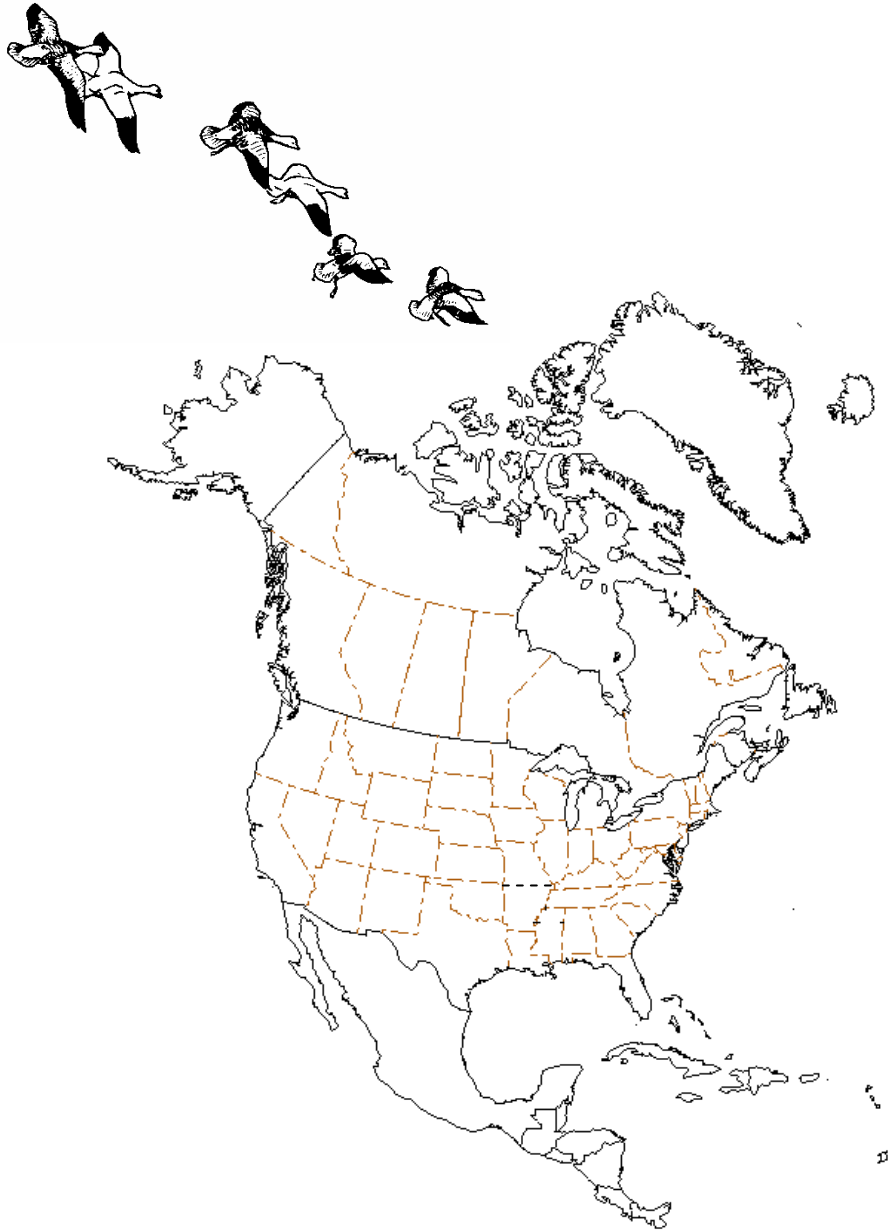


Final Environmental Impact Statement: Light Goose Management



June 2007

FINAL ENVIRONMENTAL IMPACT STATEMENT:

Light Goose Management

RESPONSIBLE AGENCY:

Department of the Interior
U.S. Fish and Wildlife Service

RESPONSIBLE OFFICIAL:

Director
U.S. Fish and Wildlife Service
Main Interior Building
1849 C Street
Washington, DC 20240

FOR FURTHER
INFORMATION CONTACT:

James R. Kelley, Jr., EIS Project Manager
U.S. Fish and Wildlife Service
Division of Migratory Bird Management
BH Whipple Federal Building
1 Federal Dr.
Fort Snelling, Minnesota 55111-4056
(612) 713-5409
James_R_Kelley@fws.gov

Robert Blohm, Chief
Division of Migratory Bird Management
U.S. Fish and Wildlife Service
Mail Stop MBSP - 4107
4401 N. Fairfax Dr.
Arlington, Virginia 22203
(703) 358-1714

Executive Summary

The term “light geese” refers collectively to three taxa of geese that have light coloration: greater snow geese, Ross’s geese, and lesser snow geese. Various light goose populations in North America have experienced rapid population growth, and have reached levels such that they are damaging habitats on their arctic and subarctic breeding areas. Habitat degradation in arctic and subarctic areas may be irreversible, and has negatively impacted light goose populations and other bird populations dependent on such. Natural marsh habitats on some migration and wintering areas also have been impacted by light geese. In addition, goose damage to agricultural crops has become a problem. There is increasing evidence that lesser snow and Ross’s geese act as reservoirs for the bacterium that causes avian cholera. The threat of avian cholera to other bird species likely will increase as light goose populations expand. The management goal for light geese in the mid-continent region is to reduce the population by 50% from the level observed in the late 1990s. The management goal for greater snow geese is to reduce the population to 500,000 birds. We believe these population levels are more compatible with the ability of habitats to support them. This document describes various alternatives for the purpose of reducing and stabilizing specific populations of light geese in North America. We analyzed five management alternatives: A) no action; B) modify harvest regulation option and refuge management (PREFERRED); C) implement direct agency control of light goose populations on migration and wintering areas in the U.S.; D) seek direct light goose population control on breeding grounds in Canada; E) two-phased approach to light goose population control. Phase one of alternative E is identical to alternative B, whereas phase two includes elements of alternatives C and D. Under Alternative E, if implementation of phase one was not successful in reducing light goose populations we would assess the need to implement phase two. Alternatives were analyzed with regard to their potential impacts on light geese, other bird species, special status species, socioeconomics, historical resources, and cultural resources.

Table of Contents

CHAPTER 1	1
PURPOSE OF AND NEED FOR ACTION	1
1.1 Introduction	1
1.2 Purpose of Action	1
1.3 Need for Action	1
1.4 Background	2
1.4.1 Background Relevant to Need for Proposed Action	2
1.4.2 U.S. Fish and Wildlife Service	3
1.4.3 Canadian Wildlife Service	3
1.4.4 Other Environmental Assessments and Rulemakings	3
1.5 Scoping and Public Involvement	4
1.5.1 Summary of Scoping Efforts	4
1.5.2 Issues and Concerns Identified During Scoping	5
1.6 Policy, Authority, and Legal Compliance	6
CHAPTER 2	9
ALTERNATIVES	9
2.1 Introduction	9
2.2 Alternatives Considered But Eliminated From Detailed Study	9
2.2.1 Establish a depredation order	9
2.2.2 Egg removal	9
2.2.3 Permit the use of lead shot to take light geese	10
2.2.4 Permit the use of rifles and/or pistols	10
2.2.5 Remove the Federal migratory bird hunting stamp requirement during normal season frameworks	11
2.2.6 Permit the use of reciprocal State hunting licenses	11
2.2.7 Permit the use of live decoys to take light geese	11
2.2.8 Permit the use of baiting to take light geese	11
2.2.9 Apply dove baiting regulations to regulations for hunting light geese	12
2.2.10 Allow rallying or herding of light geese with the aid of a motorized vehicle or device	12
2.2.11 Provide supplemental food to light geese on breeding areas	13
2.2.12 Alter U.S. farm policies to promote reduction of foods available to light geese on wintering and migration areas	13
2.2.13 Control light goose populations through use of reproductive inhibitors	13
2.2.14 Allow commercial harvesting of light geese	14
2.2.15 Allow predators to control light goose populations	14
2.3 Rationale for Design of Analyzed Alternatives	15
2.4 Description of Alternatives	15
2.4.1 Alternative A. No Action. Continue to manage light goose populations through existing wildlife management policies and practices	15
2.4.2 Alternative B (Preferred Alternative). Modify harvest regulation options and refuge management	16
2.4.3 Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.	18
2.4.4 Alternative D. Seek direct light goose population control on breeding grounds in Canada	19
2.4.5 Alternative E. Two-phased Approach to Light Goose Population Control	20
2.3.6 Light Goose Population Monitoring	23
2.3.7 Current Light Goose Regulations	24
2.5 Comparison of Analyzed Alternatives	24
CHAPTER 3	26
AFFECTED ENVIRONMENT	26
3.0 INCORPORATION OF NEW INFORMATION RECEIVED AFTER PUBLICATION OF DEIS	26
3.1 LIGHT GEESE	29
3.1.1 Definition	29
3.1.2 Geographic Distribution of Species	29
3.1.3 Population Delineation	32
3.1.4 Population Surveys	35
3.1.5 Population Status - Historical Accounts	36

Table of Contents

3.1.6	Population Status - Spring/Breeding Colony Survey Estimates	38
3.1.7	Population Status - Winter Survey Indices	43
3.1.8	Population Status - Summary	47
3.1.9	Impacts of breeding habitat degradation on light geese	48
3.1.10	Migration and Wintering Ecology	49
3.1.11	Harvest Estimates	53
3.2	HABITAT	58
3.2.1	Breeding habitat conditions and degradation	58
3.2.2	Migration and wintering habitat conditions and degradation	66
3.3	OTHER BIRD SPECIES	70
3.3.1	Waterfowl	70
3.3.2	Other bird species	71
3.3.3	Special Status Species	72
3.4	AVIAN CHOLERA	74
3.5	SOCIOECONOMIC CONSIDERATIONS	77
3.5.1	Economic impact of light goose hunting in the U.S.	77
3.5.2	Economic impact of non-consumptive uses of light geese	78
3.5.3	Subsistence uses of light geese	78
3.6	National Wildlife Refuge System	79
3.7	Historical and Cultural Resources	83
CHAPTER 4		85
ENVIRONMENTAL CONSEQUENCES		85
4.1	Introduction	85
4.2	Impacts on Light Geese	85
4.2.1	Alternative A. No action.	85
4.2.2	Alternative B. (Preferred alternative). Modify harvest regulation options and refuge management.	88
4.2.3	Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.	96
4.2.4	Alternative D. Seek direct light goose population control on breeding grounds in Canada.	99
4.2.5	Alternative E. Two-phased Approach to Light Goose Population Control.	101
4.3	Impacts on Habitat	105
4.3.1	Alternative A. No action.	105
4.3.2	Alternative B. (Preferred alternative). Modify harvest regulation options and refuge management.	108
4.3.3	Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.	109
4.3.4	Alternative D. Seek direct light goose population control on breeding grounds in Canada.	109
4.3.5	Alternative E. Two-phased approach to light goose population control.	109
4.4	Impacts on Other Species	110
4.4.1	Alternative A. No action.	110
4.4.2	Alternative B. (Preferred alternative). Modify harvest regulation options and refuge management.	111
4.4.3	Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.	113
4.4.4	Alternative D. Seek direct light goose population control on breeding grounds in Canada.	114
4.4.5	Alternative E. Two-phased approach to light goose population control.	114
4.5	Impacts on Special Status Species	114
4.5.1	Alternative A. No action.	114
4.5.2	Alternative B. (Preferred alternative). Modify harvest regulation options and refuge management.	115
4.5.3	Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.	117
4.5.4	Alternative D. Seek direct light goose population control on breeding grounds in Canada.	117
4.5.5	Alternative E. Two-phased approach to light goose population control.	118
4.6	Socioeconomic Impacts	118
4.6.1	Alternative A. No action.	119

Table of Contents

4.6.1	Alternative A. No action.....	119
4.6.2	Alternative B. (Preferred alternative). Modify harvest regulation options and refuge management.....	121
4.6.3	Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.....	123
4.6.4	Alternative D. Seek direct light goose population control on breeding grounds in Canada.....	125
4.6.5	Alternative E. Two-phased approach to light goose population control.....	129
4.7	Waste and Disposal of Geese.....	129
4.7.1	Alternative A. No action.....	129
4.7.2	Alternative B. (Preferred alternative). Modify harvest regulation options and refuge management.....	129
4.7.3	Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.....	130
4.7.4	Alternative D. Seek direct light goose population control on breeding grounds in Canada.....	130
4.7.5	Alternative E. Two-phased approach to light goose population control.....	131
4.8	Cumulative Impacts.....	131
4.8.1	Alternative A. No action.....	131
4.8.2	Alternative B. (Preferred alternative). Modify harvest regulation options and refuge management.....	132
4.8.3	Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.....	132
4.8.4	Alternative D. Seek direct light goose population control on breeding grounds in Canada.....	132
4.8.5	Alternative E. Two-phased approach to light goose population control.....	133
4.9	Impacts on Historical and Cultural Resources.....	133
4.10	Environmental Justice.....	133
CHAPTER 5.....		137
LIST OF PREPARERS.....		137
Acknowledgements.....		137
CHAPTER 6.....		138
LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS TO WHOM COPEIS OF THE DEIS WERE SENT.....		138
State/Provincial Agencies.....		138
Organizations.....		139
Tribal and Private individuals.....		140
CHAPTER 7.....		141
PUBLIC COMMENTS ON DEIS AND SERVICE RESPONSE.....		141
7.1	Introduction.....	141
7.2	Comments from Federal Agencies.....	141
7.3	Comments from Flyway Councils.....	144
7.4	Comments from State and Provincial Wildlife Agencies.....	147
7.5	Comments from State Representatives.....	153
7.6	Comments from Tribal Groups.....	154
7.7	Comments from Private Individuals.....	156
7.8	Comments from Private Organizations.....	170
CHAPTER 8.....		194
LITERATURE CITED.....		194

LIST OF APPENDICES

Appendix 1 Notice of Intent to Prepare an Environmental Impact Statement..... 204

Appendix 2 Notice of Meetings..... 209

Appendix 3 Environmental Protection Agency Rating of Lack of Objection to Draft EIS on Light Goose Management..... 213

Appendix 4 Maps of distribution of light goose harvest in the Atlantic, Mississippi, Central, and Pacific Flyway..... 215

Appendix 5 Light goose conservation order regulations..... 223

Appendix 6 Light goose permit regulations..... 231

Appendix 7 Historical light goose harvest regulations in the U.S..... 237

Appendix 8 Regional listing of special status species that overlap in geographic range with various populations of light geese in Service Regions 1-7..... 241

LIST OF FIGURES

Fig. 3.1	Primary geographic distribution of greater and lesser snow and Ross's geese	29
Fig. 3.2	Boundaries of administrative Flyways.....	30
Fig. 3.3	Major Arctic and subarctic geographic features referenced in text.....	32
Fig. 3.4	Geographic distribution of the Mid-Continent Population and Western Central Flyway Population of light geese.....	33
Fig. 3.5	Primary geographic distribution of the Western Population of Ross's geese and the Pacific Flyway Population of lesser snow geese	34
Fig. 3.6	Primary geographic distribution of the Wrangel Island Population of lesser snow geese.....	35
Fig. 3.7	Population growth of greater snow geese as measured by photo-inventories during spring migration in the St. Lawrence River valley, 1965-2000.....	39
Fig. 3.8	Lesser snow goose population estimates from breeding colonies in the eastern Arctic, determined from photo inventories, 1973-97.....	40
Fig. 3.9	Light (lesser snow and Ross's) goose population estimates from breeding colonies in the central Arctic, determined from photo inventories, 1966-98.....	42
Fig. 3.10	Lesser snow goose population estimates from breeding colonies in the western Arctic, determined from photo inventories, 1976-2002.....	42
Fig. 3.11	Winter index of greater snow geese in the Atlantic Flyway, 1955-2003.....	43
Fig. 3.12	Winter index of the Mid-Continent Population of light geese, 1970-2003.....	44
Fig. 3.13	Winter index of the Western Central Flyway Population of light geese, 1970-2003.....	45
Fig. 3.14	Winter index of Central/Mississippi Flyway (CMF) light geese, 1955-2003.....	46
Fig. 3.15	Winter index of light geese in the Pacific Flyway, 1955-2003.....	47
Fig. 3.16	Original coastal marsh wintering range (black shading), extent of initial range expansion, and recent wintering range boundary of light geese in Texas and Louisiana.....	51
Fig. 3.17	Harvest of greater snow geese in Canada and the U.S., 1967-02.....	54
Fig. 3.18	Spring population estimates (millions, 1964-2002) and harvest rate indices (1967-2002) of greater snow geese in the Atlantic Flyway.....	54
Fig. 3.19	Winter indices and harvest rates of Central/Mississippi Flyway light geese, 1962-2002.....	55
Fig. 3.20	Winter indices and harvests of Central/Mississippi Flyway light geese and active adult hunter numbers, 1962-2002.....	56
Fig. 3.21	Left: Banding locations of CMF light geese (summarized by degree blocks) harvested during conservation orders in the U.S. Right: Recovery locations of light geese harvested during conservation orders in the Central and Mississippi Flyways.....	58
Fig. 3.22	Negative feedback loop between light geese and their habitat; which leads to habitat destruction ...	60

Fig. 3.23	Increase in the proportion of bare soil resulting from degradation of habitat by light geese on each of 3 intertidal marshes at La Perouse Bay, Manitoba from 1986 to 1997.....	61
Fig. 3.24	Example of light goose habitat destruction at La Perouse Bay, Manitoba. Empty pond basin at right was caused by goose grubbing activity. Red plants surrounding dead willow trees are salt-tolerant species.....	62
Fig. 3.25	Goose exclosure plot at La Perouse Bay, Manitoba. Green vegetation is enclosed by fencing that prevents geese from feeding in plot. Areas devoid of vegetation outside of plot were exposed to goose feeding and are characterized by mudflats and exposed gravel.....	62
Fig. 3.26	Satellite imagery of the cumulative damage at La Perouse Bay caused by light geese during 1973-93.....	64
Fig. 3.27	Additional area (hectares) of salt marsh vegetation decline at La Perouse Bay after 1973 when monitoring began. Actual loss of vegetation was determined by comparison of satellite imagery from 1973, 1984, and 1993.....	64
Fig. 3.28	Documented decline of semi-palmated sandpiper and red-necked phalarope nests on permanent study plots at La Perouse Bay, Manitoba, 1983-99.....	72
Fig. 3.29	Location of whooping crane sightings in the Central Flyway, 1943-99.....	73
Fig. 3.30	Temporal distribution of whooping crane sightings in Nebraska, 1919-2000.....	74
Fig. 3.31	Location of recurring avian cholera outbreaks and associated waterfowl migration pathways.....	75
Fig. 3.32	Frequency of occurrence of avian cholera outbreaks in the U.S.....	76
Fig. 4.1	Trajectories of the greater snow goose population resulting from implementation of various harvest rates (expressed as %), in relation to a population goal of 500,000 birds. Trajectories begin with the preliminary spring 2006 population estimate of 1,016,900 birds.....	91
Fig. 4.2	Projection of additional hectares of salt marsh vegetation that would be lost at La Perouse Bay in the absence of light goose population control.....	106

LIST OF TABLES

Table 1.1	General categories of issues and concerns identified during the light goose EIS scoping process.....	5
Table 2.1	Summary of management alternatives to be analyzed.....	25
Table 3.1	Distribution of legband recoveries for lesser snow and Ross’s geese banded in the western, central, and eastern Arctic by decade, 1950-98.....	31
Table 3.2	Breeding adult lesser snow and Ross’s goose population estimates as estimated from aerial photo inventories, 1966-99 (compiled by R. Kerbes, CWS). Inclusion of estimates of non-breeding adults would increase population estimates by 30%.....	41
Table 3.3	Parameters used to estimate harvest rates of greater snow geese, 1999-2004.....	53
Table 3.4	Estimated U.S. light goose (lesser snow and Ross’s goose) harvests during regular season and conservation order periods in the Central and Mississippi Flyways (combined) during 1998-2002.....	57
Table 3.5	Compensation paid to farmers in Quebec as a result of crop damages due to grazing by greater snow geese (Filion et al. 1998).....	67
Table 3.6	Locally declining populations of other avian species in the La Pérouse Bay area. Bold indicates a significant decline (Rockwell et al. 1997b).....	71
Table 3.7	Light goose harvest in the U.S during 1997/98, and the proportion of the \$146 million total economic impact generated by light goose hunting distributed among Flyways.....	77
Table 3.8	Peak population estimates for greater snow geese on National Wildlife Refuges in Region 5, 1994-99.....	80
Table 3.9	Refuges in Region 5 that receive snow goose use, and the proportion of each refuge open to hunting (USFWS, unpublished data).....	81
Table 3.10	Average number of annual use/days by light geese on selected refuges in the southern portion of the Central and Mississippi Flyways (USFWS, unpublished data).....	81
Table 3.11	Examples of changes in management on various National Wildlife Refuges (NWR) and impacts on light goose harvest (USFWS, unpublished data).....	82
Table 3.12	Average number of annual use-days by light geese on selected refuges in the Pacific Flyway (USFWS, unpublished data).....	84
Table 4.1	Impacts of liberalization in methods of take (electronic calls, unplugged shotguns) on harvest of lesser snow geese (LSGO), Ross’s geese (ROGO), and total light geese (LSGO plus ROGO) in 1999 and 2000, versus mean harvest for the same calendar periods in late winter/spring 1996-98.....	89
Table 4.2	Estimated impacts resulting from implementation of new light goose (lesser snow and Ross’s geese) harvest regulations in the U.S. portion of the Central and Mississippi Flyways.....	89
Table 4.3	Estimated impact of reducing the population of greater snow geese to 500,000 birds by authorizing new regulations in the U.S. to increase harvest.....	91

Table 4.4	Projected continental harvest and harvest rate of greater snow geese if special regulations had been implemented in the U.S. portion of the Atlantic Flyway, 1992-2002.....	92
Table 4.5	Estimation of the number of Central/Mississippi Flyway light geese that would need to be removed on an annual basis by direct agency control in order to achieve a 50% reduction in number of geese.....	98
Table 4.6	Potential economic impact of closure of light goose hunting in each Flyway, based on losses of trip-related expenditures by hunters.....	120
Table 4.7	Potential economic impact of trip-related expenditures during an extended time in which to take light geese in each Flyway.....	123
Table 4.8	Estimated costs (Canadian \$\$) of removal of light geese during the incubation period on specific colony sites in the eastern and central Arctic according to level of removal and disposition of carcasses (un-retrieved or retrieved and processed). Estimates were calculated for low efficiency (1 bird shot/3 minutes) and high efficiency (1 bird shot/minute) harvest by sharpshooters.....	127
Table 4.9	Estimated costs (Canadian \$\$) of removal of light geese during the brood-rearing period on specific colony sites in the eastern and central Arctic according to level of removal and disposition of carcasses (un-retrieved or retrieved and processed). Estimates were calculated for low efficiency (1 bird shot/3 minutes) and high efficiency (1 bird shot/minute) harvest by sharpshooters.....	128
Table 4.10	Summary of environmental consequences of light goose management alternatives.....	134

CHAPTER 1

PURPOSE OF AND NEED FOR ACTION

1.1 Introduction

This chapter discusses the purpose and need for action; background on the U.S. Fish and Wildlife Service (Service or “we”) and Canadian Wildlife Service (CWS); the planning process, which includes scoping of issues and identification of alternatives; and the legal basis for the action.

This document has been developed to ensure that our proposed management action is in compliance with NEPA. Furthermore, this process will ensure that proposed actions do not adversely affect listed species and their critical habitats under the Endangered Species Act, as well as non-listed species covered under the Migratory Bird Treaty Act.

1.2 Purpose of Action

This document describes various alternatives for the purpose of reducing and stabilizing specific populations of light geese in North America. The term “light geese” refers collectively to three taxa of geese that have light coloration: greater snow geese, Ross’s geese, and lesser snow geese. This document addresses concerns under the National Environmental Policy Act of 1969 (NEPA). The NEPA regulations direct Federal agencies to use the NEPA process, as a decision-making tool, as early as possible in any planning process (40 CFR 1501).

1.3 Need for Action

There is a need to reduce and stabilize the size of several populations of light geese that have become injurious, via their feeding actions, to habitats on their breeding, migration, and/or wintering grounds. In addition, there is a need to reduce certain light goose populations to alleviate damage to agricultural crops. Furthermore, there is a need to conduct population control that is cost-effective for wildlife agencies.

Lesser snow and Ross’s geese are suspected carriers of the bacterium that causes the deadly disease avian cholera. Cholera outbreaks are often associated with high densities of birds and the disease affects nearly 100 species of birds, some of which are listed as threatened or endangered. There is a need to reduce certain light goose populations to reduce the likelihood of future cholera outbreaks.

The Stakeholder’s Committee on Arctic Nesting Geese (1998) has stated that geese killed for management purposes should be killed as humanely as possible and utilized as food wherever feasible.

However, Johnson (1997) suggested that ethical use of birds may have to be set aside in favor of more rigorous efforts to control the population and save Arctic habitats. The Arctic Goose Habitat Working Group has stated that light geese are a valuable natural resource, as game animals and as food (Batt 1997). In developing their management recommendations, the Working Group did not consider any population reduction strategies that advocated slaughter and destruction of birds followed by their being wasted in landfills or some similar fate (Batt 1997). Therefore, there is a need to reduce light goose populations with alternatives that are as humane as possible and, where feasible, do not constitute a waste of the goose resource.

1.4 Background

1.4.1 Background Relevant to Need for Proposed Action

Various light goose populations in North America have experienced rapid population growth, and have reached levels such that they are damaging habitats on their Arctic and subarctic breeding areas (Abraham and Jefferies 1997, Alisauskas 1998, Jano et al. 1998, Didiuk et al. 2001). Habitat degradation in arctic and sub-arctic areas may be irreversible, and has negatively impacted light goose populations (Abraham and Jefferies 1997), and other bird populations dependent on such habitats (Gratto-Trevor 1994, Rockwell 1999, Rockwell et al. 1997). Natural marsh habitats on some migration and wintering areas have been impacted by light geese (Giroux and Bedard 1987, Giroux et al. 1998, Widjeskog 1977, Smith and Odum 1981, Young 1985). In addition, goose damage to agricultural crops has become a problem (Bedard and Lapointe 1991, Filion et al. 1998, Giroux et al. 1998, Delaware Div. of Fish and Wildlife 2000).

There is increasing evidence that lesser snow and Ross's geese act as prominent reservoirs for the bacterium that causes avian cholera (Friend 1999, Samuel et al. 1997, Samuel et al. 1999a). Over 100 species of waterbirds and raptors are susceptible to avian cholera (Botzler 1991). The threat of avian cholera to endangered and threatened bird species is continually increasing because of increasing numbers of outbreaks and the expanding geographic distribution of the disease (Friend 1999). This threat likely will increase as light goose populations expand (Samuel et al. 2001). The above issues are described in more detail in Chapter 3 Affected Environment.

The Arctic Goose Habitat Working Group recommended that light goose numbers in the mid-continent region should be reduced by 50% (Arctic Goose Habitat Working Group 1997). The Working Group outlined a strategy that advocated monitoring the number of mid-continent light geese to see that appropriate population reductions are achieved, and to simultaneously monitor habitats in the Arctic coastal ecosystem. They further recommended that when the population size reached a level that is causing no further habitat damage, the management program should be changed to stabilize light goose numbers at that threshold (Rockwell et al. 1997:96). In 1998, the Arctic Goose Habitat Working Group recommended a

short-term management goal of stabilizing the greater snow goose population at between 800,000 to 1 million birds (Giroux et al. 1998). However, a reduction of the population below that level was recommended if natural habitats continue to deteriorate, or if measures taken to reduce crop depredation do not achieve desired results (Giroux et al. 1998). More recently, the Canadian Stakeholders Committee in Quebec adopted a population goal of 500,000 birds to address continued habitat degradation and agricultural depredations in the St. Lawrence valley (Arctic Goose Joint Venture Technical Committee 2001). The population goal of 500,000 birds is in agreement with both the Atlantic Flyway Council goal and North American Waterfowl Management Plan goal for greater snow geese (U.S. Dept. of the Interior et al. 1998). Although the number of light geese breeding in the western Arctic is increasing, the Arctic Goose Habitat Working Group has not identified an immediate management concern for habitat in that region. The number of lesser snow geese in the western Arctic is expected to grow from the current level of approximately 579,000 birds to 1 million by the year 2010. Some researchers have suggested a proactive approach to management of western Arctic lesser snow geese by stabilizing the population at its current level before it escapes control via normal harvest (Hines et al. 1999).

1.4.2 U.S. Fish and Wildlife Service

We are the primary Federal agency responsible for conserving, protecting, and enhancing the Nation's fish and wildlife resources and their habitats. Our mission is to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. Responsibilities are shared with other Federal, State, tribal, and local entities; however, we have specific responsibilities for endangered species, migratory birds, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters that we administer for the management and protection of these resources.

1.4.3 Canadian Wildlife Service

The mandate of Environment Canada, of which the CWS is part, is to preserve and enhance the quality of the natural environment, including water, air and soil quality; conserve Canada's renewable resources, including migratory birds and other non-domestic flora and fauna; conserve and protect Canada's water resources; carry out meteorology; enforce the rules made by the Canada - United States International Joint Commission relating to boundary waters; and coordinate environmental policies and programs for the federal government. The CWS handles wildlife matters that are the responsibility of the Federal government. These include protection and management of migratory birds, nationally significant habitat and endangered species, as well as work on other wildlife issues of national and international importance. In addition, CWS conducts research in many fields of wildlife biology.

1.4.4 Other Environmental Assessments and Rulemakings

In January 1999, we published a Final Environmental Assessment (EA) that examined several management alternatives for addressing problems associated with large populations of light geese. The

Purpose of and Need For Action

preferred management alternative identified in the EA was to authorize additional methods of take of light geese, and implement a conservation order for the reduction of overabundant light geese.

On February 16, 1999, we published 2 separate rules in the *Federal Register (FR)* that 1) authorized additional methods of take of light geese (lesser snow geese and Ross's geese) in the Central and Mississippi Flyways (64 *FR* 7507); and 2) created a conservation order for the reduction of the light goose population in the central portion of North America (64 *FR* 7517). At the same time, we announced our intent to initiate preparation of an Environmental Impact Statement (EIS) beginning in 2000 that would consider the effects on the human environment of a range of long-term resolutions for the light goose population problem.

On March 2, 1999, several private groups filed a motion for a preliminary injunction against the light goose regulations we published the previous month. Although the Federal judge refused to issue an injunction, he did indicate a likelihood the plaintiffs might succeed on their argument that we should have prepared an EIS prior to authorizing new light goose regulations. In order to avoid further litigation, and because we had earlier indicated we would initiate preparation of an EIS in 2000, we withdrew the regulations on June 17, 1999 (64 *FR* 32778), and began preparation of the EIS. Subsequently, the light goose regulations were re-instated when the Arctic Tundra Habitat Emergency Conservation Act (P.L. 106-108) was signed into law on November 29, 1999. On September 28, 2001 (66 *FR* 49668) we announced publication of the Draft EIS on light goose management.

1.5 Scoping and Public Involvement

1.5.1 Summary of Scoping Efforts

Scoping is the initial stage of the EIS process used to design the extent and influence of a management proposal. On May 13, 1999 (64 *FR* 26268), we published a Notice of Intent to prepare an EIS on light goose management (Appendix 1). The public notice opened a 60-day comment period and solicited public participation in the scoping process to identify issues, alternatives, and impacts that we should address in the EIS. On August 30, 1999 (64 *FR* 7332), we published a Notice of Meetings that identified the date and location of nine public scoping meetings throughout the U.S. (Appendix 2). The Notice of Meetings opened another comment period that lasted 84 days. Scoping meetings provided an additional opportunity for public comment on the issues, alternatives, and impacts to be addressed in the EIS.

The Notice of Intent was mailed to a standard mailing list that the Division of Migratory Bird Management uses for its *Federal Register* notices. In addition, we sent copies of the notice to all individuals, organizations, and agencies that submitted public comments during our 1998-1999 EA process. The Notice of Meetings was mailed to the same entities, as well as individuals, organizations, and agencies that submitted comments in response to the Notice of Intent published on May 13, 1999.

Purpose of and Need For Action

As part of our consultation with the Canadian government, CWS agreed to distribute French and English versions of our Notice of Intent to potentially affected groups in Canada. The CWS distribution list contained approximately 600 individuals, and national or provincial organizations that have indicated an interest in waterfowl management in Canada. The distribution list included wildlife management boards and councils that oversee wildlife programs affecting First Nations people in Canada.

On September 28, 2001 (66 FR 49668) and October 5, 2001 (66 FR 51274), notices were published in the *Federal Register* announcing the availability of a Draft EIS (DEIS) on light goose management for public review. On October 12, 2001 (66 FR 52147) we published a notice in the *Federal Register* to announce the schedule of public hearings to invite further public participation in the Draft EIS review process. Hard copies of the DEIS were sent out to our EIS mailing list. CWS sent notices of availability to entities that had responded to the notice of intent.

1.5.2 Issues and Concerns Identified During Scoping

Comments from the initial scoping process covered a range of issues and concerns, but were divided into 2 basic categories. A total of 332 comments were received, of which 278 (84%) agreed that light goose population levels present a problem and that active management should be pursued. The second group of comments (9% of respondents) questioned whether widespread habitat degradation has actually occurred and/or that light goose population levels are unprecedented. The second group of comments also indicated that no management actions should be taken against light geese, and that natural processes should be allowed to rectify any perceived habitat and/or population problems. A summary of issues and concerns identified during scoping is presented in Table 1.1.

Table 1.1. General categories of issues and concerns identified during the light goose EIS scoping process.

Issue or concern identified	Portion of draft EIS that addresses issue or concern
Documentation of light goose population growth	Chapter 3, Sections 3.1.4 – 3.1.8
Impacts on light geese	Chapter 3, Section 3.1.9; Chapter 4, Section 4.2
Documentation of habitat degradation	Chapter 3, Section 3.2
Impacts on habitat	Chapter 4, Section 4.3
Impacts on other species	Chapter 3, Section 3.3; Chapter 4, Section 4.4
Impacts on socio-economics	Chapter 3, Section 3.5; Chapter 4, Section 4.5
Management alternatives that were identified in public comments but not included for analysis in the EIS are reviewed in Chapter 2.	

1.6 Policy, Authority, and Legal Compliance

The Secretary of the Interior is authorized and directed by the Migratory Bird Treaty Act to determine when it is compatible with the conventions to issue regulations to allow the take of these birds and their nests and eggs. Of the four migratory bird conventions, three are applicable to the adoption of these regulations: the *Convention Between the United States and the Union of Soviet Socialist Republics* (now Russia) *Concerning the Conservation of Migratory Birds and Their Environment* (1978), the *Convention for the Protection of Migratory Birds and Game Mammals with Mexico* (1937), and the *Convention for the Protection of Migratory Birds with Canada* (1916). With respect to the fourth, the *Convention Between the Government of the United States of America and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction, and Their Environment* (1974), there is no positive evidence that the birds that are the subject of these regulations migrate between Japan and the United States (see Article I, Section 1.).

When two or more conventions are applicable to our adoption of regulations, we must ensure the action is compatible with each or, where conventions have provisions on the same specific issue, the more stringent of the provisions. Each of the conventions, negotiated at different times with four different countries, address particular issues important to each country and, because of differing perspectives and needs, contain agreements on similar actions that are presented in uniquely different ways.

The convention with Canada, in addition to including requirements regarding the authorization of the hunting of migratory game birds, the taking of migratory birds for scientific, educational, propagative and other purposes, and the harvesting of migratory birds and eggs by indigenous inhabitants of Alaska, allows for permitting the killing of migratory birds that are seriously injurious to agricultural or other interests in any particular community (see Article VII). It is our conclusion from all of the information available to us, and which is summarized and referenced in this Environmental Impact Statement, that several light goose populations have exhibited extraordinary growth. Due to their feeding actions, overabundant light geese have become seriously injurious to habitats on various breeding, migration and wintering areas and in some situations have also caused damage to agricultural crops. Consistent with the same article of the convention, the regulations also provide for the suspension of the permission granted by the regulations to take these birds when no longer needed to prevent the injuries to the habitat. In furtherance of the overall objectives of the convention, these regulations will help insure the preservation of these and other migratory birds covered by this convention.

The convention with Mexico provides that for migratory game birds the parties agree to establish “close seasons” (unspecified periods or lengths) during which migratory game birds may not be taken (see Article II). We read this to relate only to hunting because of the specific reference to “seasons”. As such, the agreement to establish close seasons does not apply to the adoption of these regulations because this is not a

Purpose of and Need For Action

hunting program. It is a management action that is taken in order to reduce the severe habitat damage that light geese are causing on their nesting, migration or wintering grounds. There are no other applicable provisions in this convention except the overall purpose to protect these birds “(i)n order that they may not be exterminated.” The specificity of the regulations with regard to implementation, monitoring, and reporting, coupled with the revocation and suspension provisions ensure that this will be met.

The convention with Russia, with a somewhat different approach, contains an agreement that the parties will prohibit the taking of migratory birds generally. It then provides for exceptions, one of which is “(f)or scientific, educational, propagative, or other special purposes not inconsistent with the principles of” the convention (see Article II). Another is for “the purpose of protecting against injury to persons or property” (see also Article II). These regulations fall within both of these exceptions. The action not only recognizes that birds of common interest to Russia and the United States “have common flyways, breeding, wintering, feeding, and moulting habitat which should be protected”, the action is designed to protect that habitat. We are “implementing measures for the conservation of migratory birds and their environment and other birds of mutual interest” by taking actions available to us to prevent further destruction of breeding and feeding habitat by the unusually abundant light geese. (See provisions of the convention introductory to the Articles).

In addition to the specific provision regarding taking noted above, the 1916 treaty with Great Britain was amended in 1999 by the governments of Canada and the United States to provide broader principles regarding migratory bird management. These regulations and the efforts of the United States in this regard are compatible with those provisions. Article II of the amended U.S.-Canada migratory bird treaty (Treaty) states that, in order “to ensure the long-term conservation of migratory birds, migratory bird populations shall be managed in accord with... conservation principles” that include (among others): to manage migratory birds internationally; to sustain healthy migratory bird populations for harvesting needs; and to provide for and protect habitat necessary for the conservation of migratory birds.

Article III of the Treaty states that the governments should meet regularly to review progress in implementing the Treaty. The review shall address issues important to the conservation of migratory birds, including the status of migratory bird populations, the status of important migratory bird habitats, and the effectiveness of management and regulatory systems. The governments agree to work cooperatively to resolve identified problems in a manner consistent with the principles of the Treaty and, if the need arises, to conclude special arrangements to conserve and protect species of concern.

Article IV of the Treaty states that each government shall use its authority to take appropriate measures to preserve and enhance the environment of migratory birds. In particular, the governments shall,

Purpose of and Need For Action

within their constitutional authority, seek means to prevent damage to such birds and their environments and pursue cooperative arrangements to conserve habitats essential to migratory bird populations.

This EIS and planning process is in compliance with NEPA, which requires Federal agencies to consider all environmental factors related to their proposed actions. An EIS is an explanation/declaration of the consequences, both favorable and unfavorable, of a particular action that is contemplated by a Federal agency. In the DEIS published on September 28, 2001 we summarized then current information on light goose population levels, impacts of light geese on various habitats, and analyses of different alternatives for managing light goose populations. For the Final EIS we updated databases whenever possible and revised analyses to include such updates. The Environmental Protection Agency reviewed our DEIS and assigned a rating of Lack of Objection, stating that the DEIS provided adequate documentation of the potential environmental impacts (Appendix 3).

CHAPTER 2

ALTERNATIVES

2.1 Introduction

This chapter describes the process we employed to develop and analyze five alternatives for management of light goose populations. We also present a brief description of alternatives that were eliminated from detailed study and the reason for their elimination. The array of five alternatives that we analyzed in detail provides a means to compare different ways of meeting the purpose and need and for addressing issues outlined in Chapter 1.

2.2 Alternatives Considered But Eliminated From Detailed Study

During preparation of our EA, and during the scoping process of this EIS, we received recommendations to consider an array of options for managing light goose populations. The following recommendations were considered but rejected because they did not have the capacity to address our responsibilities, and did not possess the potential to alleviate problems associated with large light goose populations. Many of the recommendations involved minor modification of existing migratory bird hunting regulations that would not significantly increase harvest. We chose not to analyze such alternatives because they would create unnecessary confusion concerning regulations without significantly decreasing light goose abundance.

2.2.1 Establish a depredation order

We issue depredation orders to allow, without a permit, the killing of migratory birds that "...have accumulated in such numbers in a particular area as to cause or about to cause serious damage to agricultural, horticultural, and fish cultural interests..." (50 *CFR* Part 21.42). A depredation order would not be an efficient method of controlling light goose populations because much of the damage caused by light geese often is restricted to natural marsh and tundra habitats, which is not covered by depredation order regulations. However, light geese also cause damage to crops such as hay and cereal grains. In such cases, farmers would be eligible to apply for a depredation permit instead (50 *CFR* Part 21.41).

2.2.2 Egg removal

Removal or destruction of eggs on light goose breeding colonies has been suggested as a method to alleviate habitat damage. No field studies have been conducted in the Arctic that would provide information about the effectiveness of such a program. However, results from modeling the population dynamics of lesser snow geese in the mid-continent region indicate that egg removal would be an inefficient method of

reducing population growth, compared to methods that lower adult survival (Rockwell et al. 1997a). A 5.7% reduction in adult survival would induce a decline in the population, whereas a 36% decline in fertility (an end result of egg removal) would be needed to achieve the same effect (Rockwell et al. 1997a). To equal the effect of removing an adult bird from a population, all eggs produced by that goose during its entire lifetime must be removed (Smith et al. 1999). Furthermore, egg removal must be nearly complete in order to prevent recruitment from a small number of surviving nests offsetting the control efforts (Smith et al. 1999). Rockwell et al. (1997a) estimated that 2.7 million eggs would need to be removed annually from nests simply to reduce the population growth rate to just below 1.0. Costs for egg removal in the Arctic are not available; however Cooper and Keefe (1997) estimated that removal costs in Minnesota are \$6.38 per egg. Using the Minnesota egg removal cost estimate for La Perouse Bay translates to \$17 million per year to induce population decline at just one light goose colony site. Search time for egg removal in light goose colonies likely would be low due to high nest densities, but this savings would likely be offset by the high cost of conducting field work in the Arctic. Even if complete egg removal could be achieved at a colony site, the large number of adult birds remaining in the population would continue to degrade habitats. Due to high costs and the large number of surviving adults, we do not view egg removal as a viable alternative for consideration.

2.2.3 Permit the use of lead shot to take light geese

It was suggested that light goose harvest can be increased by allowing the use of lead shot, which is perceived as being ballistically superior to other shot types. Lead shot has been demonstrated to be poisonous to birds once ingested, and was responsible for annual mortality of 2-3% of the fall waterfowl population (Anderson et al. 2000). Consequently, we prepared an EIS in 1976, and a Supplemental EIS in 1986, to require the use of steel (nontoxic) shot for hunting waterfowl and coots in the U.S. In 1991, we implemented a nationwide ban on the use of lead shot for hunting waterfowl and coots (50 *CFR* Part 20.21[j]). Following the 1991 ban, several additional shot types have been approved for waterfowl hunting (e.g., bismuth-tin, tungsten-iron, tungsten-polymer, tungsten-matrix, tungsten-nickel-iron). Most waterfowl hunters now understand and support the need to use nontoxic shot and have adjusted well to the use of an alternative to lead. Legalization of lead shot to hunt light geese would result in massive deposition of lead in the environment that could be ingested by non-target species, which may include endangered or threatened species. Therefore, we consider the use of lead shot to increase the harvest of light geese to be unacceptable.

2.2.4 Permit the use of rifles and/or pistols

The use of rifles or pistols for migratory bird hunting was prohibited in 1935 (50 *CFR* Part 20.21[a]). Migratory bird hunters often hunt in close proximity to each other. Rifles and pistols have a significantly longer range than shotguns, and therefore present a human safety hazard for any persons inside or outside shotgun range. Additionally, there is no evidence to suggest that the use of rifles and pistols by hunters would increase harvest of light geese. Due to both the safety risks associated with the use of rifles or

pistols for migratory bird hunting, and the lack of evidence that their use would increase harvest of light geese, we will not consider them as options for reducing light goose populations.

2.2.5 Remove the Federal migratory bird hunting stamp requirement during normal season frameworks

All hunters 16 years of age and older must possess a valid Federal migratory bird hunting and conservation stamp (duck stamp) as prescribed in the Migratory Bird Hunting Stamp Act of 1934, as amended (16 U.S.C. 718 [a]) in order to hunt waterfowl during normal hunting seasons. Congressional action to amend the Migratory Bird Hunting Stamp Act of 1934 would be required to waive the Federal duck stamp requirement. Citizens that would hunt light geese during normal seasons likely would have already purchased a duck stamp to hunt other waterfowl species. Therefore, we do not believe that waiver of the duck stamp requirement would recruit additional hunters to harvest light geese during normal seasons.

2.2.6 Permit the use of reciprocal State hunting licenses

Federal regulations do not prohibit reciprocal licensing among States. Such agreements would expand opportunities to take light geese for non-resident hunters. Reciprocal licensing would permit an individual holding a valid hunting license in one State to hunt light geese within one or more other cooperating States. Whereas we have jurisdiction over the broader waterfowl hunting frameworks within which States operate, we must defer to State sovereignty where State hunting licenses are concerned (50 *CFR* Part 10.3). Therefore, we have no jurisdictional authority regarding State regulations or statute requirements for State migratory bird hunting licenses. Whereas we support the concept of reciprocal licensing, individual States must enter into a reciprocal licensing agreement on their own authority.

2.2.7 Permit the use of live decoys to take light geese

The use of live birds as decoys to attract and hunt waterfowl was prohibited in 1935 (50 *CFR* Part 20.21[f]). There is a risk of transmitting certain avian diseases to wild birds from captive-reared or domestic birds. We believe the use of live decoys to attract wild light geese would increase that risk; therefore this alternative was rejected.

2.2.8 Permit the use of baiting to take light geese

Baiting is the direct or indirect placing, exposing, depositing, distributing, or scattering of salt, grain, or other feed that could lure or attract migratory game birds to, on, or over any areas where hunters are attempting to take them. The use of baiting to hunt migratory birds was prohibited in 1935 (50 *CFR* Part 20.21[i]), and has continued to be a source of controversy. Therefore, authorization of baiting is not a viable alternative.

2.2.9 Apply dove baiting regulations to regulations for hunting light geese

Baiting regulations were modified in the early 1970s to distinguish those pertaining to dove hunting from those for hunting waterfowl (50 *CFR* Part 20.21[i]). Baiting regulations were modified again in 1999 to clarify which plant and soil management practices are legally compatible with dove and waterfowl hunting, respectively. One of the primary differences between dove and waterfowl baiting regulations is that doves may be hunted over areas where grain or feed has been distributed or scattered solely as the result of the manipulation of an agricultural crop or other feed on the land where grown (50 *CFR* 20.21[i][2]). Light geese and other waterfowl may not be hunted over such areas. Waterfowl may be hunted on or over the following lands or areas: where standing crops or flooded standing crops (including aquatics); standing, flooded, or manipulated natural vegetation; flooded harvested croplands; or lands or areas where seeds or grains have been scattered solely as the result of a normal agricultural planting, harvesting, post-harvest manipulation or normal soil stabilization practice (50 *CFR* 20.21[i][1][i]).

Some State waterfowl management plans include objectives to provide high-energy foods during winter and migration periods after normal hunting seasons have ended. Taking light geese over such areas during a conservation order would create a baited situation, and would be illegal. Therefore, States must choose between providing for the needs of many waterfowl species during critical periods, or allow increased harvest of light geese to control their population size. Baiting has been one of the most controversial issues throughout the history of waterfowl management. This is due primarily to the rapid response of waterfowl species to food availability, thus making them more susceptible to harvest. Manipulation of agricultural crops to make them available to wintering and migrating birds would attract not only light geese but also a variety of other waterfowl species. Allowing the taking of light geese on these manipulated sites may increase harvest of light geese for a short period, but it may also increase the likelihood of non-target species being taken. Furthermore, opening such sites to light goose hunting would create a disturbance to other species, thus making food resources unavailable to them for extended periods. We believe these potential negative impacts to other species outweighs the increase in light goose harvest that might be realized, and therefore will not include changes in baiting regulations as part of our management strategy.

2.2.10 Allow rallying or herding of light geese with the aid of a motorized vehicle or device

Migratory bird hunting regulations prohibit the take of migratory birds by means or aid of any motor-driven land, water, or air conveyance, or any sailboat used for the purpose of or resulting in the concentrating, driving, rallying, or stirring up of any migratory bird (50 *CFR* Part 20.21 [h]). Additionally, migratory birds may not be hunted by means, aid, or use of aircraft of any kind (50 *CFR* Part 20.21 [d]). Rallying with the aid of a powered device presents a potential safety hazard to hunters and any person within

range. Furthermore, rallying of birds may result in “flock-shooting” which may cause wounding of large numbers of birds that subsequently are not retrieved. Although the use of these techniques may cause a slight increase in harvest of light geese, we feel that the risk to human safety and the potential for wounding losses of birds are too great to allow their authorization.

2.2.11 Provide supplemental food to light geese on breeding areas

A recommendation was made to alleviate light goose damage to arctic and sub-arctic habitats by providing supplemental food to geese on their breeding grounds. There is no evidence to suggest that light geese would abandon the consumption of preferred natural foods during the breeding period in favor of food supplied artificially. Furthermore, if supplemental food sources are utilized by light geese, it is likely that high population levels will be maintained and recovery of natural vegetation in damaged habitats will be impossible. Maintenance of large, mobile goose populations will also increase the likelihood that intact habitats will be damaged in the future. Therefore, we did not analyze this alternative.

2.2.12 Alter U.S. farm policies to promote reduction of foods available to light geese on wintering and migration areas

The agricultural sector is a critical component of the U.S. economy. In 1999, approximately 143.8 million acres were planted to corn, rice, and wheat, producing a total crop value of over \$25 billion (U.S. Dept. Agriculture 2000). In the Mississippi and Central Flyways, approximately 124 million acres were planted to corn, rice, and wheat, and produced \$22 billion worth of crops. Reduction of the availability of post-harvest waste grain to light geese on private land would entail significant reductions in the total area planted to such crops. These reductions would seriously impact not only U.S. farmers, but also the U.S. economy in general. The Service has no regulatory control over U.S. farm policies and programs and therefore cannot manipulate the availability of agricultural foods to light geese. Furthermore, the potentially large negative impact of this alternative on the U.S. economy makes it impractical. Therefore, this alternative was not analyzed.

2.2.13 Control light goose populations through use of reproductive inhibitors

Conjugated linoleic acid has been demonstrated to reduce goose egg hatching rates in the laboratory when supplied consistently to birds during the egg formation period (Hill and Craven, unpublished data). However, no effective delivery mechanism has been developed for use in remote field situations on a broad scale. Therefore, researchers have suggested that reproductive inhibitors currently are not a practical method for controlling wild goose populations. Even if reproduction could be prevented, existing goose populations would remain high for many years due to the long life span of adult birds.

2.2.14 Allow commercial harvesting of light geese

The Migratory Bird Treaty prohibits the sale of migratory birds, their nests, and their eggs; except under certain conditions by Aboriginal peoples. Article II of the Treaty states that Aboriginal people in Canada may sell down and inedible by-products of their traditional harvest of migratory birds, but only within or among Aboriginal communities. Article II also provides for the limited sale of inedible by-products of migratory birds taken by indigenous inhabitants of Alaska, if such by-products are incorporated into authentic articles of handicraft. The harvest of such items must be consistent with the customary and traditional uses by indigenous inhabitants for their own nutritional and other essential needs. Such limitations on the commercial sale of light geese prevent this alternative from being an effective avenue for disposing of large numbers of light geese. Expansion of commercial sale of migratory birds by Aboriginal people, or authorization of commercial harvesting by non-Aboriginal people, would require a change in the Treaty. Such changes would entail time-consuming negotiations between the U.S. and Canadian Federal governments, with uncertain results. Many light goose populations would continue to increase during the negotiation period, thus making control more difficult if and when expanded commercial harvesting were eventually authorized. More importantly, the Canadian Wildlife Service has indicated that they do not support development of general commercial activities and take for the purpose of light goose control. They do not wish to establish a short-lived commercial opportunity that could have serious long-term effects on community support for and compliance with regulations. Therefore, we have chosen not to analyze this alternative.

2.2.15 Allow predators to control light goose populations

Major predators of light goose eggs and young include Arctic fox (*Alopex lagopus*), red fox (*Vulpes fulva*), herring gulls (*Larus argentatus*), glaucous gulls (*L. hyperboreus*), and parasitic jaegers (*Stercorarius parasiticus*; Mowbray et al. 2000, Sovada et al. 2001). Other predators include polar bear (*Ursus maritimus*), black bear (*U. americanus*), gray wolf (*Canis lupus*), coyote (*C. latrans*), common raven (*Corvus corax*), sandhill crane (*Grus canadensis*), long-tailed jaeger (*Stercorarius longicaudus*), snowy owls (*Nyctea scandiaca*), and caribou (*Rangifer tarandus*; Mowbray et al. 2000, Sovada et al. 2001). Adult geese do not commonly fall prey to predators (Sargeant and Raveling 1992). The nesting period in the Arctic typically is short and highly synchronized among individuals. The rapid increase in eggs and young available to predators during the nesting season likely overwhelms the ability of predator species to take full advantage of the new food supply (Sovada et al. 2001). Therefore, predation likely has little potential to limit growth of most light goose populations and we chose not to analyze this alternative.

2.3 Rationale for Design of Analyzed Alternatives

All alternatives considered were evaluated in relation to their ability to reduce and stabilize light goose populations, and prevent further degradation of habitats important to light geese and other migratory birds. NEPA regulations require analysis of a No Action alternative. Three additional alternatives were developed for the Draft EIS as a result of our previous EA on light goose management, as well as input received during the scoping phase of the EIS. One of the alternatives proposed to create additional regulatory tools and alter habitat management programs on some of our refuges for the purpose of reducing and stabilizing specific populations of light geese in North America. The remaining two alternatives in the Draft EIS proposed direct control of light goose populations either on the breeding grounds, or on migration and wintering areas.

We received substantial public comment on the Draft EIS concerning the original four alternatives. Several State wildlife agencies and Flyway Councils expressed concern that the alternatives were mutually exclusive and prevented a more integrated approach to management. Specifically, the States and Flyway Councils preferred a program that included the use of direct population control by wildlife agencies, if deemed necessary, to complement harvest of light geese resulting from regulatory tools such as a conservation order. In response to this input, we created and analyzed a fifth alternative that is essentially a combination of alternatives B, C, and D.

2.4 Description of Alternatives

2.4.1 Alternative A. No Action. Continue to manage light goose populations through existing wildlife management policies and practices.

Under the No Action alternative light goose populations would be allowed to increase in size. This alternative would continue to manage light geese through existing wildlife management policies and practices, with the exception of temporary light goose regulations implemented under the Arctic Tundra Habitat Emergency Conservation Act. Traditional harvest of light geese will continue during the regular season and will be managed using existing administrative procedures. Light goose hunting regulations adopted by States will be confined to Federal frameworks that provide for a maximum season length of 107 days, occurring during the period September 1 to March 10 as prescribed by the Treaty (U.S. Fish and Wildlife Service 1988). Existing hunt programs and existing administrative procedures for establishing new hunt programs, on national wildlife refuges administered by the Service will remain in place. Habitat management programs on refuges would continue as normal with regard to the purposes for which each refuge was established.

2.4.2 Alternative B (Preferred Alternative). Modify harvest regulation options and refuge management.

This alternative would modify Title 50 Code of Federal Regulations (*CFR*) Part 20 to allow the use of additional hunting methods to hunt light geese within current migratory bird hunting-season frameworks. We would authorize the use of electronic calls and unplugged shotguns to harvest light geese during normal light-geese hunting seasons when all other waterfowl and crane hunting seasons, excluding falconry, are closed.

This alternative would also create a new Subpart to 50 *CFR* Part 21 specifically for the management of overabundant light goose populations. Under this new Subpart, we would establish a conservation order under the authority of the Migratory Bird Treaty Act with the intent to reduce and stabilize light goose population levels. The conservation order would authorize each State/Tribe in eligible areas to initiate aggressive light goose harvest strategies, within the conditions that we provide, with the intent to reduce the populations. The order will enable States/Tribes to use hunters to harvest light geese, by way of shooting in a hunting manner, during a period when all waterfowl (including light geese) and crane hunting seasons, excluding falconry, are closed, inside or outside the migratory bird hunting season frameworks. The order would also authorize the use of electronic calls and unplugged shotguns, eliminate daily bag limits on light geese, and allow shooting hours to continue until one-half hour after sunset. Due to the dynamic nature of annual migration and wintering patterns of light geese it is not feasible to identify specific sites in the U.S. where harvest of light geese would occur in a given year. However, examination of recent patterns in snow and Ross's goose harvest by county provides a general overview of where goose concentrations and harvest would likely occur in the future (Appendix 4).

The Service will annually monitor and assess the overall impact and effectiveness of the conservation order to ensure compatibility with long-term conservation of this resource. Reduction of light goose populations to management goals will result in numeric levels that still provide abundant opportunities for non-consumptive uses of the resource (e.g. wildlife viewing). If at any time evidence is presented that clearly demonstrates that there no longer exists a serious threat of injury to the area or areas involved for a particular light goose population, we will initiate action to suspend the conservation order, and/or regular-season regulation changes, for that population. Suspension of regulations for a particular population would be made following a public review process. Specific details of light goose regulations under *CFR* Parts 20 and 21 are presented in Appendix 5. The conservation order will be conducted such that it does not adversely affect other migratory bird populations or any species designated under the Endangered Species Act as threatened or endangered.

Finally, this alternative would alter management practices on some Service national wildlife refuges to decrease the amount of sanctuary and food available to migrating and wintering light geese. The most likely action that a refuge would implement is creating new areas open to light goose hunting, or enlarging areas that currently are open. While some refuges may be opened for migratory bird hunting without area limitation, the National Wildlife Refuge System Administration Act of 1966 stipulates that only 40% of certain refuges may be opened to migratory bird hunting. The Fish and Wildlife Improvement Act of 1978 (Public Law 95-616) amended the 1966 Act to permit the opening of greater than 40% of certain refuges to hunting when it is determined to be beneficial to the species hunted. Following Executive Order 12996 issued on March 25, 1996, Congress enacted the National Wildlife Refuge System Improvement Act of 1997, amending the National Wildlife Refuge System Administration Act of 1966 to establish that compatible wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation are the priority public uses of the Refuge System. In order to establish a refuge hunt program, a determination must be made that the program is compatible with the major purposes for which the refuge was established (U.S. Fish and Wildlife Service 1986). Establishment of a hunt program includes preparation of the plan itself, an Environmental Assessment, Section 7 consultation in accordance with the Endangered Species Act, and Proposed and Final Rules in the Federal Register (U.S. Fish and Wildlife Service 1986). Each year, we make new proposals for amendments to refuge-specific hunting regulations available for public review and comment in the Federal Register.

Due to the dynamic nature of annual migration and wintering patterns of light geese, as well as changing habitat conditions, we cannot provide a definitive listing of annual management actions that some refuges may implement. Changes to refuge management may also include alteration of habitat programs to reduce food availability for, and make habitats less attractive to, light geese. For example, many refuges have been undertaking reforestation programs. While such programs were not initiated in response to the light goose issue, they will have the added effect of reducing food available to light geese. Some refuges that harbor significant numbers of light geese may choose to alter impoundment water levels in order to create roosting areas and attract birds near hunted sites, or eliminate roosting areas to encourage birds to move to areas where hunting does occur. Reduction of areas planted to agricultural crops on some refuges will also decrease food available to light geese. Modification of prescribed burn programs may also be used to make certain areas on refuges more or less attractive to light geese depending on the size of the burn area. Any uses included with changes in management practices on a particular refuge will be permitted only after they have been determined to be compatible with the purposes for which the refuge was established, and due regard to potential impacts to special status (threatened or endangered) species has been made.

2.4.3 Alternative C. Implement direct light goose population control on wintering and migration areas in the U.S.

We define direct control as the purposeful removal of large numbers of birds from a population using lethal means. This alternative would implement direct population control to achieve desired light goose population levels. Control efforts would be undertaken by wildlife agencies (Federal and/or State) on light goose migration and wintering areas in the U.S. Under this alternative we would create a special light goose permit within 50 *CFR* Part 21 specifically for the reduction of light goose populations. Regulations governing the issuance of permits to take, capture, kill, possess, and transport migratory birds are authorized by the Migratory Bird Treaty Act and are promulgated in 50 *CFR* parts 13 and 21. Federal courts have affirmed that all Federal agencies are subject to prohibitions in the Migratory Bird Treaty Act, including the restrictions on take of migratory birds. Executive Order 13186 state that *all* Federal agencies are subject to the provisions of the MBTA. Directors Order 131 clarifies Service policy regarding applicability of the MBTA to Federal agencies and the issuance of permits to agencies, including the Service. Any Federal personnel that undertake light goose management activities that will result in take of light geese must apply for and receive a permit from the appropriate Regional Office of the Service to do so. The permit would allow Federal and State agencies involved in migratory bird management, and/or their authorized designated agents, to initiate light goose population reduction actions within the conditions/restrictions of the program. Permits will be issued to the appropriate Regional Director of the Service that oversees the geographic area in question. The permit will delegate authority to Federal personnel and/or cooperating State wildlife agency personnel that will be involved in control activities.

Applications for the special light goose permit would require a statement from the agency that provides a general description of the action area, an estimate of the approximate number of light geese expected to be found in the action area and the approximate number of light geese that are to be taken. Permit holders would be required to properly dispose of or utilize light geese killed under the program. Light geese killed under this permit could be donated for scientific and educational purposes, or be donated to charities for human consumption. In the absence of such disposal options, geese may be buried or incinerated. Light geese, and their plumage, taken under these permits may not be sold, offered for sale, bartered, or shipped for purpose of sale or barter. Control activities would be undertaken such that they do not adversely affect other migratory bird populations or any species designated under the Endangered Species Act as threatened or endangered.

Agencies may use their own discretion for methods of take. Methods may include, but are not limited to, firearms, traps, chemicals or other control techniques that are consistent with accepted wildlife-damage management programs. The advantage of live-trapping is that non-target species would be released unharmed. Chemical control would be achieved by treating corn or other food with chemicals (e.g., DRC-

1339, Avitrol, or alpha chloralose) and broadcasting the treated bait in areas where light geese are feeding. Currently, these chemicals are not registered for use on light geese. Under this alternative, agencies would apply to the Environmental Protection Agency for use of these chemicals on light geese under a Section 18 Specific Exemption, or a Section 24C registration, under the Federal Insecticide and Rodenticide Act. All chemical control efforts would be used only in areas utilized by large flocks of light geese. This will increase efficiency of the control effort and minimize the take of non-target species, which tend to avoid sites used by large flocks of light geese (J. Cummings, U.S. Dept. Agriculture, personal communication).

Due to the dynamic nature of annual migration and wintering patterns of light geese, we cannot provide a definitive listing of sites where geese would be taken. However, examination of recent patterns in snow and Ross's goose harvest by county provides a general overview of where goose concentrations, and thus control efforts, would likely occur in the future (Appendix 4). By necessity, control efforts will have to be opportunistic with regard to daily and seasonal movements of geese. Sites likely would include agricultural fields and roosting areas near wetlands, preferably on Federal or State wildlife areas where access would not be an issue. Control activities would be undertaken such that they do not adversely affect other migratory bird populations or any species designated under the Endangered Species Act as threatened or endangered.

Permit holders will be required to keep records of all activities performed under the permit and submit annual reports to the Service office that granted the permit. We will annually review such reports and assess the overall impact of this program to ensure compatibility with the long-term conservation of this resource. If at any time evidence is presented that clearly demonstrates that there no longer exists a serious threat of injury to the area or areas involved for a particular light goose population, we will initiate action to suspend the special permits for that population. Specific conditions/restrictions of this permit are outlined in Appendix 6.

2.4.4 Alternative D. Seek direct light goose population control on breeding grounds in Canada.

This alternative would achieve light goose population reduction through direct control on the breeding grounds in Canada. We do not have the authority to unilaterally implement direct population control measures in Canada. However, we have discussed the issue of direct population control with the Canadian Wildlife Service during meetings of the Arctic Goose Joint Venture. The Joint Venture has formed a working group to outline potential methods of direct control if such measures are ever deemed necessary. The working group report by Alisauskas and Malecki (2003) outlined costs of conducting direct control on the breeding grounds. This alternative may or may not involve U.S. wildlife agency participation, depending on the availability of funding and manpower in Canada. Regardless, the Canadian government would be the lead authority under this alternative.

Methods of control would include shooting, trapping, or chemical control. Shooting of birds by sharpshooters would most likely be conducted during the nest incubation period when birds are attentive to nests, and their movements are limited. Personnel would be flown into nesting colonies and would conduct control efforts during the short nest incubation period. Sharpshooters would easily be able to identify bird species before shooting, and thus avoid take of non-target bird species. Capture methods would be employed during the brood-rearing period when young birds have not yet attained flight stage and adult birds are undergoing feather molt. In most instances, capturing of birds would be accomplished by driving birds into capture pens with the aid of helicopters. Birds would be euthanized after being captured. Any non-target bird species caught incidental to light goose trapping would be released. The agency costs of implementing this alternative depend on the distance of the specific breeding colony to the nearest human settlement, the timing of when direct control would occur (nest incubation period or post-hatch), and the fate of birds that are killed (un-retrieved or retrieved for processing).

Chemical control may also be employed during the flightless period when treated baits could be broadcast on sites utilized by large flocks of birds. Chemical types and methods of application would be similar to those outlined in Alternative C. The cost of conducting fieldwork in the Arctic under this alternative is much higher than control efforts in the U.S. To reduce costs, leaving goose carcasses in the field would be an option for consideration. Although we would consider this a waste of the goose resource, the nutrients contained in goose carcasses would be returned to the environment. Alternatively, carcasses could be collected and air-lifted to the nearest available facility for processing.

2.4.5 Alternative E . Two-phased Approach to Light Goose Population Control.

This alternative would achieve light goose population control using an integrated, two-phased approach involving increased harvest resulting from new regulatory tools (e.g. conservation order), changes in refuge management, and direct agency control. Phase one of this alternative is identical to Alternative B, whereas phase two includes elements of Alternatives C and D. In phase one, we would modify Title 50 Code of Federal Regulations (*CFR*) Part 20 to allow the use of additional hunting methods to hunt light geese within current migratory bird hunting-season frameworks. We would authorize the use of electronic calls and unplugged shotguns to harvest light geese during normal light-geese hunting seasons when all other waterfowl and crane hunting seasons, excluding falconry, are closed. In addition, we would create a new Subpart to 50 *CFR* Part 21 specifically for the management of overabundant light goose populations. Under this new Subpart, we would establish a conservation order under the authority of the Migratory Bird Treaty Act with the intent to reduce and stabilize light goose population levels. Specific details of the proposed light goose regulations under *CFR* Parts 20 and 21 are presented in Appendix 5.

During phase one, we would also alter management practices on some Service national wildlife refuges to decrease the amount of sanctuary and food available to migrating and wintering light geese. The most likely action that a refuge would implement is creating new areas open to light goose hunting, or enlarging areas that currently are open. Changes to refuge management may also include alteration of habitat programs to reduce food availability for, and make habitats less attractive to, light geese.

Although annual monitoring of our program will be conducted (see section 2.3.6), under this alternative we would evaluate the effectiveness of the light goose management program under phase one within 5 years of its initiation and assess the potential need for phase two. Phase two of this alternative incorporates direct agency control of light goose populations as described previously in Alternatives C and D. Direct population control would be implemented for a particular population after we determined that reduction of the population cannot be achieved solely through implementation of regulations, such as a conservation order, and changes in refuge management. Management actions initiated during phase one would be continued in order to compliment population reductions achieved in phase two.

Because we have no jurisdiction over management actions in Canada (Alternative D), this alternative provides that if phase two were needed it would begin with the actions outlined in Alternative C. If additional population control actions were found to be needed we would then approach the Canadian Wildlife Service and urge implementation of actions outlined in Alternative D. Initial direct control efforts would be undertaken by wildlife agencies (Federal and/or State) on light goose migration and wintering areas in the U.S. Under this alternative we would create a special light goose permit within 50 *CFR* Part 21 specifically for the reduction of light goose populations. Permits will be issued to the appropriate Regional Director of the Service that oversees the geographic area in question. The permit will delegate authority to personnel of the Service, other Federal personnel, and/or cooperating State wildlife agency personnel, to initiate light goose population reduction actions within the conditions/restrictions of the program. Control activities would be undertaken such that they do not adversely affect other migratory birds or any species designated under the Endangered Species Act as threatened or endangered. If at any time evidence is presented that clearly demonstrates that there no longer exists a serious threat of injury to the area or areas involved for a particular light goose population, we will initiate action to suspend the special permits for that population. Specific conditions/restrictions of this permit are outlined in Appendix 6.

Agencies may use their own discretion for methods of take. Methods may include, but are not limited to, firearms, traps, chemicals or other control techniques that are consistent with accepted wildlife-damage management programs. The advantage of live-trapping is that non-target species would be released unharmed. Chemical control would be achieved by treating corn or other food with chemicals (e.g., DRC-1339, Avitrol, or alpha chloralose) and broadcasting the treated bait in areas where light geese are feeding. Currently, these chemicals are not registered for use on light geese. Under this alternative, agencies would

apply to the Environmental Protection Agency for use of these chemicals on light geese under a Section 18 Specific Exemption, or a Section 24C registration, under the Federal Insecticide and Rodenticide Act. All chemical control efforts would be used only in areas utilized by large flocks of light geese. This will increase efficiency of the control effort and minimize the take of non-target species, which tend to avoid sites used by large flocks of light geese (J. Cummings, U.S. Dept. Agriculture, personal communication).

Due to the dynamic nature of annual migration and wintering patterns of light geese, we cannot provide a definitive listing of sites where geese would be taken in the U.S. However, examination of recent patterns in snow and Ross's goose harvest by county provides a general overview of where goose concentrations, and thus control efforts, would likely occur in the future (Appendix 4). By necessity, control efforts will have to be opportunistic with regard to daily movements of geese. Sites likely would include agricultural fields and roosting areas near wetlands, preferably on Federal or State wildlife areas where access would not be an issue. Prior to initiation of control efforts on any areas, the presence of threatened or endangered species would be determined in order to prevent potential impacts to such species.

If the combination of phases one and two of this alternative implemented in the U.S. is not successful in achieving desired population reduction goals, further management actions in Canada will be needed. These actions are identical to those outlined in Alternative D. Methods of control would include shooting, chemicals, or capturing. Shooting of birds by sharpshooters would most likely be conducted during the nest incubation period when birds are attentive to nests, and their movements are limited. Personnel would be flown into nesting colonies and would conduct control efforts during the short nest incubation period. Sharpshooters would easily be able to identify bird species before shooting, and thus avoid take of non-target bird species. Capture methods would be employed during the birds' flightless period in summer when they are undergoing feather molt. Capturing of birds would be accomplished by driving birds into capture pens with the aid of helicopters or float planes. Birds would be euthanized after being captured. Any non-target bird species caught incidental to light goose trapping would be released. The agency costs of implementing this alternative depend on the distance of the breeding colony to the nearest human settlement, the timing of when direct control would occur (nest incubation period or post-hatch), and the fate of birds that are killed. Chemical control may also be employed during the flightless period when treated baits could be broadcast on sites utilized by large flocks of molting birds. Chemical types and methods of application would be similar to those outlined in Alternative C.

Once the desired reduction of a particular light goose population is achieved, management actions can be curtailed. However, to prevent a rebound of the population certain maintenance level actions should remain in place. For example, retention of the use of additional hunting methods (electronic calls, unplugged shotguns) to hunt light geese within current migratory bird hunting-season frameworks would maintain

harvest pressure. Temporary reinstatement of a conservation order may be needed in some years to achieve the level of harvest necessary to maintain a population at the desired level.

2.3.6 Light Goose Population Monitoring

Common to all analyzed alternatives is the existence of a variety of light goose population monitoring programs in North America. These programs include annual winter surveys, periodic photo surveys of nesting colonies, and marking of birds with leg bands to estimate goose distribution, and survival and recovery rates. Monitoring of annual light goose harvest would continue through our normal waterfowl harvest surveys and those conducted by the Canadian Wildlife Service. More detailed descriptions of several of these programs are presented in Chapter 3. Information from monitoring programs will enable us to monitor the response of light goose populations to each of the alternatives. For Alternatives B-D, existing population monitoring programs will be used to determine when population reduction programs should be suspended.

Alternatives B, C, and E advocate light goose management on migration and wintering areas in the U.S. Under these alternatives, managers will minimize the risk of impacting lesser snow geese from Wrangel Island, Russia, which have experienced years of poor reproduction due to climatic conditions on their breeding areas. Monitoring of marked birds has indicated that birds from Wrangel Island that migrate to the Pacific Flyway through British Columbia and Washington are geographically separated from western arctic birds, which tend to migrate through Alberta and Saskatchewan (Armstrong et al. 1999). Harvest pressure on Wrangel Islands birds found in eastern Oregon can be reduced by delaying hunting seasons, or control efforts, in the fall. This is possible due to the tendency of Wrangel Island birds to arrive two weeks earlier than western arctic birds in such areas. Furthermore, potential light goose control efforts in the Imperial Valley of southern California will not impact Wrangel Island birds because the area is used primarily by birds from the western Arctic (Armstrong et al. 1999).

The Arctic Goose Joint Venture has prepared science needs documents for greater snow geese (Arctic Goose Joint Venture Technical Committee 2001) and lesser snow and Ross's geese (Arctic Goose Joint Venture Technical Committee 1998). These documents outline expenditures for existing population monitoring programs (described above) and those for programs to be developed in the next several years. New programs include expansion of population monitoring to other colony sites, vegetation mapping of previously un-mapped goose colony areas, vegetation monitoring, and monitoring biodiversity at colony sites. Information provided by such programs will be used in an adaptive management process, whereby managers will learn about the response of light goose populations and their habitats to whatever management alternative is implemented.

2.3.7 Current Light Goose Regulations

Under each alternative that is analyzed, traditional harvest of light geese will continue during the regular season and will be managed using existing administrative procedures. Light goose hunting regulations adopted by States will be confined to Federal frameworks that provide for a maximum season length of 107 days, occurring during the period September 1 to March 10 as prescribed by the Treaty with Canada (USDI 1988). Existing hunting programs, and administrative procedures for establishing new hunting programs, on national wildlife refuges administered by the Service will remain in place.

2.5 Comparison of Analyzed Alternatives

All of the alternatives we analyzed would allow harvest of light geese (Table 2.1). Alternative A (no action) would maintain normal light goose hunting seasons that are regulated through existing administrative procedures. Alternative B (Preferred Alternative) seeks to control light goose populations by increasing harvest within and outside normal hunting season frameworks, and by altering habitat management practices on Service-owned national wildlife refuges. Implementation of a conservation order would allow take of light geese outside of normal hunting season frameworks, while geese are still present on wintering and migration areas in the U.S. Authorization of new methods of take would increase the effectiveness of hunters during normal hunting seasons, as well as the effectiveness of participants in conservation order activities. Alteration of goose habitats and hunting programs on national wildlife refuges would slightly decrease the amount of food and sanctuary available to light geese on wintering and migration areas in the U.S. Alternatives C and D involve direct control of light geese by removing large numbers of birds from the population(s) in a short period of time. The primary difference between Alternatives C and D is whether control of birds occurs in the U.S. or Canada. Alternative E represents an integrated, two-phased approach to management that incorporates aspects of Alternatives B, C, and D. Phase one of Alternative E is identical to Alternative B. If sufficient population reduction is not achieved in phase one, phase two would be considered for implementation. Phase two of Alternative E would begin with implementation of management actions in the U.S. as described in Alternative C. If further population reduction was needed, we would consult with the Canadian Wildlife Service to urge implementation of Alternative D on the breeding grounds.

Table 2.1. Summary of light goose management alternatives to be analyzed.

Actions	Alternative A. No Action.	Alternative B. (Preferred). Modify harvest regulation options and refuge management.	Alternative C. Direct control of light goose populations on wintering and migration areas in U.S.	Alternative D. Direct control of light goose populations on breeding areas in Canada.	Alternative E. Two-phased approach to light goose population control.
Light goose populations	Allowed to increase.	Reduced through harvest.	Reduced by wildlife agencies in U.S.	Reduced by Canadian agencies on breeding grounds with possible U.S. assistance.	Reduced through harvest in phase one. Reduced through harvest and direct agency control in phase two.
Existing light goose harvest regulations	Remain in place.	Remain in place.	Remain in place.	Remain in place.	Remain in place.
New light goose regulations	No new regulations.	New methods of take and creation of a conservation order.	Creation of special light goose permit.	No new U.S. regulations.	New methods of take and creation of a conservation order. Creation of light goose permit for direct control.
Refuge hunt programs	Remain in place. Normal changes occur using existing administrative process.	Expanded.	Remain in place. Normal changes occur using existing administrative process.	Remain in place. Normal changes occur using existing administrative process.	Expanded.
Refuge habitat management	Proceeds as normal.	Modified .	Proceeds as normal.	Proceeds as normal.	Modified.

CHAPTER 3

AFFECTED ENVIRONMENT

3.0 Incorporation of new information received after publication of our Draft EIS on light goose management

Subsequent to our publication of the DEIS on light goose management on September 28, 2001 we continued to monitor the status of light goose populations through a variety of surveys. In addition, we have included newly-published information on the impacts of light geese on various habitats, estimates of the cost of direct population control in arctic and sub-arctic regions, as well as the socioeconomic impacts of non-consumptive use of light geese in Canada. We also have included this new information in our analysis of management alternatives outlined in the EIS (Chapter 4).

With regard to revised information on population status, we have included additional unpublished FWS and CWS survey information to provide the latest estimates of the spring population (Fig. 3.7) and winter index (Fig. 3.11) of greater snow geese. Current estimates of the winter index for MCP light geese (Fig. 3.12), WCFP light geese (Fig. 3.13), CMF light geese (Fig. 3.14), and light geese in the Pacific Flyway (3.15) are provided. As was discussed in our DEIS, these updated indices continue to show that light goose populations remain above desired NAWMP and Flyway Council goals.

Section 3.1.9 of the FEIS contains an expanded explanation of our concern about the impacts of habitat degradation on light goose populations. The need for this additional text arose from a public comment on the DEIS (see FEIS section 7.8, comment 141). The comment stated that the No Action alternative premise that light goose populations would be allowed to increase in size is untenable. In our response to the comment, we indicated that nowhere in the DEIS did we state that light goose populations would increase indefinitely. We stated the possibility that geese would seek out new habitats for food resources after they degraded other sites. The DEIS also raised the possibility that density-dependent regulation of the population would occur (see DEIS section 4.2.1). In the DEIS we cited Abraham and Jeffries' (1997) extensive review of light goose population increases, the effects of light geese on habitats, and the resulting impacts of habitat degradation on light geese themselves. In FEIS section 3.1.9 we have included citations of Cooch et al. (1989), Cooch et al. (1991a, b), Reed and Plante (1997), and Williams et al. (1993). Although we did not include these citations in the DEIS, the papers were discussed in the Abraham and Jeffries (1997) review paper upon which we based much of our concern. The cited papers merely reinforce our concern that light geese will damage breeding habitats to such an extent that food supplies may become depleted, body condition of adult birds and clutch sizes may decline, and goslings could experience slower growth rates or starvation.

Affected Environment

Following publication of our DEIS, results of studies on greater snow geese by Feret et al. (2003) and Mainguy (2002) were published. We included results of these studies in the FEIS (section 3.1.10, page 46) because they provide new information on the impact of increased spring harvest of snow geese in Quebec. Years with spring harvest in Quebec may have caused reduced foraging time by geese on farmlands. Consequently, reduced intake of agricultural foods may in turn have caused reduced body condition and possibly reduced goose production later in spring (Feret et al. 2002, Mainguy 2002). This new information was considered in our analysis of the impacts of management alternatives on light geese; however it did not change our conclusions. The information generated from the new studies reinforces our contention in the DEIS (section 3.1.10) that an agricultural food subsidy can improve body condition and survival of geese, and lead to enhanced productivity and population growth.

The FEIS contains updates from our annual waterfowl harvest surveys (section 3.1.11). Regular season harvest information for greater snow geese was updated (Fig. 3.17) and used to provide more recent estimates of harvest rates for the population (Fig. 3.18, Table 3.3). The additional years of harvest data following publication of the DEIS allowed us to refine our harvest rate estimates for greater snow geese (Table 3.3). At the time of publication of the DEIS there was sufficient information to estimate a harvest rate (16.7%) only for the 1999-2000 period (DEIS pg. 42). With finalized U.S. harvest data for the 1999-2000 regular season, the harvest rate estimate for greater snow geese was revised to 15% (FEIS Table 3.3). Harvest rates during 1999-2005 ranged from 13% to 25% (average 18.5%; FEIS Table 3.3). This new information allowed us to refine our estimates of harvest that would result if the U.S. implemented a conservation order for greater snow geese (Table 4.4). The information did not result in a change in our preferred alternative, and it merely allowed us to refine our prediction of how long a population reduction would take (Fig. 4.1).

We provide updates of regular season and conservation order harvest of CMF light geese in Table 3.4. In our DEIS we utilized preliminary data to estimate total CMF harvest for the 1998/99 and 1999/00 periods, which ranged from 1.0 to 1.3 million birds (DEIS Table 3.3). Our updated estimates for total annual harvest through spring 2005 ranged from 1.1 to 1.5 million birds (Table 3.4). This additional data was considered in our analysis of the impacts of modifying harvest regulations on CMF light geese (FEIS section 4.2.2). The additional data resulted in a slight lowering of the estimated percent increase in harvest resulting from new harvest regulations (Table 4.2); however the new information did not cause us to change our preferred alternative.

With regard to new information in the FEIS related to light goose impacts on habitat, we cite studies published by Jefferies and Rockwell (2002), Handa et al. (2002), and Handa and Jefferies (2000). Jefferies and Rockwell (2002) documented increases in the proportion of bare soil resulting from habitat degradation by light geese in 3 intertidal marshes at La Perouse Bay, Manitoba (Fig. 3.23). Handa et al. (2002)

Affected Environment

commented on the short-lived nature of any plant communities that attempt to colonize exposed sediments. Handa and Jefferies (2000) pointed out the difficulties of trying to artificially re-establish marsh plant communities on a large scale. These studies reinforce our DEIS descriptions of habitat degradation and our contention of poor prospects of recovery of such habitats.

In FEIS section 3.3.2 we cited new information from Sherfy and Kirkpatrick (2003) that demonstrated potential light goose impacts on the availability of invertebrate food resources for shorebirds. This new study reinforces our concern expressed in the DEIS that habitat degradation caused by light geese has the potential to affect the ability of other bird species to utilize such habitats.

In our DEIS (section 3.5.2) we cited the lack of information on the economic impact of non-consumptive uses of the light goose resource. Recent information published by CWS (2005) provides insight to the potential economic impact of non-consumptive uses of waterfowl migration through Quebec. An economic impact of more than \$19 million (Canadian \$) can be attributed to birdwatching activities at four main waterfowl migration areas in Quebec. An additional \$5 million was generated annually by 2 greater snow goose festivals, one Canada goose festival, and operation of associated educational centers (CWS 2005). We incorporated this information in our response to comment numbers 163 and 182 in FEIS Chapter 7. We incorporated these impacts in our analysis of each management alternative in section 4.6 of the FEIS; however the new information did not cause us to change our preferred alternative.

3.1 LIGHT GEESE

3.1.1 Definition

The term light geese refers collectively to three taxa in North America: lesser snow geese (*Chen caerulescens caerulescens*), greater snow geese (*C. c. atlantica*), and Ross’s geese (*C. rossii*). These taxa are referred to as “light” geese due to their light coloration; as opposed to “dark” geese such as Canada geese (*Branta canadensis*) and white-fronted geese (*Anser albifrons*). Interestingly, there are two color phases of lesser snow geese: the dark phase, typically referred to as “blue” geese, and white phase, typically referred to as “snow” geese or “white” geese. Blue phase lesser snow geese are the same species as white phase lesser snow geese and the two color phases may interbreed. Regardless of the color phase, blue and snow geese are referred to as light geese.

3.1.2 Geographic Distribution of Species

Greater snow geese. — Greater snow geese breed in the eastern Arctic of Canada and migrate southward through Quebec, New York, and New England to their wintering grounds in the mid-Atlantic U.S. (Fig. 3.1).

Ross’s geese. — Approximately 90-95% of Ross’s geese breed in the Queen Maud Gulf region of the central Arctic (Kerbes 1994). Small numbers of Ross’s geese also breed on Banks Island in the western Arctic, along western and southern Hudson Bay, and Southampton and Baffin Islands in the eastern Arctic. Prior to the 1960s, Ross’s geese nested primarily in the central arctic region and most birds migrated to wintering areas in California. This species has dramatically expanded its range eastward in recent decades (Ryder and Alisauskas 1995; Fig. 3.1). Examination of the occurrence of Ross’s geese in the harvest of the various Flyways (Fig. 3.2) illustrates the range expansion. Ross’s geese did not occur in the Central Flyway

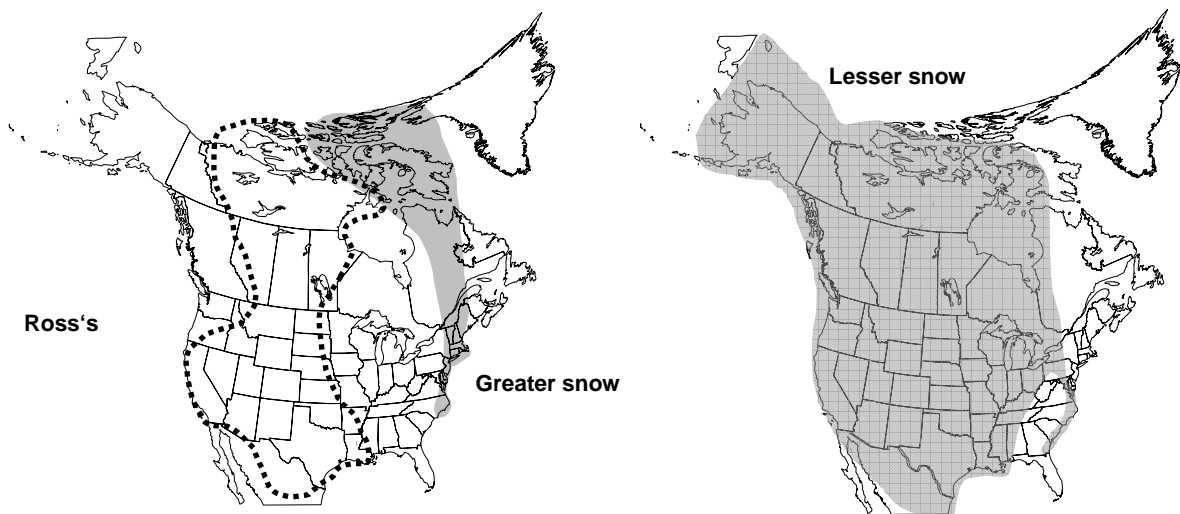


Fig. 3.1. Left. Primary geographic distribution of greater snow (shaded area) and Ross’s (dotted line) geese. Right. Primary geographic distribution of lesser snow geese.

Affected Environment

harvest survey until 1974, and did not occur in the Mississippi Flyway harvest survey until 1982. The first occurrence of Ross's geese in the Atlantic Flyway harvest was in 1996 (Sharp and Moser 1999). The largest proportion of Ross's geese winters in the Central Valley of California. Smaller numbers of Ross's geese winter in the southwest portion of the Central Flyway, and in Arkansas and Louisiana. Changes in the distribution of recoveries of banded birds further illustrate the range expansion from the 1950s to the 1990s (Table 3.1).

Lesser snow geese. — Lesser snow geese breed throughout much of the arctic region of North America. Additionally, a population that breeds on Wrangel Island, Russia, migrates through Alaska, western Canada, and several western States (Fig. 3.1). The wintering range of this species is broad, with birds nesting in the western Arctic tending to winter in the Pacific Flyway, and birds nesting in the central and eastern Arctic wintering in the Central and Mississippi Flyways (Table 3.1). Small numbers of lesser snow geese winter in the Atlantic Flyway.

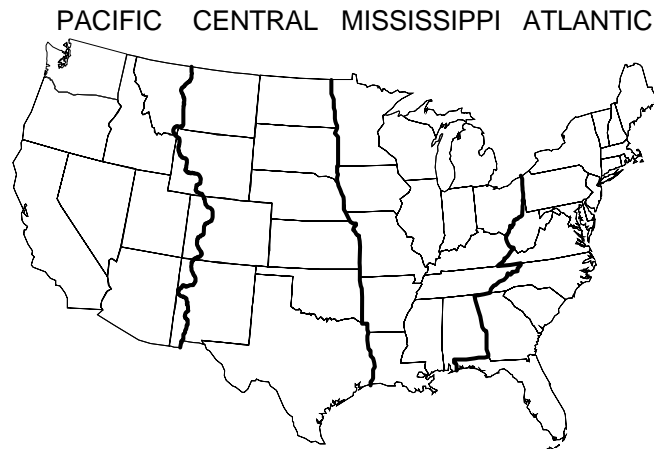


Fig. 3.2. Boundaries of administrative Flyways.

Table 3.1. Distribution of legband recoveries for lesser snow and Ross' s geese banded in the western, central, and eastern Arctic by decade, 1950-98. Numbers in parentheses represent sample size for each species by decade. Recoveries are not weighted by population size, nor are they adjusted for differences in band-reporting rates among flyways.

Species	Flyway	Western Arctic ¹					Central Arctic ²					Eastern Arctic and Subarctic ³				
		1950s (0)	1960s (0)	1970s (0)	1980s (0)	1990-98 (0)	1950s (2)	1960s (279)	1970s (274)	1980s (45)	1990,98 (479)	1950s (0)	1960s (7)	1970s (30)	1980s (9)	1990-98 (160)
Ross' s	Pacific						100	96	94	87	60	29	3	0	8	
	Central					0	3	5	13	32	43	90	100	63		
	Mississippi					0	<1	<1	0	8	29	7	0	29		
	Atlantic					0	0	0	0	0	0	0	0	0		
Lesser	Pacific	(41)	(648)	(448)	(190)	(334)	(0)	(25)	(42)	(34)	(409)	(3,293)	(16,328)	(9,810)	(3,603)	
	Central	95	95	96	84	87	4	10	0	2	<1	<1	<1	<1		
	Mississippi	5	5	4	15	11	88	80	82	61	78	70	70	74	63	
	Atlantic	0	0	0	1	2	8	10	18	37	22	30	30	25	37	
		0	0	0	0	0	0	0	0	0	0	0	0	0	<1	

¹ Area between 115° and 140° W longitude, above 65° latitude.

² Area between 95° and 115° W longitude, above 65° latitude.

³ Area east of 95° W longitude.

3.1.3 Population Delineation

Waterfowl management activities frequently are based on delineation of populations that are the focus of management. In most instances, populations are delineated according to where they winter, whereas others are delineated based on location of their breeding grounds. For management purposes, populations can be comprised of one or more species of geese that generally breed and/or winter in similar areas. For example, lesser snow geese and Ross’s geese in the central portion of North America are frequently found in the same breeding, migration, and wintering areas. Due to these similarities, the term “light goose population” is used to refer to various populations comprised of both lesser snow geese and Ross’s geese, as described below. In descriptions of geographic areas, eastern Arctic refers to the area east of approximately longitude 95° W; the central Arctic refers to the area between 95° W and approximately 115° W and the western Arctic refers to the area west of 115° W (Fig. 3.3). Administrative Flyway boundaries also are used to describe population ranges (Fig. 3.2).

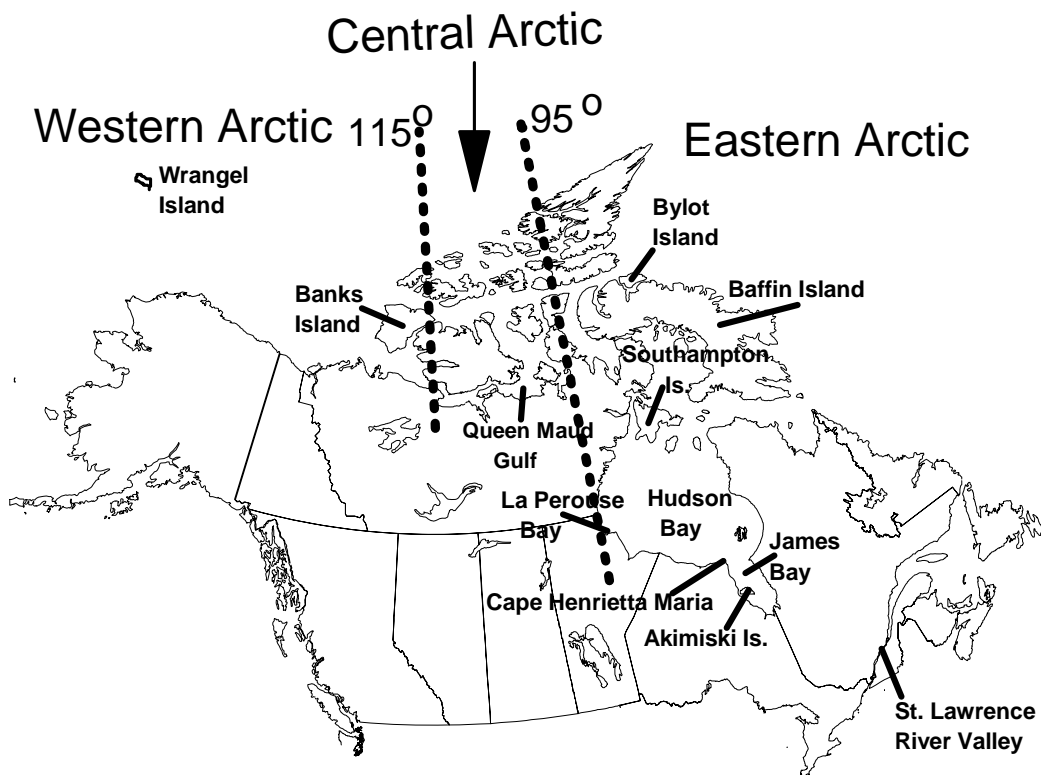


Fig. 3.3. Major arctic and subarctic geographic features referenced in text, with approximate 95 and 115 degrees longitude labeled to designate eastern, central and western arctic regions.

Affected Environment

Greater snow geese. — A single population of greater snow geese is recognized in North America. The population is relatively isolated from other light goose populations, except for potential mixing with small groups of lesser snow geese in the central portion of the Atlantic Flyway (Fig. 3.1).

Mid-Continent Population (MCP) of light geese. — This term is used to describe light geese (lesser snow and Ross's geese) that migrate primarily through North Dakota, South Dakota, Nebraska, Kansas, Iowa, and Missouri, and winter in Arkansas, Louisiana, Mississippi, and eastern, central, and southern Texas (Fig. 3.4). MCP birds nest in colonies along the southern and western shores of Hudson Bay and on Southampton and Baffin Islands in the eastern Arctic, and in the Queen Maud Gulf region of the central Arctic (Fig. 3.3). Field studies conducted in Texas during winter indicate that MCP light geese are comprised of approximately 94.3% lesser snow geese and only 5.7% Ross's geese (Sullivan 1995).

Western Central Flyway Population (WCFP) of light geese. — WCFP light geese winter in southern Colorado, northwestern Texas, New Mexico, and the Northern Highlands of Mexico (Hines et al. 1999). WCFP light geese nest primarily in the central and western Canadian Arctic (Fig. 3.4), with nesting colonies on Banks Island (mostly lesser snow geese, with some Ross's geese) and Queen Maud Gulf (mostly Ross's geese, with some lesser snow geese). Observations of birds marked with neck collars indicate that 2.4 % of lesser snow geese from the central Arctic, and 24% of lesser snow geese from the western Arctic, migrate to WCFP wintering areas (Hines et al. 1999). Neck collar data are not available for Ross's geese. Overall, the WCFP is comprised of approximately 79% lesser snow geese and 21% Ross's geese (Thorpe 2000).

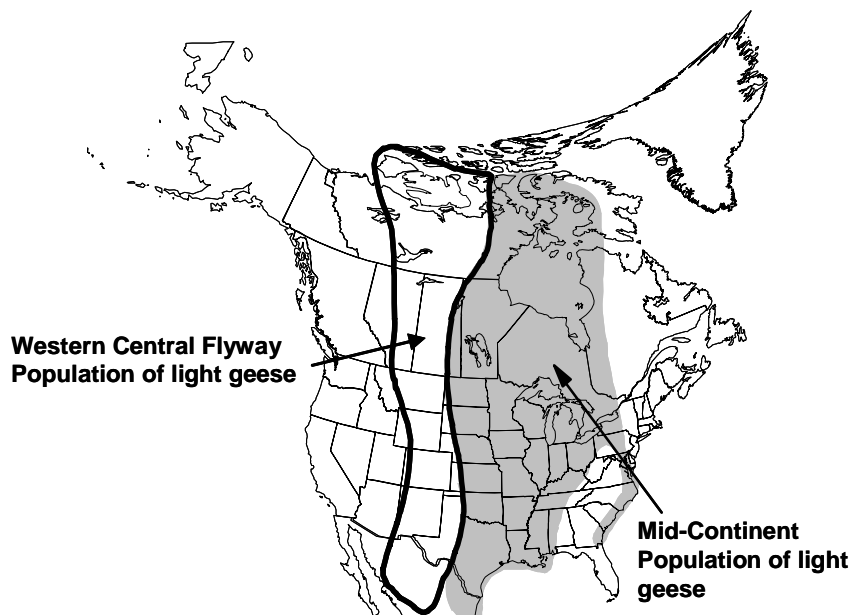


Fig. 3.4. Geographic distribution of the Mid-Continent Population and Western Central Flyway Population of light geese (Lesser snow and Ross's geese, combined).

Affected Environment

MCP and WCFP light geese confine most of their migration and wintering activities to the Mississippi and Central Flyways. For this reason, these 2 populations were collectively referred to as Mid-Continent Light Geese (MCLG) in our previous Environmental Assessment (U.S. Fish and Wildlife Service 1999a). However, the term Mid-Continent Light Geese often was confused with the term Mid-Continent Population (MCP) of light geese. In order to eliminate such confusion, we have chosen to refer to the combination of MCP and WCFP birds as Central/ Mississippi Flyway (CMF) light geese.

Unlike the Central and Mississippi Flyways, there are no formal population designations of light geese in the Pacific Flyway; with the exception of the population of lesser snow geese that breed on Wrangell Island, Russia and migrate to the Pacific Flyway. In the absence of accepted population definitions, and for the purposes of this document, we have developed designations for lesser snow and Ross's geese that breed in the central or western Arctic and migrate to the Pacific Flyway.

Western Population of Ross's geese (WPRG). — We have chosen this designation for those Ross's geese that migrate to the Pacific Flyway; primarily to the Central Valley of California (Fig. 3.5). Birds of the WPRG nest mainly in the Queen Maud Gulf region of the central Arctic, with some birds nesting on Banks Island in the western Arctic. The WPRG comprises the largest percentage of wintering Ross's geese in the U.S. However, the percent of band recoveries of central Arctic Ross's geese that occur in the Pacific Flyway has declined from nearly 100% in the 1950s and 1960s, to 60% during 1990-98 (Table 3.1).

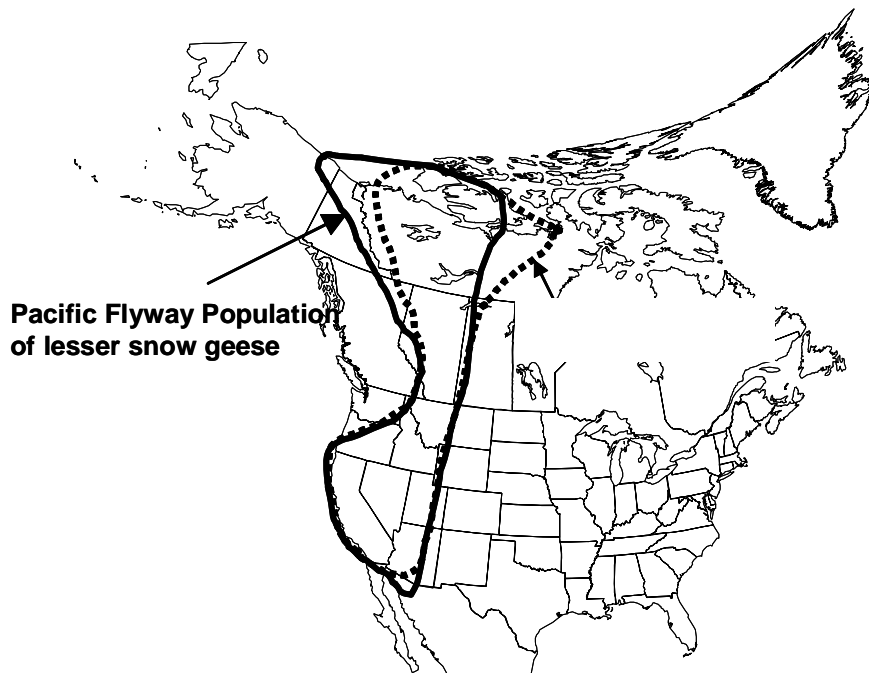


Fig. 3.5. Primary geographic distribution of the Western Population of Ross's geese (dashed line) and the Pacific Flyway Population of lesser snow geese (solid line).

Affected Environment

Pacific Flyway Population of lesser snow geese (PFSG). — PFSG winter in the Pacific Flyway and nest primarily on Banks Island, and coastal river deltas on the mainland at Anderson River and Kendall Island in the western Arctic (Fig. 3.5). Neck collar observations indicate that approximately 76% of lesser snow geese that nest in the western Arctic migrate to PFSG wintering areas (Hines et al. 1999). Very few lesser snow geese banded in the central and eastern Arctic are recovered in the Pacific Flyway (Table 3.1).

Wrangel Island Population of lesser snow geese. — This population nests on Wrangel Island off the north coast of Russia, and winters in southern British Columbia, the Puget Sound area of Washington, and in northern California (Fig. 3.6).

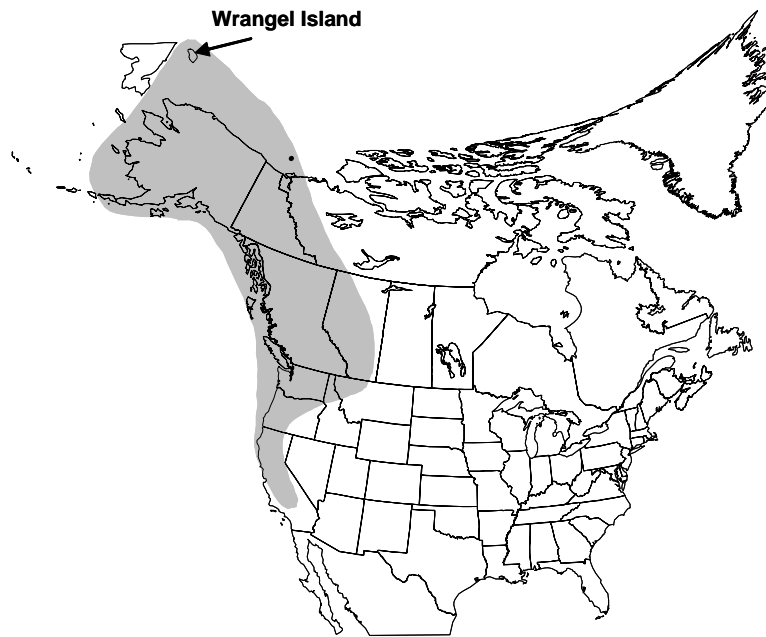


Fig. 3.6. Primary geographic distribution of the Wrangel Island Population of lesser snow geese.

3.1.4 Population Surveys

The status of light goose populations in North America is monitored using a combination of aerial and ground surveys conducted on breeding, migration, and wintering areas. Due to the difficulty of conducting surveys throughout the vast arctic region, light goose breeding colonies (primarily lesser snow geese and Ross's geese) are monitored on a 5-year rotating basis using low-level aerial photography (Kerbes 1994, Kerbes et al. 1999). Therefore, estimates of the number of breeding birds at each colony are not available every year. Surveys of breeding colonies provide estimates of the number of nesting birds, but not the number of non-breeding birds (primarily 1- and 2-year olds). Consequently, the total population size in spring is higher than breeding colony estimates. On the average, snow goose populations are considered to have 25-35% non-breeders in spring (Kerbes et al. 1999). Therefore, the total population size may be 1.3 to 1.5 times greater than breeding colony estimates indicate.

Affected Environment

The size of the population of greater snow geese is estimated each spring (1965-present) when the entire population is staging in the St. Lawrence River Valley during northward migration (Reed et al. 1998). Recently, monitoring of radio-marked birds has been used to determine the percentage of birds that have dispersed outside the surveyed areas. The photo survey estimate is then corrected for the percentage of birds outside the survey coverage. By taking advantage of the concentration of the entire population at one point in time, this survey is a reliable method for monitoring population size of this species.

Mid-winter waterfowl surveys are conducted each year throughout the entire lower 48 States in the U.S. These surveys began in some areas as early as the 1930s; however, consistent survey coverage and data summarization began in 1955. Biologists did not begin separate inventories of MCP and WCFP light geese until the winter of 1969/70. Therefore, during 1955-1969, the CMF light goose count could not be separated into MCP and WCFP components.

Because not all areas in each State are surveyed, the mid-winter survey does not provide a complete population estimate for light geese. Instead, the survey provides an index to the winter population of geese, which should not be confused with the size of the breeding population. Past photographic inventories of eastern arctic nesting colonies suggested that winter indices averaged about half of the actual spring population estimate (Kerbes 1975). Boyd et al. (1982) used a correction factor of 1.6 to apply to winter indices to estimate the approximate size of the spring breeding population.

Surveys of light geese wintering in Mexico are conducted every 3 years. Therefore, a complete winter inventory of WCFP light geese is obtained every 3 years. However, WCFP light geese that occur in the U.S. are surveyed every winter in Central Flyway States. By maintaining similar survey methods from year to year, the winter index is utilized to monitor the relative size of the various populations each year. Because U.S. winter index data are available every year for most light goose populations (versus every 5 years for arctic breeding colony data), the winter index is utilized to annually monitor populations and aid in making many management decisions.

3.1.5 Population Status - Historical Accounts

Estimates of the size of light goose populations prior to the advent of modern aerial surveys (i.e. pre-1955) do not exist. There were no coordinated, simultaneous air or ground surveys conducted over the majority of light goose breeding or wintering ranges prior to 1955. Bent (1962:164-188; reprint of original 1925 publication) presents several accounts of observations of greater snow geese, Ross's geese, and lesser snow geese (distinguished as snow and blue geese) during winter, migration, and breeding periods. Some of these accounts allude to large numbers of birds concentrated over large areas; however, few report actual numbers of birds observed. Furthermore, observer variability cannot be adequately assessed from the accounts. The variability in observers' frames of reference to flock size is illustrated by comments of M.

Affected Environment

Frazar and Harrison Lewis (Bent 1962:174). M. Frazar wrote a letter describing a “large flock” of greater snow geese he saw in 1908 that was comprised of “at least 75 birds.” Lewis wrote of C. Dionne’s reference to “considerable flocks” of snow geese comprised of “three or four thousand individuals.” In this situation, 2 observers are referring to seemingly large flocks of birds, but the actual number of birds may be as low as 75, or as high as 3,000 to 4,000 birds. This variability in descriptions illustrates the difficulty in trying to compare historical, anecdotal accounts of light goose abundance with population estimates derived from standardized aerial surveys.

McIlhenny (1932) reported observing a flock of blue-phase snow geese in March 1914 that was estimated to contain 1.25-1.5 million birds. The methodology used to obtain the estimate was not specified. Prior to the 1960s, snow geese wintered almost exclusively in salt marsh habitats on the Gulf Coast (Lynch 1975, Bateman et al. 1988). In fact, McIlhenny (1932) felt that at least 70% of all wintering blue-phase lesser snow geese inhabited the marsh habitats near where his observations were made. By early March, the snow geese on the Gulf Coast seemed to gather into only 2 or 3 flocks (McIlhenny 1932). Therefore, it is not surprising that large flocks of birds were encountered in the first part of the 20th century. Lynch (1975) wrote that the number of geese wintering on the Gulf Coast prior to the advent of rice culture is unknown and is a matter of conjecture.

Johnsgard (1974) felt that early 20th century goose population estimates were either wildly optimistic, or the number of snow geese in the mid-continent region declined greatly in subsequent decades. If early anecdotal accounts of flock sizes were accurate, it is unclear why coordinated winter surveys several decades later accounted for far fewer birds. The 1954/55 winter count of light geese (primarily lesser snow geese) in the Mississippi Flyway was only 368,000 birds. There are no reports of large die-offs of geese between the early part of the 20th century and the advent of winter surveys in the mid-1950s. Furthermore, market hunting had been prohibited in 1918 with passage of the Migratory Bird Treaty Act. Therefore, evidence of large-scale declines in goose populations after the early 20th century does not exist. Evidence of arctic nesting colonies of sufficient size to corroborate early 20th century reports of large goose populations on wintering grounds also is lacking (Abraham and Jefferies 1997).

We do not question the observational abilities of the few naturalists that wrote about flocks of light geese in the mid-continent region near the turn of the 20th century. Nor do we doubt that they often encountered flocks of light geese that were of considerable size. However, it was impossible to obtain accurate range-wide estimates of light goose population size during the pre-survey period. Therefore, we have every reason to believe that current numbers of light geese in the mid-continent region are unprecedented.

Affected Environment

In the early 20th century, Ross's geese were considered to be the rarest goose species that visited the U.S. (Bent 1962). Although locations of the species' breeding colonies were unknown, the principal wintering grounds were limited to the interior valleys of California. No population estimates were made in the early 20th century, although Bent (1962) cites a report of a flock of "several thousand individuals" on the Missouri River in Montana in April 1885.

Early explorers wrote of "many thousands of white and grey geese" near present-day Quebec City in 1535, and "many wild white geese" in the same region in 1663-64 (Abraham and Jefferies 1997). It is presumed that such birds were greater snow geese. Bent (1962) cites a 1906 report by C.E. Dionne of 5,000-6,000 geese on fall and spring migration areas in Quebec that represented "probably all the greater snow geese in a wild state." The limited information available suggests a gradual increase from about 2,000 birds in the early 1900s to approximately 20,000 birds by 1941 (Reed et al. 1998). Clearly, present-day population levels of greater snow geese are unprecedented in recorded history.

3.1.6 Population Status - Spring/Breeding Colony Survey Estimates

Estimation of the spring population of greater snow geese is straightforward, because most birds are encountered during the photo survey in the St. Lawrence Valley. However, determination of the number of breeding lesser snow and Ross's geese in various populations is problematic, because populations are named based on wintering ground affiliation. For example, MCP light geese are comprised of birds that breed in the eastern and central Arctic. WCFP light geese are comprised of birds that breed in the central and western Arctic. Because photo surveys of breeding colonies for a particular region are conducted every 5 years, simultaneous estimates from 2 different portions of a population's breeding range may be lacking. Therefore, we have chosen to present breeding population estimates for lesser snow and Ross's geese for the eastern, central, and western Arctic regions; rather than providing estimates for populations that are named based on wintering ground affiliation.

Greater snow geese. — The spring population estimate of greater snow geese increased from approximately 25,400 birds in 1965, to a preliminary estimate of 1,016,900 birds in 2006 (Reed et al. 1998, Reed et al. 2000; Canadian Wildlife Service, unpublished data; Fig. 3.7). The population growth rate during 1965-2006 was 8.0 % per year, which if sustained will result in a population over 2 million by 2015, and nearly 3 million by 2020. The Atlantic Flyway Council population objective, as well as the North American Waterfowl Management Plan (NAWMP) spring population goal for greater snow geese is 500,000 birds (U.S. Dept. of the Interior et al. 1998). Therefore, the preliminary population estimate for 2006 is 103 % higher than the Atlantic Flyway Council and NAWMP goals. The Arctic Goose Habitat Working Group

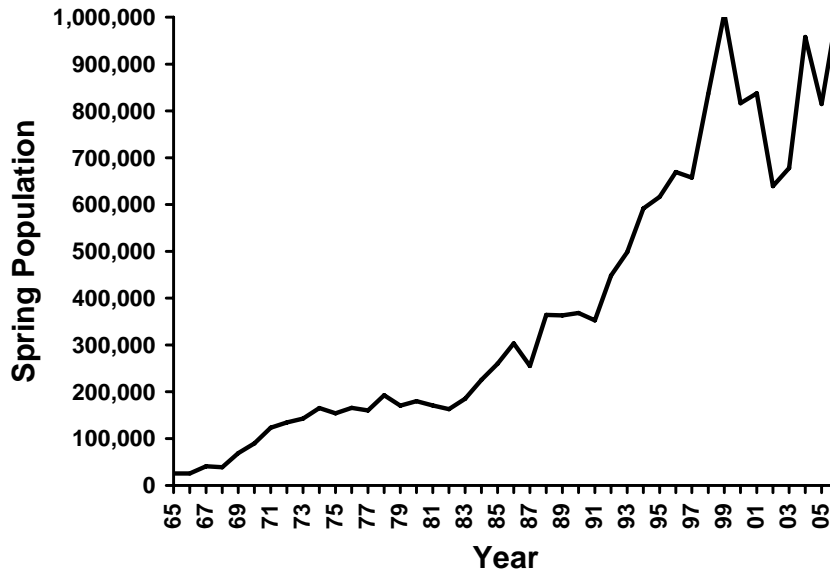


Fig. 3.7. Population growth of greater snow geese as measured by photo-inventories during spring migration in the St. Lawrence River valley, 1965-2006 (Canadian Wildlife Service, unpublished data). The 2006 estimate is considered preliminary as of July 2006.

recommended a short-term management goal of stabilizing the greater snow goose population at between 800,000 to 1 million birds (Giroux et al. 1998). However, a reduction of the population below this level was recommended if natural habitats continue to deteriorate, or if measures taken to reduce crop depredation do not achieve desired results (Giroux et al. 1998). The Canadian Stakeholders Committee in Quebec adopted a population goal of 500,000 birds to address continued habitat degradation and agricultural depredations in the St. Lawrence valley (Arctic Goose Joint Venture Technical Committee 2001).

Light geese in the eastern Arctic. — The number of breeding lesser snow geese on surveyed colonies in 1973 was approximately 1,057,400 birds (Kerbes 1975; Fig. 3.8). During 1973-97, the number of breeding lesser snow geese increased at an annual rate of 4.7%, to the most recent estimate of 3,010,200 birds (Table 3.2). Including additional non-breeding birds, the minimum total number of lesser snow geese in the eastern Arctic was nearly 4 million birds in 1997. The number of Ross’s geese in the eastern Arctic has increased from 2,000 birds in 1990, to 52,000 birds in 1998 (Table 3.2). Population goals for light geese that breed in the eastern Arctic are developed based on their wintering ground affiliation; hence there is no general numeric goal for lesser snow or Ross’s geese that breed in the eastern Arctic.

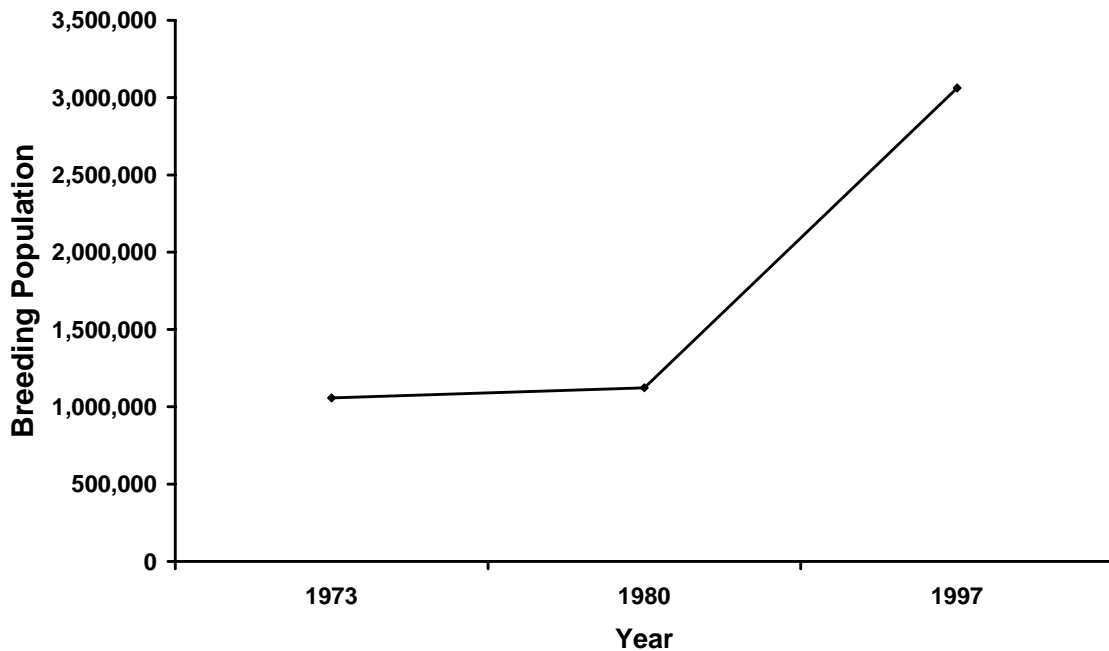


Fig. 3.8. Lesser snow goose population estimates from breeding colonies in the eastern Arctic, determined from photo inventories, 1973-97 (Kerbes 1975, Canadian Wildlife Service, unpublished data). Population estimates do not include Ross’s geese or non-breeding birds.

Light geese in the central Arctic. — In 1966, the number of breeding light geese on surveyed colonies in the central Arctic was 44,300 birds (Kerbes 1994; Fig. 3.9). During the period 1966-98, the number of breeding light geese increased at an annual rate of 11.0%, to the current estimate of 1,383,200 birds (Table 3.1). Lesser snow and Ross’s geese comprised 59% and 41%, respectively, of the total number of breeding geese in 1998 (Table 3.2). Including additional non-breeding birds, the minimum total number of light geese in the central Arctic was nearly 1.8 million birds in 1998. Population goals for light geese that breed in the central Arctic are developed based on their wintering ground affiliation; hence there is no general numeric goal for lesser snow or Ross’s geese that breed in the central Arctic.

Light geese in the western Arctic. — The number of breeding lesser snow geese on surveyed colonies in 1976 was estimated to be 169,600 birds (Kerbes et al. 1999; Fig. 3.10). During the period 1976-2002, the number of breeding lesser snow geese increased at an annual rate of 5.2%, to the most recent estimate of 579,700 birds (Canadian Wildlife Service, unpublished data; Table 3.2). Including additional non-breeding birds, the minimum total number of lesser snow geese in the western Arctic was approximately 753,700 birds in 2002. Ross’s geese are not commonly found on breeding colonies in the western Arctic; however, small numbers are found on Banks Island. Population goals for light geese that breed in the western Arctic are developed based on their wintering ground affiliation; hence there is no general numeric goal for lesser snow or Ross’s geese that breed in the western Arctic.

Table 3.2. Breeding adult lesser snow and Ross's goose population estimates as determined from aerial photo inventories, 1966-99 (compiled by R. Kerbes, CWS, and CWS unpublished data). Inclusion of estimates of non-breeding adults would increase population estimates by 30%.

Year	Lesser snow geese											
	Eastern Arctic						Ross's geese					
	Wrangel Island ¹	Western Arctic	Central Arctic	Baffin Island	Southampton Island	West Hudson Bay	La Perouse Bay	Cape Henrietta Maria	Total	Central Arctic	Eastern Arctic	Total
1966			10,300							34,000		34,000
1973	86,000			446,600	155,800	390,200	5,600	59,200	1,057,400			
1976	58,000	169,900	56,400							77,300		77,300
1977	68,200					353,200						
1978	65,400					331,800						
1979	84,500			454,800	233,000			109,200				
1980	90,700					309,200	17,000		1,123,200			90,800
1981	89,000	207,500										
1982	100,00		105,700							90,800		
1985	85,000					436,400	28,100					
1987	100,00	205,100										
1988	80,000		279,000							188,000		
1990	60,000					201,900	46,400				2,000	190,000
1995	65,000	486,100										
1997				1,766,500	715,900	153,500	66,000	280,200	3,010,200			
1998			816,100							567,100	52,000	619,100
1999												
2000	95,000											
2002		579,700										

¹ Estimates for Wrangel Island represent total birds, including yearlings and non-breeding birds (Kerbes et al. 1999). Number of breeding birds varies widely depending on spring conditions.

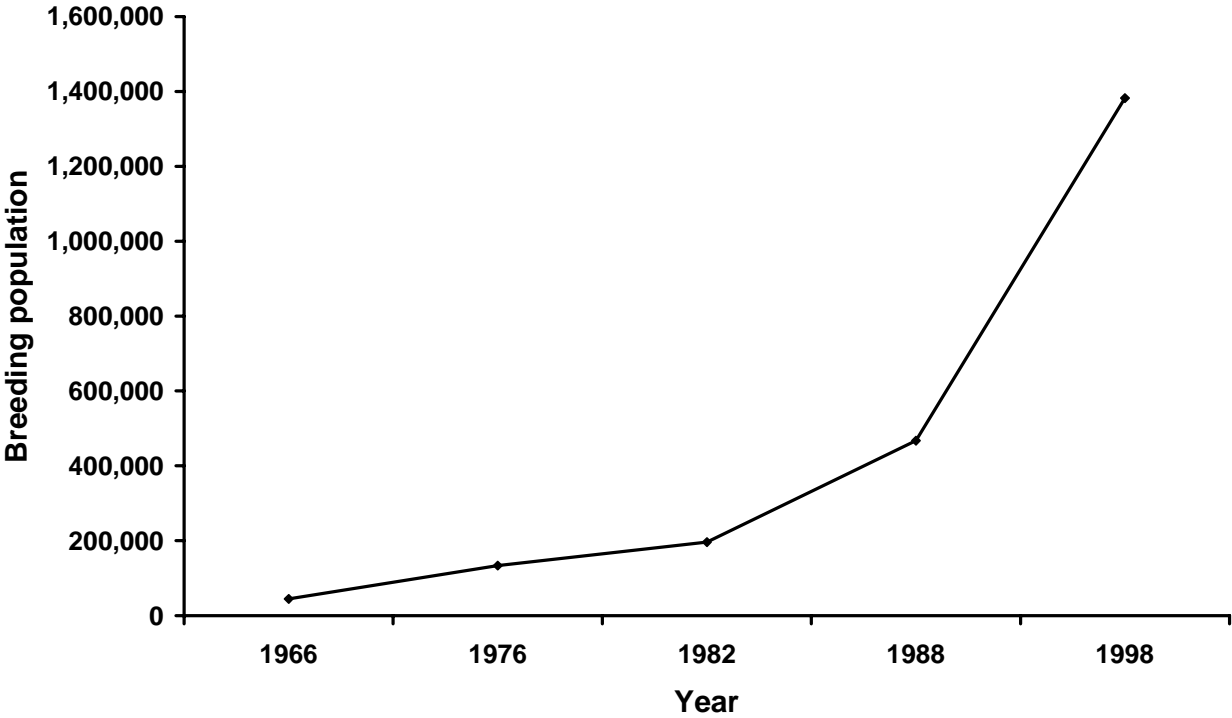


Fig. 3.9. Light (lesser snow and Ross's) goose population estimates from breeding colonies in the central Arctic as determined from photo inventories, 1966-98 (Kerbes 1994, Canadian Wildlife Service, unpublished data). Population estimates do not include non-breeding birds.

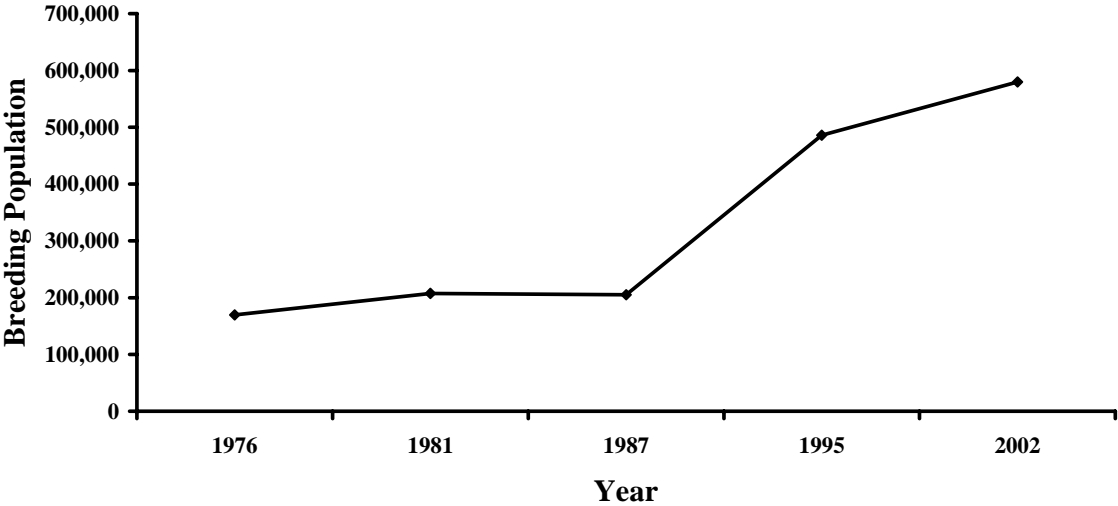


Fig. 3.10. Lesser snow goose population estimates from breeding colonies in the western Arctic as determined from photo inventories, 1976-2002 (Kerbes et al. 1999, Canadian Wildlife Service, unpublished data). Population estimates do not include non-breeding birds.

Wrangel Island Population of lesser snow geese. — The total population (breeders and non-breeders) of lesser snow geese on Wrangel Island declined from approximately 150,000 birds in 1970 to 56,000 birds in 1975, due to four consecutive years of poor reproductive success (Kerbes et al. 1999). The population increased during the 1980s to nearly 100,000 birds, but averaged only about 65,000 birds in the mid-1990s. In recent years the population size has increased, and was approximately 115,000 birds in 2005 (U.S. Fish and Wildlife Service 2005).

3.1.7 Population Status - Winter Survey Indices

Greater snow geese. — The winter index of greater snow geese has increased from approximately 46,000 birds in 1955, to approximately 385,000 birds in 2006 (U.S. Fish and Wildlife Service, unpublished data; Fig. 3.11). The index has been as high as 465,000 birds in recent years. The winter survey is a useful tool for providing information on the winter distribution of snow geese in the Atlantic Flyway. However, the winter survey counts a smaller proportion of the population than does the spring survey.

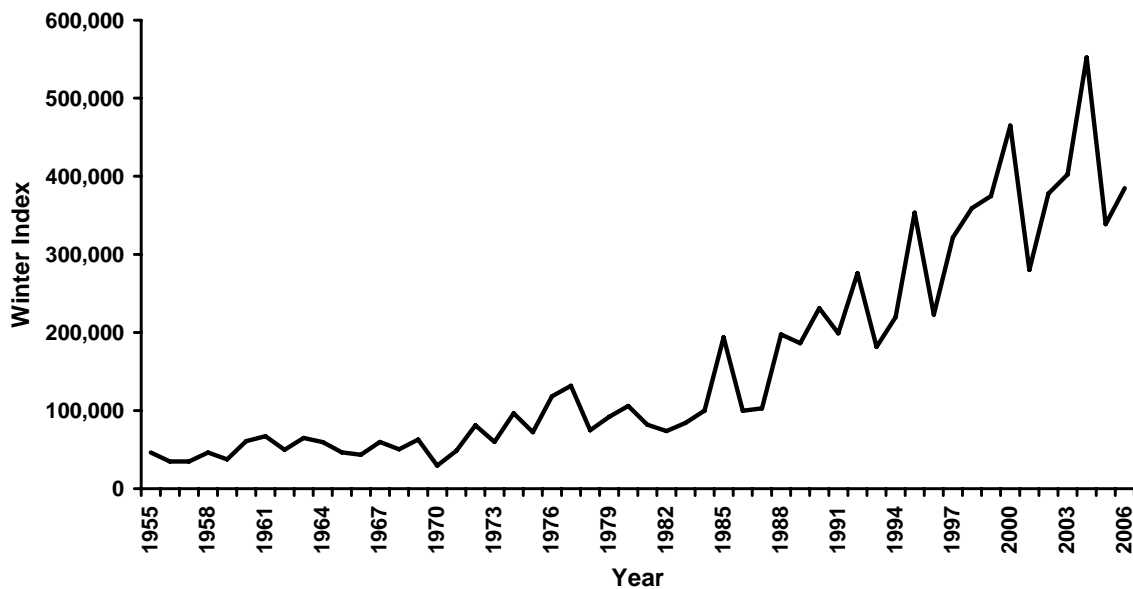


Fig. 3.11. Winter index of greater snow geese in the Atlantic Flyway, 1955-2006.

Mid-continent Population (MCP) of light geese. — The winter index of MCP light geese increased at a rate of 3.5% per year from approximately 777,000 birds in 1970, to a peak of nearly 3 million birds in 1998 (Fig. 3.12; U.S. Fish and Wildlife Service 2002). Following implementation of the conservation order in 1999, the winter index declined to 2.2 million in 2006. Field studies indicate that MCP light geese wintering in Texas are comprised of approximately 94% lesser snow geese and 6% Ross’s geese (Sullivan 1995). Surveys conducted in Louisiana during 2001 and 2002 indicated that lesser snow geese comprised 90-98%, and Ross’s geese 2-10% of light geese wintering in the state (Helm 2002). Using the average of

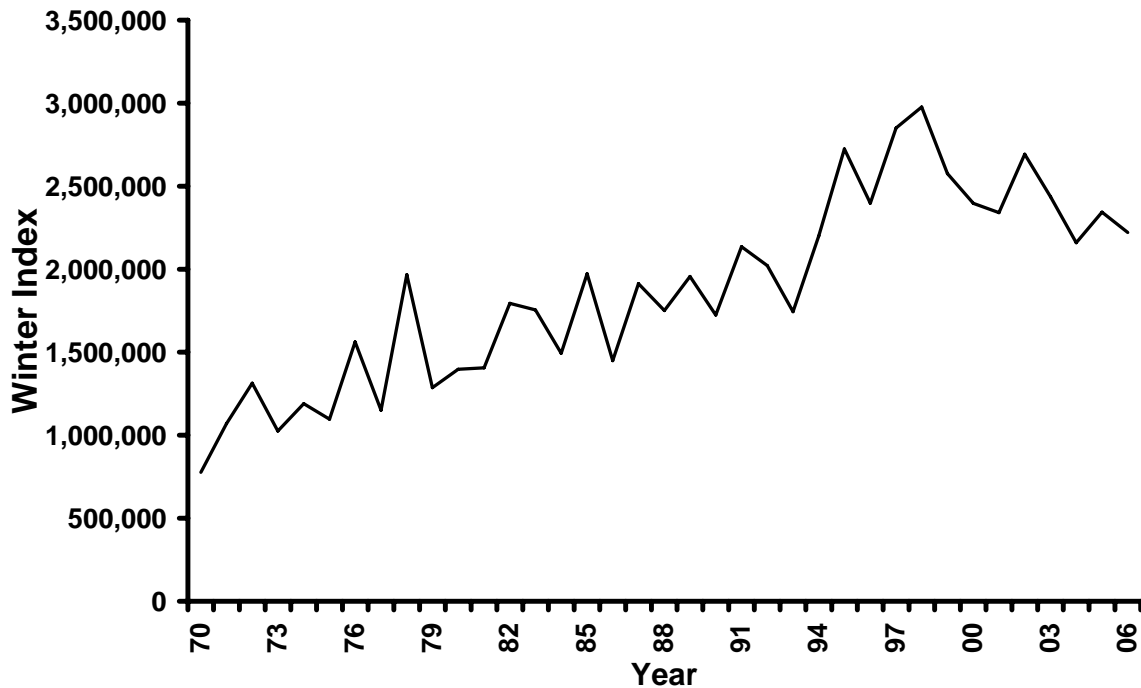


Fig. 3.12. Winter index of the Mid-Continent Population of light geese, 1970-2006.

species composition in Texas and Louisiana, the lesser snow and Ross’s goose portions of MCP light geese in winter 1998 were approximately 2.8 million and 179,000 birds, respectively. The NAWMP winter index goal for MCP lesser snow geese is 1 million, and the Central and Mississippi Flyway Councils have set an upper management threshold (winter index) of 1.5 million for MCP lesser snow geese. The peak of the lesser snow goose winter index in 1998 was 198% higher than the NAWMP goal, and 98% higher than the management threshold adopted by the Flyway Councils. The 2006 winter index of lesser snow geese remained 109% higher than the Flyway Council management threshold and 39% higher than the NAWMP goal. There is no Flyway Council or NAWMP goal for Ross’s geese in the MCP geographic range.

Western Central Flyway Population (WCFP) of light geese. — The winter index of WCFP light geese increased from 42,000 birds in 1970, to approximately 256,000 birds in 2000 (Fig. 3.13; Sharp and Moser 2000). During 1970-2000, the WCFP winter index increased 6.5% per year. Surveys were not flown in Mexico in 1998 or 1999 prior to implementation of the conservation order. Therefore, a complete WCFP winter index for the U.S. and Mexico was not available in 1998 to compare with the MCP peak that occurred in that year. As a result of increased harvest due to the light goose conservation order, the 2006 WCFP winter index has declined to approximately 228,000 birds.

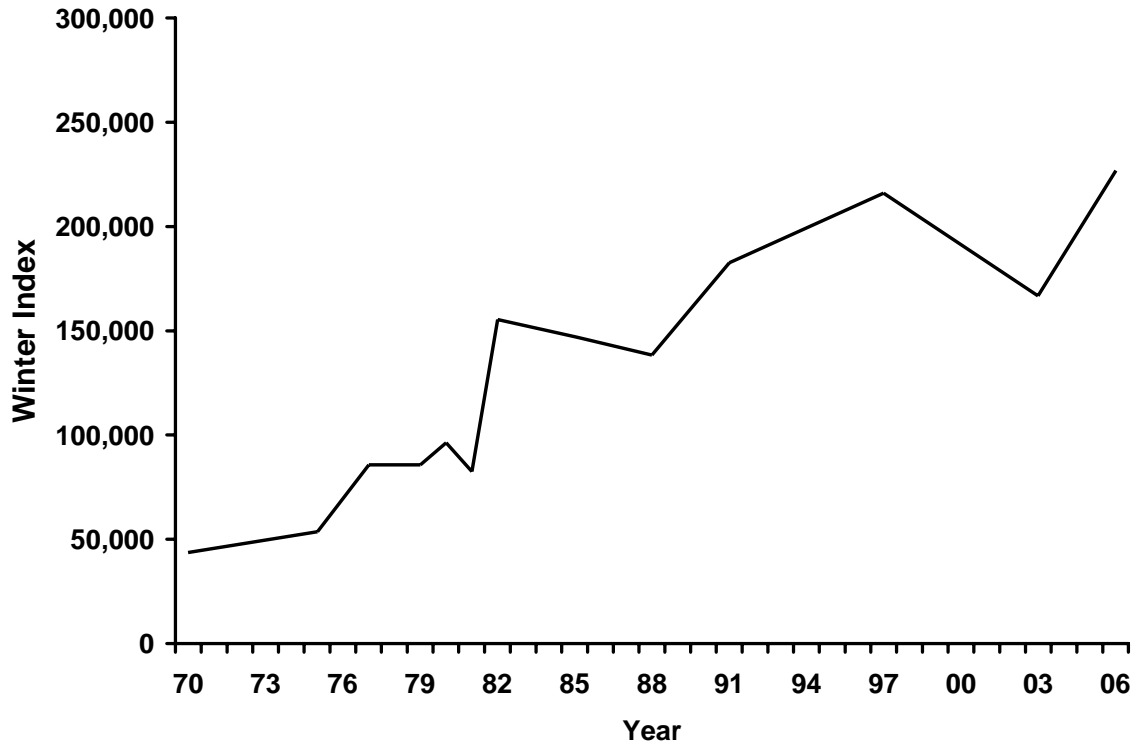


Fig. 3.13. Winter index of the Western Central Flyway Population of light geese, 1970-2006.

Lesser snow geese and Ross’s geese comprise approximately 76% and 24%, respectively, of WCFP light geese (Thorpe 2000). Using these proportions when the population peaked in 2000, the Ross’s goose component of WCFP light geese was approximately 61,700 birds. The lesser snow goose portion of WCFP light geese during the same year was approximately 194,300 birds; which was 77% higher than the NAWMP winter index goal of 110,000 for WCFP lesser snow geese. The 2006 winter index of 173,100 WCFP lesser snow geese (76% of the WCFP light goose index) was 57% higher than the NAWMP goal. Flyway Councils have not set management thresholds for WCFP lesser snow or Ross’s geese. There is no NAWMP goal for Ross’s geese in the WCFP geographic range.

MCP and WCFP components of CMF light geese were not tallied separately until 1970. However, winter indices for CMF light geese (MCP and WCFP combined) are available beginning in 1955. The U.S. portion of the winter index of CMF light geese increased from 693,421 birds in 1955 to 3.1 million birds in 1998 (Fig. 3.14). During 1955-1998, the CMF light goose winter index grew at an annual rate of 3.7%. However, the index declined at an annual rate of 2.7% after 1998 and was estimated to be approximately 2.4 million birds in 2006.



Fig. 3.14. Winter index of Central/Mississippi Flyway (CMF) light geese, 1955-2006. Only years in which surveys were flown in Mexico are plotted.

Western Population of Ross’s geese (WPRG). — Annual winter indices are not available for the WPRG because it mixes with other light goose populations in the Pacific Flyway (Fig. 3.15). Special surveys conducted during the winters of 1988 and 1989 produced estimates of 214,700 and 168,400 Ross’s geese in the Central Valley of California (Silveira 1989, 1990). A December, 2000, survey in California resulted in an estimate 256,000 Ross’s geese (U.S. Fish and Wildlife Service, unpublished data).

The NAWMP does not contain winter index goals for Ross’s geese. Instead, a continental breeding population goal of 100,000 Ross’s geese is utilized. The Pacific Flyway Council (1992) has adopted a winter index goal of 150,000 Ross’s geese. The combined 2000 winter index total of 408,750 MCP, WCFP, and WPRG Ross’s geese is 172% higher than the Pacific Flyway Council winter index goal, and 308% higher than the NAWMP breeding population goal.

Pacific Flyway Population of lesser snow geese. — No winter indices are available for PFSG because they mix with other light goose populations in the Pacific Flyway (Fig. 3.15). The distribution of band recoveries indicates that 87% of lesser snow geese banded in the western Arctic are recovered in the

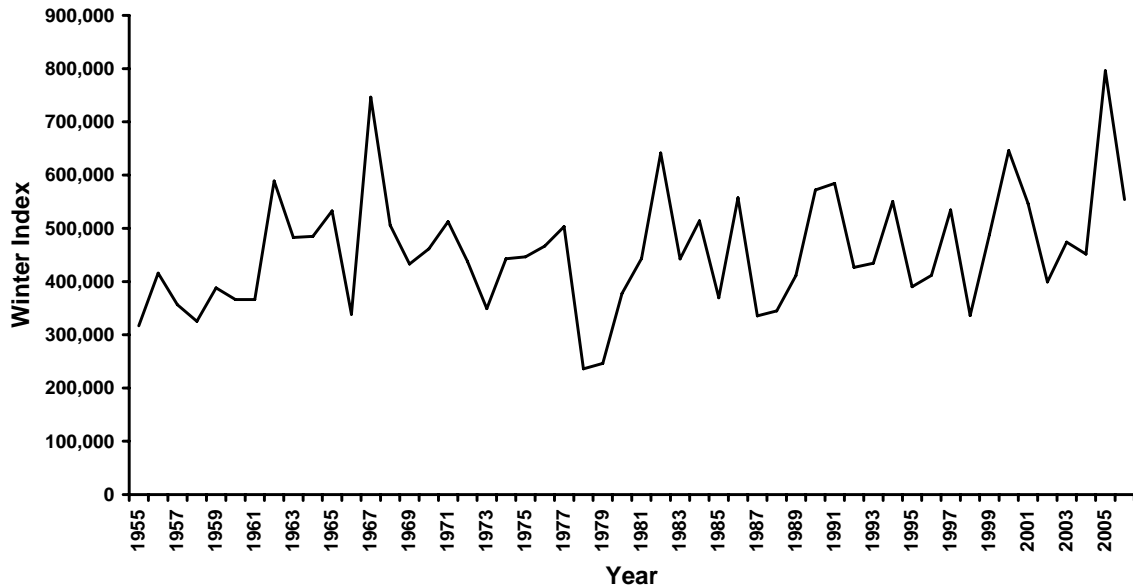


Fig. 3.15. Winter index of light geese in the Pacific Flyway, 1955-2006. Birds included in the index are derived from several breeding populations in the central and western Arctic, and Wrangel Island.

Pacific Flyway, whereas 2% or less of birds banded in the central and eastern Arctic are recovered in the Pacific Flyway (Table 3.1). Species composition surveys conducted in December, 2000, indicated a total of 409,000 lesser snow geese wintering in California (U.S. Fish and Wildlife Service, unpublished data).

Wrangel Island Population of lesser snow geese. — No winter indices are available for this population because it mixes with other light goose populations in the Pacific Flyway.

3.1.8 Population Status - Summary

The number of greater snow geese and CMF light geese increased dramatically during the past 30 years. Western arctic lesser snow geese have increased as well; however, their rate of increase has been slower than populations occurring to the east. The Wrangel Island lesser snow goose population has fluctuated widely, likely due to frequent failures in reproduction as a result of poor spring weather. Utilizing the most recent estimates for known colony sites, and accounting additional non-breeding birds, there currently are a minimum of approximately 5.8 million lesser snow and Ross’s geese in the eastern and central Arctic, 0.7 million lesser snow geese in the western Arctic and Wrangel Island. The spring population of greater snow geese in the St. Lawrence River Valley is approximately 1 million birds.

North American Waterfowl Management Plan population goals for greater snow geese, MCP and WCFP lesser snow geese, and Ross’s geese (MCP and WCFP combined) have all been exceeded. The joint

Central and Mississippi Flyway Council upper management threshold for MCP lesser snow geese was exceeded by 98% at the population peak. The Atlantic Flyway Council population objective for greater snow geese has been exceeded by 103%. These light goose population levels are the highest in recorded survey history, and likely are unprecedented (Abraham and Jeffries 1997; Reed et al. 1998).

3.1.9 Impacts of breeding habitat degradation on light geese

Habitat degradation on certain portions of the breeding grounds, and subsequent reduction in food resources, has led to several demographic changes in the goose populations using such areas. At the breeding colony at La Perouse Bay, lesser snow geese have experienced long-term declines in clutch size (Cooch et al. 1989), gosling body size (Cooch et al. 1991a,b) and gosling survival (Williams et al. 1993). These demographic parameters were negatively correlated with the size of the breeding colony, as well as the total flyway population, both of which increased significantly during the period of study (Cooch et al. 1989). Increasing numbers of breeding geese at La Perouse Bay caused a long-term degradation of habitat and reduction in available food resources (Williams et al. 1993). Reed and Plante (1997) documented a long-term decline in body mass, size, and condition of greater snow geese harvested on fall migration areas in Quebec. It was suggested that the declines in body size and condition of greater snow geese was due to a reduction in food availability on the breeding grounds (Reed and Plante 1997). However, the population had not yet shown any decline in productivity (Reed and Plante 1997).

Although the relative contribution of nutrients obtained on migration, staging area, or breeding colony sites in determining eventual clutch size of snow geese is not well understood, it is possible that decreased food availability on breeding areas has contributed to reduced clutch sizes (Cooch et al. 1989). Certainly, reduced food availability contributes directly to reduced gosling size at fledging and reduced gosling survival (Cooch et al. 1991a,b; Williams et al. 1993). Reed and Plante (1997) suggested that food availability on agricultural lands on migration and wintering areas may enable greater snow geese to attain adequate body condition for successful reproduction in spring. However, continued declines in body condition eventually will lead to reduced reproduction (Reed and Plante 1997).

The decline in body size of offspring of individual females in different nesting years suggests an environmental, rather than genetic (or selectional), basis for the change (Cooch et al. 1991a). Older female lesser snow geese tend to return to their natal colony areas, which have been degraded. However, younger females have recently tended to nest outside the traditional areas at La Perouse Bay and may be using more distant brood-rearing sites that have not been degraded (Rockwell et al. 1993, Cooch et al. 2001). Individuals that disperse to new areas experience higher reproductive success (Cooch et al. 2001), and thus "cheat" density-dependent regulation of the population (Abraham and Jefferies 1997). Correspondingly, the number of geese nesting at traditional colony sites at La Perouse Bay has declined, even though the number of geese

in the overall population nesting at La Perouse Bay and surrounding Cape Churchill area has increased (Cooch et al. 2001).

3.1.10 Migration and Wintering Ecology

Greater snow geese. — Upon leaving breeding colonies in late August, greater snow geese make an initial migration flight of over 1000 km to the central portion of the Ungava Peninsula. Geese stage on the Ungava for several days before they undertake a second long migration flight to the St. Lawrence River. Traditionally, birds staged during October almost exclusively on the St. Lawrence within a relatively small area of bulrush marshes before leaving on a non-stop flight to Delaware Bay (Reed et al. 1998). Beginning in the 1980s, some geese began dispersing from traditional staging areas early in October and moved southwesterly to Lake Saint-Pierre or northern Lake Champlain, where they feed in agricultural fields. Geese inhabit these new staging areas well into November and December. However, some birds are now overflying the St. Lawrence altogether, and are flying directly to the U.S. in fall (Maisonneuve and Bedard 1992).

The winter range of greater snow geese extends along the Atlantic coast from New Jersey to South Carolina. Main concentration areas are in New Jersey, Delaware, Maryland, Virginia and North Carolina. As a result of population growth, there has been an increase in the number of birds wintering in Maryland and Delaware. Beginning in 1991, there also has been an increase in the number of birds wintering in New Jersey, Pennsylvania and New York. Concurrent decreases have occurred in the number of birds wintering in southern portions of the range (Reed et al. 1998).

Historically, greater snow geese flew non-stop in spring from Delaware Bay to traditional bulrush marshes on the St. Lawrence River. However, many birds now make intermediate stops on Lake Champlain, the Richelieu River, and Lac Saint-Pierre before moving to traditional marshes on the St. Lawrence. Many of these intermediate stopover areas have an agricultural base and are becoming important staging areas. In late May, some geese may stage for a short time in central and eastern portions of the Ungava Peninsula before migrating to breeding colonies (Reed et al. 1998).

Feret et al. (2003) documented apparent effects of the spring conservation harvest in Quebec on the ability of greater snow geese to store nutrient reserves on staging areas. Conservation harvest activity in Quebec is restricted to farmlands, and hunter activity on such lands during spring may have decreased the amount of time that geese could feed on agricultural foods such as corn (Feret et al. 2003). Reduction in time spent foraging on agricultural foods may have indirectly caused observed reductions in body condition of geese staging in Quebec during spring (Feret et al. 2003). Nesting studies indicated that reduced body condition in years with spring harvest likely caused a reduction in goose production as well (Mainguy 2002). The fact that body condition of birds is reduced when access to agricultural foods is restricted lends support

Affected Environment

to our contention that an agricultural food subsidy has improved winter and spring condition of birds and has contributed to population growth.

Mid-continent Population (MCP) of light geese. — Prior to 1960, the lesser snow goose component of the MCP wintered exclusively on coastal marshes in Texas and Louisiana (Bateman et al. 1988). The migration from arctic breeding areas to the Gulf Coast often was completed nearly nonstop, with only occasional short stopovers (Lynch 1975). Therefore, light goose populations would not have been affected by wetland losses in interior portions of the continent in the first half of the 20th century. However, during the 1960s, noticeable changes in migration habits became evident. For example, Squaw Creek National Wildlife Refuge (NWR) in northwest Missouri rarely received any usage by snow geese during the 1940s. In the early 1970s, more than 200,000 snow geese regularly stopped at Squaw Creek NWR during fall migration (Bateman et al. 1988). Sand Lake NWR in South Dakota, and DeSoto Bend NWR in Iowa also held more than 200,000 snow geese during fall migration in the 1970s. Migration shifts continued, and MCP snow geese eventually began to stop in southern Canada and North Dakota during fall migration (Bateman et al. 1988). Currently, their wintering grounds extend across Texas, Louisiana, Arkansas, Oklahoma, Mississippi, and New Mexico and the central highlands of Mexico.

Prior to 1920, MCP lesser snow geese wintered primarily in a narrow band of brackish marsh along the Texas and Louisiana coasts (Bateman et al. 1988; Fig. 3.16). Birds seldom moved inland more than a few miles and did not consistently use bluestem prairies that lay directly north of marshes. Geese exhibited this distribution pattern until the 1920s in Texas, and the 1940s in Louisiana (Bateman et al. 1988). Due to the finite amount of suitable coastal marsh habitat available on the wintering grounds, winter food resources were presumed to be a limiting factor for winter survival (Lynch 1975).

As the extent of rice culture began to increase in Texas and Louisiana, rice fields became larger and were developed farther away from human activity centers. In addition, rice agriculture moved closer to the brackish marshes that geese inhabited. By the late 1940s, rice culture had expanded to and dominated the bluestem prairie areas of Texas and Louisiana, extending inland as far as 160 km at some points (Bateman et al. 1988). Geese began to utilize rice fields in Texas about 1920, but not until the 1940s in Louisiana. Texas rice fields were closer to natural marshes than those in Louisiana, which facilitated an earlier initiation date of use by geese. In the 1940s and 1950s, some landowners began pumping water into harvested rice fields and restricted hunting in and around water areas to hold birds for improved hunting. As a result, secure roosting areas were created (Bateman et al. 1988). Continued inland expansion of agricultural areas fostered a similar expansion of light goose wintering range. Furthermore, the addition of over 400,000 ha of rice culture significantly increased the amount of food resources available to geese.

Affected Environment

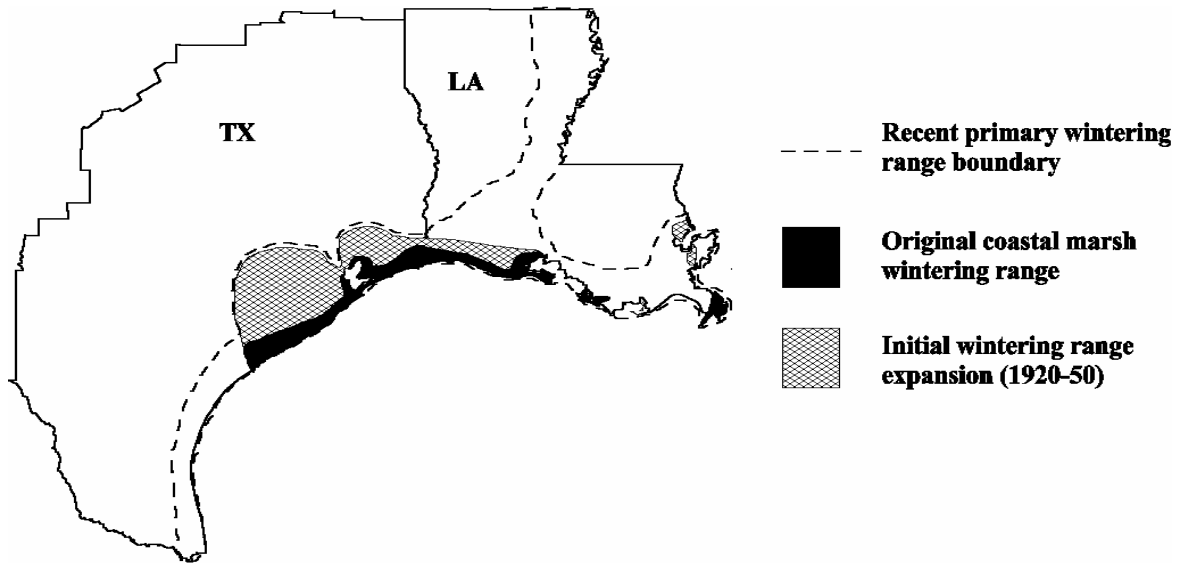


Fig. 3.16. Original coastal marsh wintering range (black shading), extent of initial range expansion (cross-hatch), and recent wintering range boundary (dashed line) of light geese in Texas and Louisiana (adapted from Bateman et al. 1988).

Historically, Ross's geese wintered in the interior valleys of California and eventually expanded into WCFP wintering range. In the early to mid-1980s, Ross's geese began to expand eastward and mix extensively with MCP lesser snow geese during winter. Evidence for this range expansion is illustrated by the increased occurrence of Ross's geese in harvests from eastern areas between 1974 and 1996. Inland range expansion of Ross's geese occurred in a fashion similar to that of lesser snow geese.

Western Central Flyway Population (WCFP) of light geese. — WCFP light geese typically migrate south along the western edge of the Central Flyway and winter primarily in northwestern Texas, Oklahoma, New Mexico, and the Central Highlands of Mexico. They have expanded their range and today overlap the MCP light goose range during spring migration. Their expansion inland, concurrent with agricultural expansion, was similar to that of MCP light geese.

Similar to the exploitation of agriculture in the wintering States, CMF light geese migrating through the mid- and northern-latitudes exploited cereal grain crops consisting of corn, wheat, barley, oats and rye and continue to do so today (Alisauskas et al. 1988). For example, an estimated 1 to 2 million light geese stage in the Rainwater Basin in Nebraska from mid-February to mid-March and primarily feed on post-harvest waste corn (USFWS 1998a). These waste crops provide light geese with additional nutrients during spring migration, thus enabling birds to arrive on the breeding grounds in prime condition to breed. Increased food resources afforded by agriculture during spring migration resulted in higher reproductive potential and breeding success (Ankney and McInnes 1978, Abraham and Jefferies 1997). Consequently,

Affected Environment

more geese survived the winter and migration and were healthier as they returned to their breeding grounds in Canada.

Pacific Flyway Population of lesser snow geese (PFSG). — Lesser snow geese following westerly migration corridors interrupt their fall migration more frequently to rest and feed than do birds to the east (Bellrose 1980). The Mackenzie Delta is the major staging area for lesser snow geese in the western Arctic before birds move on to resting and feeding areas in southeastern Alberta and southwestern Saskatchewan (Bellrose 1980, Armstrong et al. 1999). In Montana, the migration corridors diverge into three components; one directed toward the southwest to the Klamath Basin of northern California, one south-southwest to Nevada, and a third directly south to the Bear River marshes in Utah. Eighty percent of western arctic lesser snow geese marked with neckbands migrated to the Klamath Basin and Central Valley, whereas smaller numbers winter in the Imperial Valley of California (Armstrong et al. 1999).

Lesser snow geese wintering in California shifted their feeding habits several decades ago from natural marsh plants to agricultural foods (Bellrose 1980). Geese consume grains of barley, wheat, and rice, and they also graze on shoots of pasture grasses and cereal grains. Natural marsh plants such as alkali bulrush are still important foods for lesser snow geese in the Bear River marshes of Utah and the Klamath Basin in California (Bellrose 1980).

Western Population of Ross's geese (WPRG). — Upon leaving breeding areas in the Queen Maud Gulf, many Ross's geese migrate to the Peace-Athabasca River Delta in northern Alberta (Bellrose 1980). Birds then move through eastern Alberta and western Saskatchewan, with some stopping near Freezeout Lake, Montana until mid-October (Bellrose 1980, Ryder and Alisauskas 1995). Most birds migrate through the Klamath Basin in California and winter either in the Sacramento Valley or in the grasslands of the San Joaquin Valley (Bellrose 1980, Ryder and Alisauskas 1995). During winter, Ross's geese utilize agricultural habitat much of the time for feeding (Ryder and Alisauskas 1995). Barley is an important food for birds in the Klamath Basin, whereas rice is commonly used in the Sacramento Valley (Bellrose 1980).

Wrangel Island Population of lesser snow geese. — Most lesser snow geese from Wrangel Island migrate along several corridors off or along the coast of southeast Alaska and British Columbia (Bellrose 1980). A small number of birds migrate to wintering areas through prairie areas in Alberta and Saskatchewan (Armstrong et al. 1999). Observations of birds marked with neckbands indicate that Wrangel Island birds winter either in British Columbia, Washington, or in the Central Valley of California (Armstrong et al. 1999). Food habits of Wrangel Island birds are assumed to be similar to other lesser snow geese in such wintering areas.

3.1.11 Harvest Estimates

Federal frameworks. — Light goose harvest is influenced by several variables that comprise frameworks for hunting seasons in the U.S. Federal frameworks are comprised of earliest opening and latest closing dates for hunting seasons and maximum season length and daily bag and possession limits (Appendix 7). State hunting regulations may be more restrictive than Federal frameworks, but cannot be more liberal. Waterfowl managers have attempted to increase the harvest of light geese by liberalizing all components of the Federal frameworks. Possession limits for light geese were increased in 1980 from 5 to 10 birds in the Mississippi Flyway and portions of the Central Flyway. Beginning in 1984, season closing dates were moved closer to the March 10 closing date allowed by the Migratory Bird Treaty. The season length for light geese was 60 days in 1961, but by 1991 had been increased to 107 days in western portions of the Central Flyway and all portions of the Mississippi and Central Flyways by 1994. In 1998 the daily bag limit for light geese was increased from 10 to 20 birds, and possession limits were eliminated.

Greater snow geese. — Regular season harvest estimates for greater snow geese in the U.S. and Canada are presented in Figure 3.17. The hunting season in the U.S. was re-opened in 1975. We calculated a regular season harvest rate index for greater snow geese by dividing the estimated regular season harvest in the U.S. and Canada by the population estimate of the previous spring (Fig. 3.18). To obtain a more accurate estimate of the harvest rate that includes harvest from the recent spring conservation order in Quebec, we determined the approximate fall population size using the method described by Reed et al. (1998). The size of the adult population in fall 1999 was determined by applying a spring-to-fall survival rate of 0.946 to the 1999 spring population estimate. The number of juveniles in the fall population was estimated by multiplying the adult population size in fall by the proportion of juveniles in the fall flight (0.028; Ferguson 1999), divided by the proportion of adults in the fall flight. We estimated a harvest rate of 15% by dividing the sum of the continental harvest during the 1999/00 regular season and the spring conservation harvest in Quebec during 2000, by the 1999 fall population estimate. Similar calculations produced harvest rate estimates ranging from 13% to 25% during 2000-2004 (Table 3.3)

Table 3.3. Parameters used to estimate harvest rates of greater snow geese, 1999-2004.

Fall/Spring	Regular season harvest		Conservation order harvest	Total harvest	Fall population	Harvest rate
	U.S.	Canada	Quebec			
1999/2000	54,115	43,000	54,600	151,715	981,037	0.15
2000/2001	70,495	108,500	49,800	228,795	1,181,054	0.19
2001/2002	77,354	97,116	71,800	246,270	998,966	0.25
2002/2003	38,734	48,259	22,650	109,643	622,199	0.18
2003/2004	35,067	89,738	32,900	157,705	761,743	0.21
2004/2005	31,548	66,326	34,594	132,468	1,030,591	0.13

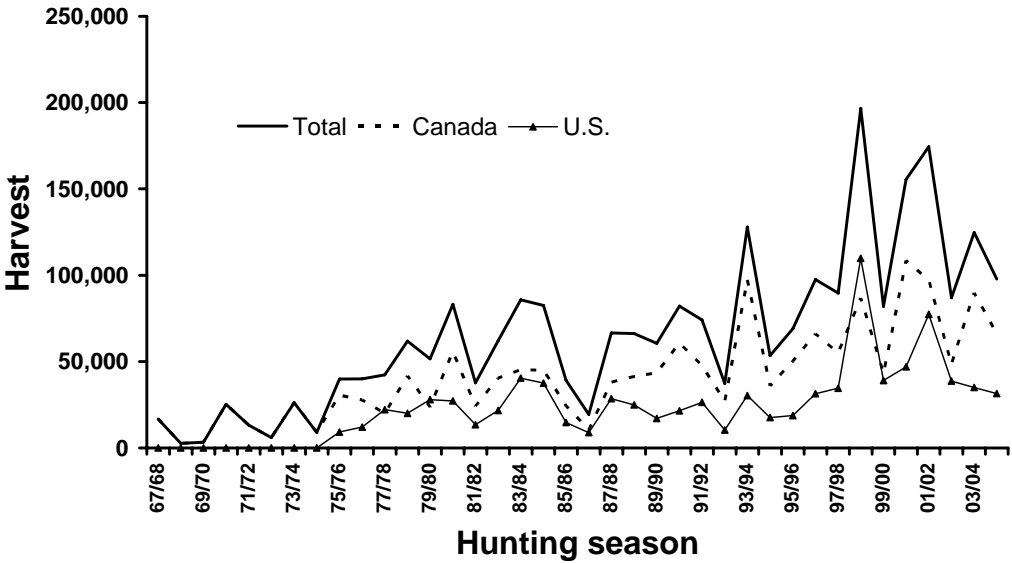


Fig. 3.17. Regular season harvest of greater snow geese in Canada and the U.S., 1967-04. U.S. estimates after 1998 are derived from the Harvest Information Program.

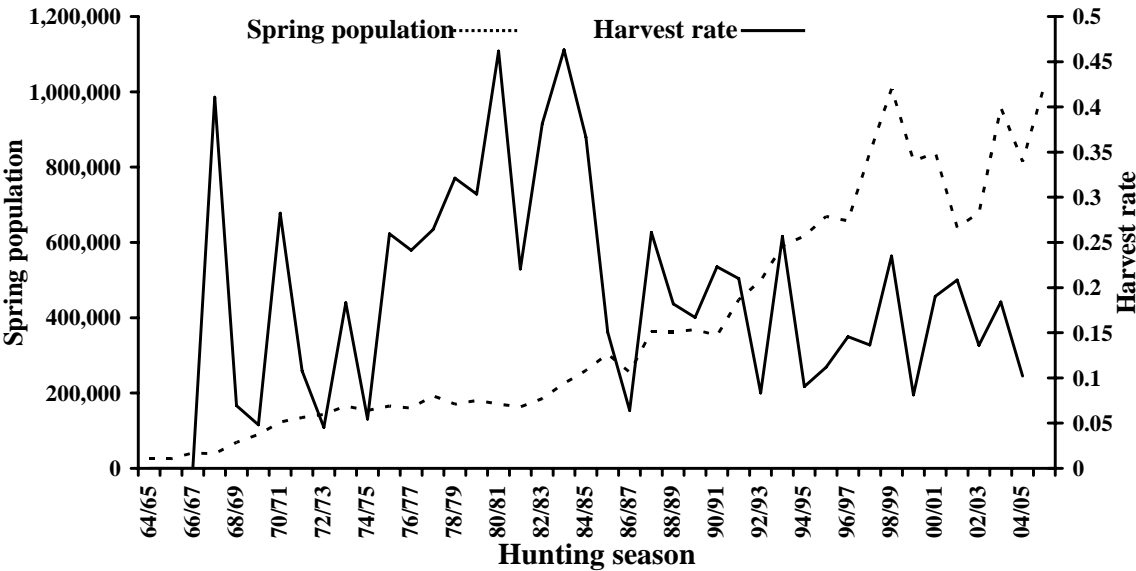


Fig. 3.18. Spring population estimates (1964-05) and regular season harvest rate indices (1967-05) of greater snow geese in the Atlantic Flyway. U.S. estimates after 1998 are derived from the Harvest Information Program.

Affected Environment

CMF light geese. — Gradual liberalizations in regular-season frameworks prior to 1999 were ineffective at controlling the population growth of CMF light geese, as indicated by the harvest rate. Surveys to estimate light goose harvest were implemented in 1962. A crude index to the harvest rate was obtained by dividing the total estimated harvest in a given season by the population winter index for that season. This is not equal to the true harvest rate because the winter index represents only a certain portion of the total winter population. The harvest rate index for CMF light geese gradually declined after the 1960s, to a low in 1992/93 season (Fig. 3.19). This was partially due to a decrease in hunter numbers, but was primarily due to the high growth rate of the light goose population during this period (Fig. 3.20).

Concurrent with the advent of 107-day seasons in the early 1990s, total regular-season harvest of CMF light geese increased in a nearly linear fashion (Fig. 3.20). During 1992-1997, total regular-season CMF light goose harvest increased by approximately 79,800 birds each year. In spring 1999, alternative harvest strategies were implemented in the Central and Mississippi Flyways in an attempt to reduce the number of CMF light geese (February 16, 1999, *Federal Register*; 64 FR 7507-7529). Strategies included authorization of the use of electronic calls and unplugged shotguns to hunt light geese during the regular season when all other waterfowl and crane seasons (excluding falconry) were closed. In addition, States were authorized to implement a conservation order that allowed take of CMF light geese at any time of year, authorized use of electronic calls and unplugged shotguns, removed bag limits, and extended shooting hours, provided that all waterfowl and crane hunting seasons (excluding falconry) were closed.

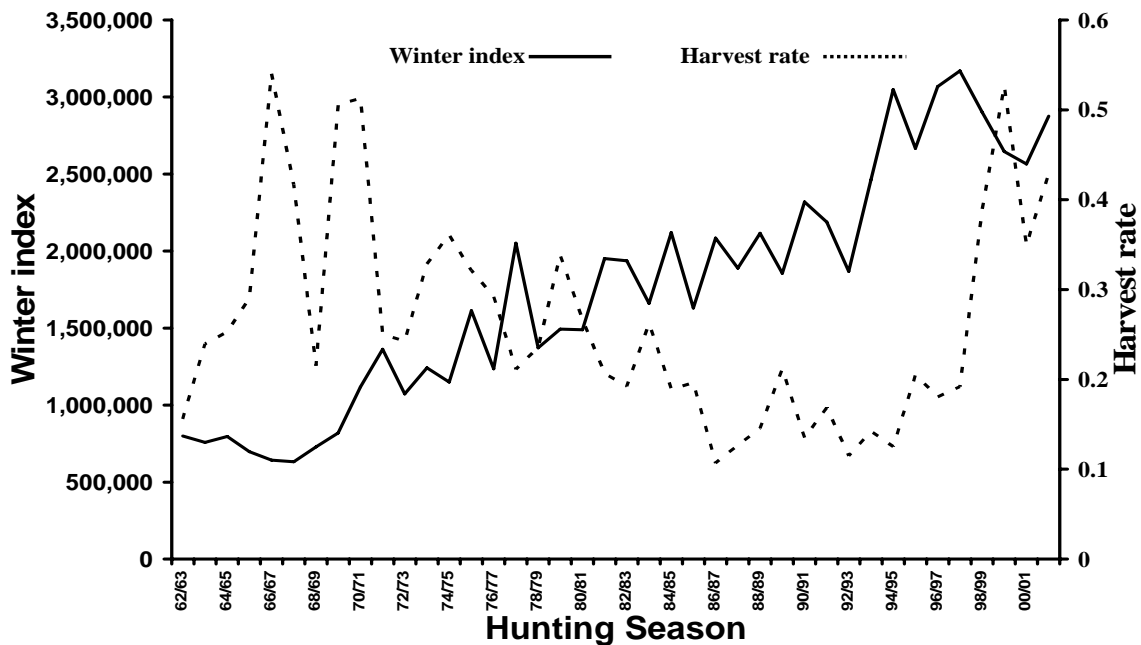


Fig. 3.19. Winter indices and harvest rates of Central/Mississippi Flyway light geese, 1962-2002.

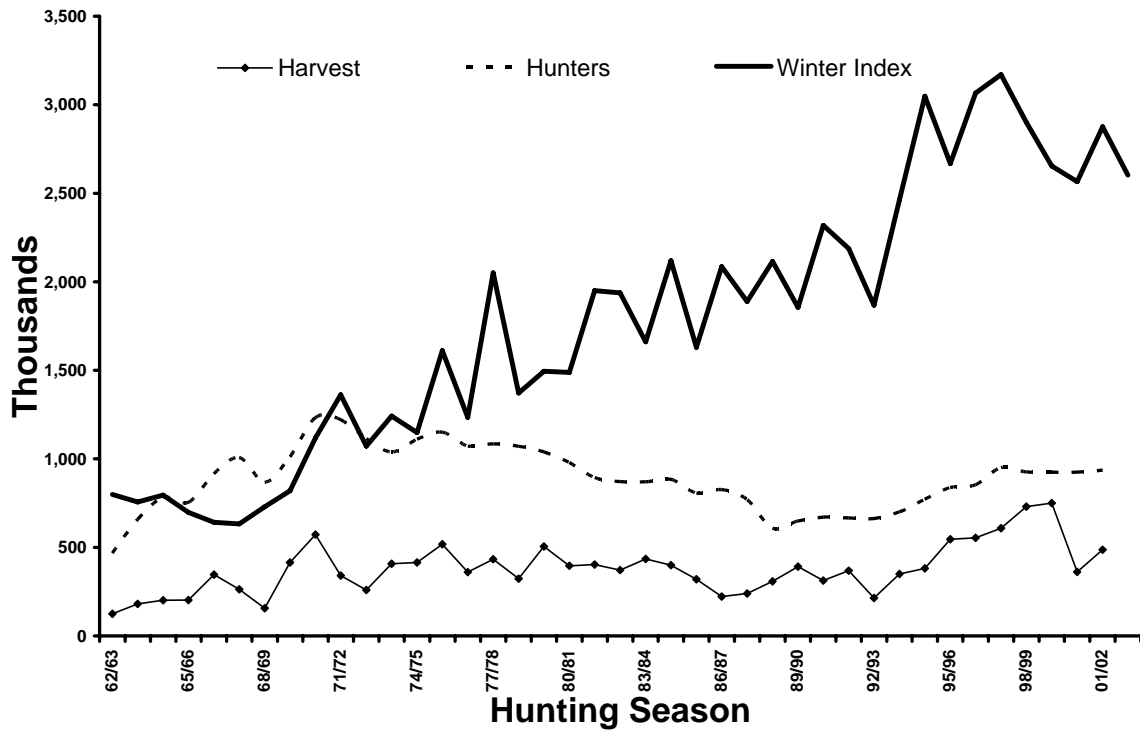


Fig. 3.20. Winter indices and harvests of Central/Mississippi Flyway light geese and active adult hunter numbers, 1962-2002.

To be eligible to implement a conservation order during the September 1-March 10 period in which hunting is allowed by the Treaty, States were required to close their regular seasons for waterfowl and cranes (excluding falconry). During winter and spring 1999, approximately 93,302 light geese were taken during the regular season in the time period when alternative methods of take were authorized in participating States (Table 3.3). In addition, approximately 398,455 light geese were taken during the conservation order.

The alternative light goose regulations were subsequently challenged in court in May 1999, and we eventually withdrew them in order to prevent further litigation. However, the regulations were later reinstated in November 1999, through enactment of the Arctic Tundra Habitat Emergency Conservation Act (P.L. 106-108). Following the 1998/99 season, there has been a decline in the number of light geese taken in the regular season during periods when special regulations were authorized in participating States (Table 3.4). This decline in special harvest during the regular season is due to the fact that more States have opted to close the regular season and implement a conservation order earlier in the year, which effectively reduced the length of the regular season.

Affected Environment

Table 3.4. Estimated light goose (lesser snow and Ross’s goose) harvests during regular season and conservation order periods in the Central and Mississippi Flyways (combined) during 1998-2004.

Season	Regular season harvest ¹					Conservation order harvest ²		
	United States			Canada sub-total	Total regular season	U.S.	Canada	Total harvest
	Without special regulations	With special regulations ²	U.S. sub-total					
1998/99	637,105	93,302	730,407	148,979	879,386	398,455	n/a	1,277,841
1999/00	630,662	35,000	665,662	151,203	816,865	643,470	1,267	1,461,602
2000/01	489,336	4,200	493,536	117,483	611,019	536,296	5,233	1,152,548
2001/02	580,379	4,000	584,379	142,080	726,459	749,349	7,718	1,483,526
2002/03	340,355	0	340,355	140,711	481,066	640,526	12,939	1,134,531
2003/04	418,549	0	418,549	165,457	584,006	805,583	16,881	1,406,470
2004/05	388,113	0	388,113	121,586	509,699	660,358	9,886	1,179,943

¹ U.S. estimates for 1998/99 season are from the U.S. Federal Harvest Survey, whereas estimates for 1999/00 and beyond are from the Harvest Information Program.

² State Harvest Survey estimates.

The total harvest of CMF light geese during 1999-2004 ranged from 1.2 to 1.5 million birds. This level of harvest approaches, and sometimes exceeds, the annual harvest of 1.4 million birds that is required to reduce the CMF light goose population by 50% (Rockwell and Ankney 2000). Any harvest in excess of 1.4 million birds in a given year reduces the amount of time required to reach population reduction goals (Rockwell and Ankney 2000).

Each year, thousands of light geese are captured on arctic breeding grounds and marked with uniquely numbered leg bands. Hunter reports of leg-banded birds harvested in subsequent months allow documentation of migratory patterns. Banding locations of CMF light geese harvested during conservation orders indicate that such geese originated from arctic breeding areas where habitat damage is occurring (Fig. 3.21). The majority of light geese harvested during conservation orders originated from the west coast of Hudson and James Bays and the Queen Maud Gulf region of the central Arctic.

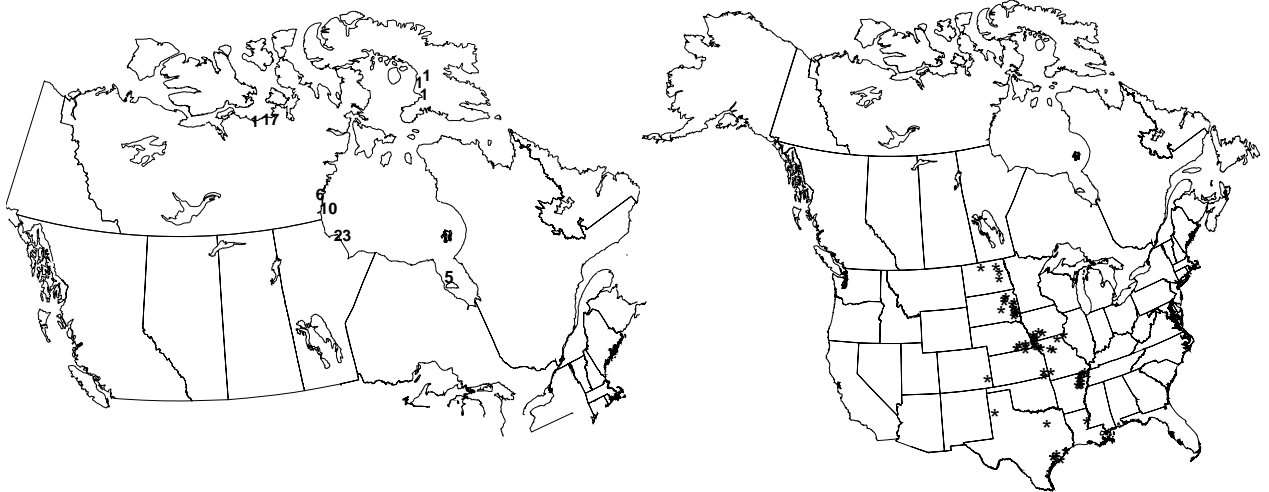


Fig. 3.21. Left: Banding locations of CMF light geese (summarized by degree blocks) harvested during conservation orders in the U.S. Right: Recovery locations of light geese harvested during conservation orders in the Central and Mississippi Flyways.

3.2 HABITAT

3.2.1 Breeding habitat conditions and degradation

Greater snow geese. — Greater snow geese nest in the high Arctic, where salt marsh habitat is rare. Instead, geese utilize inland freshwater habitats that include permanent water bodies (ponds/lakes) and wet sedge meadows (Giroux et al. 1998). Approximately 15% of the breeding population nests on the south plain of Bylot Island, and events occurring there are likely typical of those happening elsewhere in the breeding range (Reed et al. 1998). Although the south plain covers an area of approximately 1,600 km², only 11% of the land is covered by wetlands, the preferred feeding habitat of brood-rearing geese (Masse et al. 2001).

Although levels of grazing by geese can be very high on Bylot Island, there are presently no indications that grazing is preventing vegetative re-growth or denuding vegetated areas. However, monitoring of long-term goose exclosures has shown that composition of the plant community is modified by geese, and that annual plant productivity is reduced in heavily-grazed areas. Long-term, intense grazing by geese leads to a low-level production equilibrium between geese and plants. When grazing is experimentally stopped (via exclosures), plant biomass increases rapidly within a few years (Giroux et al. 1998). Unlike the situation where moderate grazing by lesser snow geese on salt-marsh plants can increase plant quality and quantity, grazing by greater snow geese has not shown such an "overcompensation" effect (Giroux et al. 1998). In addition, fecal matter deposited by greater snow geese in freshwater habitat does not appear to have the same fertilization effect that occurs with lesser snow geese in salt-marsh habitats (Giroux et al. 1998).

Affected Environment

Short-term measurements of food availability on Bylot Island were used to estimate that greater snow geese consume 46% of total food available in wetland habitats (Masse et al. 2001). This suggests that the short-term ability of habitat to support geese has not been exceeded. However, if the high rate of increase of greater snow geese observed prior to 2002 resumes, it is highly probable that the intensity of grazing will increase and that the capacity of plants to recover will be exceeded (Masse et al. 2001).

Eastern and central Arctic light geese. — Light geese have a profound effect on habitat through their feeding actions, and have developed several modes of feeding on plant material for meeting their energy needs (Goodman and Fisher 1962, Bolen and Rylander 1978). Where spring thawing has occurred, and above-ground plant growth has not begun, lesser and greater snow geese dig into and break open the turf (grubbing), consuming the highly nutritious belowground portions (e.g., roots and rhizomes) of plants. Grubbing continues into late spring. Lesser and greater snow geese also engage in shoot-pulling where birds pull the shoots of large sedges, consume the highly nutritious basal portion, and discard the remainder of the plant. A third feeding strategy utilized by all light goose species is grazing of above-ground plant material by clipping action of the bill. The extent to which Ross's geese utilize grubbing and shoot-pulling is not known. However, Ross's geese are known to feed on below-ground roots of sedges and grasses in early spring (Ryder and Alisauskas 1995, Didiuk et al. 2001). Due to their smaller bill size, Ross's geese are able to graze shorter stands of vegetation than can lesser and greater snow geese. In addition, Ross's geese cause considerable damage to vegetation by pulling up plants during nest-building activities (Didiuk et al. 2001).

Under certain levels of grazing intensity, some salt marsh plants show enhanced growth following defoliation and are subject to multiple defoliations throughout the growing season (Abraham and Jefferies 1997, Bazely and Jefferies 1989, Hik and Jefferies 1990, Kotanen and Jefferies 1987). However, other plant species show only limited shoot growth or no growth following defoliation (Zellmer et al. 1993). At high levels of grazing intensity, plant communities are unable to rebound from constant feeding pressures (Srivastava and Jefferies 1996). Once snow geese graze an area to the point where they can no longer obtain sufficient food, they will leave to exploit other areas. Normally, this would allow plant communities to rebound from grazing. However, Ross's geese can further impact damaged areas after snow geese leave because they can graze on shorter stands of plants, which may delay or prevent recovery (Abraham and Jefferies 1997, Didiuk et al. 2001). The potential for plant recovery is further reduced by the short growing season in Arctic and sub-arctic habitats.

Accelerated habitat degradation results from a negative feedback loop between light geese and the plant communities they utilize (Abraham and Jefferies 1997; Fig. 3.22). Removal of above-ground plant cover reduces the thickness of the vegetative mat that insulates underlying sediments from the air. This causes an increase in the rate of evaporation from surface sediments and greater concentration of inorganic

CHAPTER 8

LITERATURE CITED

- Abraham, K. F., R. L. Jefferies, R. F. Rockwell, and C. D. MacInnes. 1996. Why are there so many white geese in North America? 7th International Waterfowl Symposium, Memphis, TN.
- _____ and _____. 1997. High goose populations: causes, impacts and implications. Pages 7-72 in B. D. J. Batt, ed. Arctic Ecosystems in Peril: Report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario. 120 pp.
- Alisauskas, R. 1998. Nutritional ecology and population biology of Ross' geese. Progress Report March 1998. Can. Wildl. Serv., Saskatoon, Saskatchewan. 27pp.
- Alisauskas, R. 2000. Nutritional ecology and population biology of Ross' geese. Progress Report March 2000. Can. Wildl. Serv., Saskatoon, Saskatchewan. 18pp.
- _____, and R. Malecki. 2003. Direct control methods for population reduction of light geese in the Arctic. Pages 43-86 in Johnson, M.A., C.D. Ankney, editors. 2003. Direct control and alternative harvest strategies for North American light geese: Report of the Direct Control and Alternative Harvest Measures Working Group. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington, DC and Canadian Wildlife Service, Ottawa, Ontario.
- _____, S.M. Slattery, D.K. Kellett, D.S. Stern, and K.D. Warner. 1998. Spatial and temporal dynamics of Ross's and snow goose colonies in Queen Maud Gulf Bird Sanctuary, 1966-1998. Canadian Wildlife Service, Saskatoon, Saskatchewan. 21pp.
- _____, C. D. Ankney, and E. E. Klaas. 1988. Winter diets and nutrition of mid-continental lesser snow geese. *J. Wildl. Manage.* 52:403-414.
- Anderson, W.L., S.P. Havera, and B.W. Zercher. 2000. Ingestion of lead and nontoxic shotgun pellets by ducks in the Mississippi Flyway. *J. Wildl. Manage.* 64:848-857.
- Ankney, C. D. and C. D. MacInnes. 1978. Nutrient reserves and reproductive performance of female lesser snow geese. *Auk* 95:459-471.
- Arctic Goose Habitat Working Group. 1997. Conclusions and recommendations for future actions. Pages 117-120 in B. D. J. Batt, ed. Arctic Ecosystems in Peril: Report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario. 120 pp.
- Arctic Goose Joint Venture Technical Committee. 1998. Science needs for the management of increasing snow goose populations. Arctic Goose Joint Venture Special Publication. Canadian Wildlife Service, Ottawa, Ontario and U.S. Fish and Wildlife Service, Washington, D.C. 61pp.
- _____. 2001. Science needs for the adaptive management of the greater snow goose. Arctic Goose Joint Venture Special Publication. Canadian Wildlife Service, Ottawa, Ontario and U.S. Fish and Wildlife Service, Washington, D.C. 78pp.
- Armstrong, W.T., K.M. Meeres, R.H. Kerbes, W.S. Boyd, J.G. Silveira, J.P. Taylor, and B. Turner. 1999. Routes and timing of migration of lesser snow geese from the western Canadian Arctic and Wrangel Island, Russia, 1987-92. Pages 75-88 in R.H. Kerbes, K.M. Meeres, and J.E. Hines (eds.),

Literature Cited

- Distribution, survival, and numbers of lesser snow geese of the Western Canadian Arctic and Wrangel Island, Russia. Can. Wildl. Serv. Occas. Pap. No. 98, Ottawa, Ontario.
- Backstrand, J.M., and R.G. Botzler. 1986. Survival of *Pasteurella multocida* in soil and water in an area where avian cholera is enzootic. J. Wildl. Diseases 22:257-259.
- Batt, B. D. J., editor. 1997. Arctic ecosystems in peril: report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario.
- Barry, T. W. 1960. Waterfowl reconnaissance in the western Arctic. Arct. Circ. 13:51-58.
- Bateman, H.A., T. Joanen, and C.D. Stuzenbaker. 1988. History and status of mid-continent snow geese on their Gulf Coast winter range. Pages 495-515 In: M.W. Weller (ed), Waterfowl in Winter, University of Minnesota Press, Minneapolis. 624pp.
- Bazely, D.R. and R.L. Jefferies. 1989. Leaf and shoot demography of an Arctic stoloniferous grass, *Puccinellia phryganodes*. J. Ecol. 77:811-822.
- Bedard, J. and G. LaPointe. 1991. Responses of hayfields vegetation to spring grazing by greater snow geese *Chen caerulescens atlantica*. J. Appl. Ecol. 28:187-93.
- Bellrose, F. C. 1980. Ducks, Geese, and Swans of North America. Stackpole Books, Harrisburg, PA.
- Bent, A.C. 1962. Life histories of North American wild fowl. Part II. Dover Publications, Inc. New York. (Reprint of 1925 publication).
- Bolen, E.G., and M.K. Rylander. 1978. Feeding adaptations in the lesser snow goose (*Anser caerulescens*). Southwest. Nat. 23:158-161.
- Botzler, R.G. 1991. Epizootiology of avian cholera in wildfowl. J. Wildl. Dis. 27:367-395.
- Bourget, A. 1974. Migrations de la sauvagine dans la region de Quebec. Pages 66-72 in H. Boyd (ed.) Waterfowl studies in eastern Canada, 1969-73. Canadian Wildlife Service, Report Series Number 29.
- Boyd, H., G. E. J. Smith and F. G. Cooch. 1982. The lesser snow goose of the eastern Canadian Arctic: their status during 1964-1979 and their management from 1982-1990. Canadian Wildlife Service Occasional Paper No. 46. 21 pp.
- Brand, C.J. 1984. Avian cholera in the Central and Mississippi Flyways during 1979-80. J. Wildl. Manage. 48:399-406.
- Canadian Wildlife Service. 2005. The migration of waterfowl – The migration of greater snow goose and Canada goose: Economic benefits far outweigh costs. The Flight 2 (November 2005): 2 pp.
- Canadian Wildlife Service Waterfowl Committee. 2000. Population status of migratory game birds in Canada: November 2000. CWS Migr. Birds Regul. Rep. No. 1.
- Canadian Wildlife Service Waterfowl Committee. 2001. Population status of migratory game birds in Canada: November 2001. CWS Migr. Birds Regul. Rep. No. 4.
- Canadian Wildlife Service Waterfowl Committee. 2002. Population status of migratory game birds in Canada: November 2002. CWS Migr. Birds Regul. Rep. No. 7.

Literature Cited

- Canadian Wildlife Service Waterfowl Committee. 2003. Population status of migratory game birds in Canada: November 2003. CWS Migr. Birds Regul. Rep. No. 10.
- Caswell, J.H., A.D. Afton, and F.D. Caswell. 2003. Vulnerability of nontarget goose species to hunting with electronic snow goose calls. *Wildl. Soc. Bull.* 31:1117-1125.
- Chou, R., C. Vardy and R.L. Jefferies. 1992. Establishment from leaves and other plant fragments produced by the foraging activities of geese. *Functional Ecol.* 6:297-301.
- Cooch, E.G., D.B. Lank, R.F. Rockwell and F. Cooke. 1989. Long-term decline in fecundity in a snow goose population: evidence for density dependence? *J. Animal Ecol.* 58:711-726.
- _____, _____, R.F. Rockwell and F. Cooke. 1991a. Long-term decline in body size in a snow goose population: evidence of environmental degradation? *J. Animal Ecol.* 60:483-496.
- _____, _____, A. Dzubin, R.F. Rockwell and F. Cooke. 1991b. Body size variation in lesser snow geese: environmental plasticity in gosling growth rates. *Ecology* 72:503-512.
- _____, R.F. Rockwell, and S. Brault. 2001. Retrospective analysis of demographic responses to environmental change: a lesser snow goose example. *Ecol. Monogr.* 71:377-400.
- Cooper, J.A., and T. Keefe. 1997. Urban Canada goose management: Policies and procedures. *Transactions of the North American Wildlife and Natural Resources Conference* 62:412-430.
- Delaware Division of Fish and Wildlife. 2000. Greater snow goose season and damage evaluation 1999-2000. 2pp.
- Didiuk, A.B., R.T. Alisauskas, and R.F. Rockwell. 2001. Interaction with Arctic and subarctic habitats. Pages 17-26 in T.J. Moser, ed. *The status of Ross's geese*. Arctic Goose Joint Venture Ross's Goose Subcommittee. 65pp.
- Duda, Mark, et al. 1995. *Factors Related to Hunting and Fishing Participation in the United States: Phase IV: Quantitative Analysis*. Harrisonburg, VA. Responsive Management.
- Federal-State Contingency Plan Committee. 2000. 2000-2001 Contingency Plan: Federal-State Cooperative Protection of Whooping Cranes. 36pp.
- Feret, M., G. Gauthier, A. Bechet, J-F. Giroux, and K.A. Hobson. 2003. Effect of a spring hunt on nutrient storage by greater snow geese in southern Quebec. *J. Wildl. Manage.* 67:796-807.
- Ferguson, C. 1999. Waterfowl productivity surveys for the Atlantic Flyway – 1999. Pages 2-7 in J. Bidwell, ed. *Productivity surveys of geese, swans, and brant wintering in North America 1999*. U.S. Dept. Interior, Fish and Wildl. Serv., Arlington, VA. 79pp.
- Filion, B., D. Luszcz, and G. Allard. 1998. Impact of geese on farmlands. Pages 58-64 in B. D. J. Batt, ed. *The greater snow goose: report of the Arctic Goose Habitat Working Group*. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario. 88pp.
- Friend, M. 1999. Avian cholera. Pages 75-98 in M. Friend and J.C. Franson, eds. *Field manual of wildlife diseases*. U.S. Dept. of Interior, Biological Resources Division, Information and Technology Report 1999-001.
- Fronczak, D. 2003. Waterfowl harvest and population survey data. U.S. Fish and Wildlife Service, Columbia, Missouri. 92pp.

Literature Cited

- Gauthier, G., Y. Bedard, and J. Bedard. 1988. Habitat use and activity budgets of greater snow geese in spring. *J. Wildl. Manage.* 52:191-201.
- _____, and S. Brault. 1998. Population model of the greater snow goose: projected impacts of reduction in survival on population growth rate. Pages 65-80 in B. D. J. Batt, ed. *The greater snow goose: report of the Arctic Goose Habitat Working Group*. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario. 88pp.
- Gauvin, J. and A. Reed. 1987. A simulation model for the greater snow goose population. Canadian Wildlife Service, Occasional Paper Number 64. 26pp.
- Giroux, J-F., and J. Bedard. 1987. The effects of grazing by greater snow geese on the vegetation of tidal marshes in the St. Lawrence estuary. *J. Appl. Ecol.* 24:773-788.
- _____, G. Gauthier, G. Costanzo, and A. Reed. 1998. Impact of geese on natural habitats. Pages 32-57 in B. D. J. Batt, ed. *The greater snow goose: report of the Arctic Goose Habitat Working Group*. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario. 88pp.
- _____, B. Batt, S. Brault, G. Costanzo, B. Filion, G. Gauthier, D. Luszczyk, and A. Reed. 1998. Conclusions and management recommendations. Pages 81-88 in B. D. J. Batt, ed. *The greater snow goose: report of the Arctic Goose Habitat Working Group*. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario. 88pp.
- Goodman, D.C., and H.I. Fisher. 1962. *Functional anatomy of the feeding apparatus in waterfowl*. Southern Illinois University Press, Carbondale, Illinois. 193pp.
- Gratto-Trevor, C. 1994. Monitoring shorebird populations in the Arctic. *Bird Trends* 3:10-12.
- Handa, I.T., and R.L. Jefferies. 2000. Assisted revegetation trials in degraded salt-marshes. *J. Appl. Ecol.* 37:944-958.
- _____, R. Harmsen, and R.L. Jefferies. 2002. Patterns of vegetation change and the recovery potential of degraded areas in a coastal marsh system of the Hudson Bay lowlands. *J. Ecol.* 90:86-99.
- Hanson, H. C., P. Queneau, and P. Scott. 1956. The geography, birds, and mammals of the Perry River region. *Arct. Inst. North Am. Spec. Publ.* 3. 98 pp.
- Helm, R. 2002. Results of the January 2002 Ross's goose survey. Louisiana Department of Wildlife and Fisheries, Baton Rouge, Louisiana. 3pp.
- Heyland, J.D. 1972. Vertical aerial photography as an aid in wildlife population studies. Pages 121-136 in *First Canadian Symposium on Remote Sensing*.
- Hik, D.S and R.L. Jefferies. 1990. Increases in the net above-ground primary production of a salt-marsh forage grass: a test of the predictions of the herbivore-optimization model. *J. Ecology* 78:180-195.
- _____, R.L. Jefferies, and A.R.E. Sinclair. 1992. Foraging by geese, isostatic uplift and asymmetry in the development of salt-marsh plant communities. *J. Ecology* 80:395-406.
- Hines, J.E., V.V. Baranyuk, B. Turner, W.S. Boyd, J.G. Silveira, J.P. Taylor, S.J. Barry, K.M. Meeres, R.H. Kerbes, and W.T. Armstrong. 1999. Autumn and winter distribution of lesser snow geese from the

Literature Cited

- Western Canadian Arctic and Wrangel Island, Russia, 1953-1992. Pages 39-73 in R.H. Kerbes, K.M. Meeres, and J.E. Hines (eds.), *Distribution, survival, and numbers of lesser snow geese of the Western Canadian Arctic and Wrangel Island, Russia*. Can. Wildl. Serv. Occas. Pap. No. 98, Ottawa, Ontario.
- Iacobelli, A. and R.L. Jefferies. 1991. Inverse salinity gradients in coastal marshes and the death of stands of *Salix*: the effects of grubbing by geese. *J. Ecol.* 79:61-73.
- Jano, A.P., R.L. Jefferies, and R.F. Rockwell. 1998. The detection of vegetational change by multitemporal analysis of LANDSAT data: the effects of goose foraging. *J. Ecology* 86:93-99.
- Jefferies, R.L., and L.D. Gottlieb. 1983. Genetic variation within and between populations of the asexual plant *Puccinellia x phryganodes*. *Can. J. Bot.* 61:774-779.
- _____, F.L. Gadallah, D.S. Srivastava, and D.J. Wilson. 1995. Desertification and trophic cascades in arctic coastal ecosystems: a potential climate change scenario? Pages 201-206 in T.V. Callaghan et al. (eds.) *Ecosystems research report 10. Global change and Arctic terrestrial ecosystems. Proceedings of Papers Contributed to the International Conference, 21-26 August 1993, Oppedal, Norway*. Environment Programme of Directorate-General XII – Science, Research, Development of the European Commission.
- _____, and R.F. Rockwell. 2002. Foraging geese, vegetation loss and soil degradation in an Arctic salt marsh. *Applied Veg. Sci.* 5:7-16.
- Johnsgard, P.A. 1974. *Song of the north wind: a story of the snow goose*. Anchor Press/Doubleday, Garden City, New York. 150pp.
- Johnson, M.A. 1997. Management strategies to address the mid-continent lesser snow goose overpopulation problem. Pages 101-111 in B. D. J. Batt, ed. *Arctic Ecosystems in Peril: Report of the Arctic Goose Habitat Working Group*. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario. 120 pp.
- Keefe, T. 1996. Feasibility study on processing nuisance Canada geese for human consumption. Minnesota Department of Natural Resources. 7 pp.
- Kerbes, R.H. 1974. Colonies and numbers of Ross' geese and lesser snow geese in the Queen Maud Gulf Migratory Bird Sanctuary. *Can. Wildl. Serv. Occas. Pap. No. 81*, Ottawa, Ontario.
- _____. 1975. The nesting population of lesser snow geese in the eastern Canadian arctic: a photographic inventory of June 1973. *Can. Wildl. Serv. Rep. Ser. No. 35*.
- _____. 1994. Colonies and numbers of Ross' geese and lesser snow geese in the Queen Maud Gulf Migratory Bird Sanctuary. *Can. Wildl. Serv. Occ. Pap. No. 81*. 45pp.
- _____, R.H., P.M. Kotanen, R.L. Jefferies. 1990. Destruction of wetland habitats by lesser snow geese: a keystone species on the west coast of Hudson Bay. *J. Applied Ecology* 27:242-258.
- _____, R.H., V.V. Baranyuk, and J.E. Hines. 1999. Estimated size of the Western Canadian Arctic and Wrangel Island lesser snow goose populations on their breeding and wintering grounds. Pages 25-38 in R.H. Kerbes, K.M. Meeres, and J.E. Hines (eds.), *Distribution, survival, and numbers of lesser snow geese of the Western Canadian Arctic and Wrangel Island, Russia*. Can. Wildl. Serv. Occas. Pap. No. 98, Ottawa, Ontario.

Literature Cited

- Kotanan, P.M., and R.L. Jefferies. 1987. The leaf and shoot demography of grazed and ungrazed plants of *Carex subspathacea*. *J. Ecol.* 75:961-975.
- Kotanan, P.M., and R.L. Jefferies. 1997. Long-term destruction of sub-arctic wetland vegetation by lesser snow geese. *Ecoscience* 4:179-182.
- Leafloor, J. O., K. F. Abraham, D. H. Rusch, R. K. Ross, and M. R. J. Hill. 1996. Status of the Southern James Bay Population of Canada geese. 7th International Waterfowl Symposium, Memphis, TN.
- Lewis, J.C., G. Archibald, R.C. Drewien, R. Edwards, G. Gee, B. Huey, L. A. Linam, R.A. Lock, S. Nesbitt, and T. Stehn. 1994. Whooping crane recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA.
- Lynch, J. J. 1975. Winter ecology of snow geese on the Gulf Coast, 1925-1975. 37th Midwest Fish and Wildlife Conference, Toronto. 45 pp.
- Madsen, J., and A.D. Fox. 1995. Impacts of hunting disturbance on waterbirds – a review. *Wildl. Biol.* 1:193-207.
- Mainguy, J., J. Bety, G. Gauthier, and J-F. Giroux. 2002. Are body condition and reproductive effort of laying greater snow geese affected by the spring hunt? *Condor* 104:156-161.
- Maisonneuve, C. and J. Bedard. 1992. Chronology of autumn migration of greater snow geese. *J. Wildl. Manage.* 56:55-62.
- Martin, Elwood M. and Paul I. Padding. 1997. Administrative Report - July 1997, Preliminary Estimates of Waterfowl Harvest and Hunter Activity in the United States during the 1996 Hunting Season. Laurel, Md.: U.S. Fish and Wildlife Service, Office of Migratory Bird Management.
- Masse, H., L. Rochefort, and G. Gauthier. 2001. Carrying capacity of wetland habitats used by breeding greater snow geese. *J. Wildl. Manage.* 65:271-281.
- McIlhenny, E.A. 1932. The blue goose in its winter home. *Auk* 49:279-306.
- Mensik, G., and J. Silveira. 1993. Status of Ross' and lesser snow geese wintering in California, December 1992. USFWS unpublished report.
- Mowbray, T.B., F. Cooke, and B. Ganter. 2000. Snow goose (*Chen caerulescens*). The birds of North America, No. 514 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Olsen, R.E., and A.D. Afton. 2000. Vulnerability of lesser snow geese to hunting with electronic calling devices. *J. Wildl. Manage.* 64:983-993.
- Pacific Flyway Council. 1992. Pacific Flyway Management Plan for Ross' geese. Subcommittee on White Geese. Portland, OR. 24pp.
- Reed, A. 1989. Use of a freshwater tidal marsh in the St. Lawrence estuary by greater snow geese. Pages 605-616 in R.R. Sharitz and J.W. Gibbons (eds.). *Freshwater wetlands and wildlife*. USDOE Office of Scientific and Technical Information. Tennessee.
- Reed, A., and N. Plante. 1997. Decline in body mass, size, and condition of greater snow geese, 1975-94. *J. Wildl. Manage.* 61:413-419.
- _____, J-F Giroux, and G. Gauthier. 1998. Population size, productivity, harvest and distribution. Pages 5-31 in B. D. J. Batt, ed. *The greater snow goose: report of the Arctic Goose Habitat Working Group*.

Literature Cited

- Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario. 88pp.
- _____, G. Gauthier, and J-F Giroux. 2000. Population and productivity surveys of greater snow geese in 2000. Report to the USFWS and the Atlantic Flyway Technical Section, February 2000. 6pp.
- Robertson, D. G., and R. D. Slack. 1995. Landscape change and its effects on the wintering range of a lesser snow goose *Chen caerulescens caerulescens* population: a review. *Biological Conservation* 71:179-185.
- Rocke, T.E., and M. Friend. 1999. Avian botulism. Pages 271-281 in M. Friend and J.C. Franson, eds. *Field manual of wildlife diseases*. U.S. Dept. of Interior, Biological Resources Division, Information and Technology Report 1999-001.
- Rockwell, R.F. 1999. The impact of snow geese on nesting birds at La Perouse Bay. Interim report of the second year's activities – 10/15/99, Hudson Bay Project. 4pp.
- _____, E.G. Cooch, C.B. Thompson, and F. Cooke. 1993. Age and reproductive success in female lesser snow geese: experience, senescence and the cost of philopatry. *J. Animal Ecol.* 62:323-333.
- _____, and C.D. Ankney. 2000. Snow geese: can we pay down the mortgage? Pages 32-24 in: H. Boyd (ed.) *Population modeling and management of snow geese*. *Can. Wildl. Serv., Occas. Pap. No. 102*.
- _____, E. Cooch, and S. Brault. 1997a. Dynamics of the Mid-continent population of lesser snow geese: projected impacts of reductions in survival and fertility on population growth rates. Pages 73-100 in B. D. J. Batt, ed. *Arctic Ecosystems in Peril: Report of the Arctic Goose Habitat Working Group*. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa, Ontario. 120 pp.
- _____, D. Pollack, K. F. Abraham, P. M. Kotanen, and R. L. Jefferies. 1997b. Are there declines in bird species using La Pérouse Bay? The Hudson Bay Project status report for Ducks Unlimited, Inc.
- Ryder, J. P. 1969. Nesting colonies of Ross' goose. *Auk*:86-282-292.
- _____, and R.T. Alisauskas. 1995. Ross' goose (*Chen rossii*). *In: The birds of North America*, No. 162 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.
- Samuel, M.D., D.R. Goldberg, D.J. Shadduck, J.I. Price, and E.G. Cooch. 1997. *Pasteurella multocida* serotype 1 isolated from a lesser snow goose: evidence of a carrier state. *J. Wildl. Diseases* 33:332-335.
- _____, J.Y. Takekaws, G. Samelius, and D.R. Goldberg. 1999a. Avian cholera mortality in lesser snow geese nesting on Banks Island, Northwest Territories. *Wildl. Soc. Bull.* 27:780-787.
- _____, J.Y. Takekawa, V.V. Baranyuk, and D.L. Orthmeyer. 1999b. Effects of avian cholera on survival of lesser snow geese *Anser caerulescens*: an experimental approach. *Bird Study* 46(Suppl.):S239-S247.
- _____, K.A. Converse, and K.J. Miller. 2001. Diseases affecting Ross's geese. Pages 27-35 in T.J. Moser, ed. *The status of Ross's geese*. Arctic Goose Joint Venture Ross's Goose Subcommittee. 65pp.
- Sargeant, A.B., and D.G. Raveling. 1992. Mortality during the breeding season. Pages 396-422 in B.D.J. Batt, A.D. Afton, M.G. Anderson, C.D. Ankney, D.H. Johnson, J.A. Kadlec, and G.L. Krapu,

Literature Cited

- editors. Ecology and management of breeding waterfowl. University of Minnesota, Minneapolis, USA.
- Serie, J., and B. Raftovich. 2000. Atlantic Flyway waterfowl harvest and population survey data, July 2000. U.S. Dept. Interior, Fish and Wildlife Service. Laurel, MD. 90pp.
- Sharp, D.E., and T.J. Moser. 1999. Light geese in the Central Flyway. U.S. Dept. Interior, Fish and Wildlife Service. Denver, CO. 34pp.
- Sharp, D.E., and T.J. Moser. 2000. Light geese in the Central Flyway. U.S. Dept. Interior, Fish and Wildlife Service. Denver, CO.
- Sherfy, M.H., and R.L. Kirkpatrick. 2003. Invertebrate response to snow goose herbivory on moist-soil vegetation. *Wetlands* 23:236-249.
- Silveira, J.G. 1989. Distribution of lesser snow and Ross's geese in California, winter 1988-89. Unpublished report, California Department of Fish and Game, Sacramento, California.
- _____. 1990. Distribution of lesser snow and Ross's geese in California, winter 1989-90. Unpublished report, California Department of Fish and Game, Sacramento, California.
- Smith, T.J. III and W.D. Odum. 1981. The effects of grazing by snow geese on coastal salt marshes. *Ecology* 62:98-106.
- Smith, A.E., S.R. Craven, and P.D. Curtis. 1999. Managing Canada geese in urban environments. Jack Berryman Institute Publication 16, and Cornell University Cooperative Extension, Ithaca, N.Y.
- Sovada, M.A., R.M. Anthony, and B.D.J. Batt. 2001. Predation on waterfowl in arctic tundra and prairie breeding areas: a review. *Wildl. Soc. Bull.* 29:6-15.
- Srivastava, D.S., and R.L. Jefferies. 1996. A positive feedback: herbivory, plant growth, salinity, and the desertification of an Arctic salt-marsh. *J. Ecol.* 84:31-42.
- Stakeholders Committee on Arctic Nesting Geese. 1998. Report of the Stakeholders Committee on Arctic Nesting Geese. Unpublished report. 5pp.
- Sullivan, B. D. 1995. Estimates of Ross' geese wintering in Texas during 1994-95. Texas Parks and Wildlife Department, Austin, TX. 3pp.
- Taylor, J.P., and R.E. Kirby. 1990. Experimental dispersal of wintering snow and Ross' geese. *Wildl. Soc. Bull.* 18:312-319.
- Teisl, M.F., and R. Southwick. 1995. The economic contributions of bird and waterfowl recreation in the United States during 1991. Southwick Associates, Arlington, VA. 11pp.
- Thomas, V.G., and B.K. MacKay. 1998. A critical evaluation of the proposed reduction in the mid-continent lesser snow goose population to conserve sub-arctic salt marshes of Hudson Bay. Special Scientific Report. Animal Protection Institute and The Humane Society of the United States. Washington, D.C. 32pp.
- Thorpe, P. 2000. Western Central Flyway Light Goose Productivity Report – 2000. Pages 19-27 in J. Bidwell, ed. Productivity surveys of geese, swans, and brant wintering in North America 2000. U.S. Dept. Interior, Fish and Wildl. Serv. Arlington, VA. 89pp.

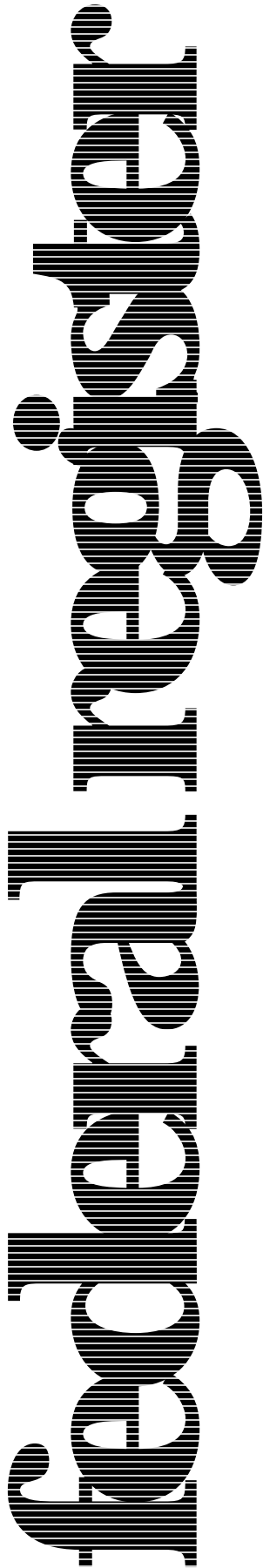
Literature Cited

- U.S. Department of Agriculture. 1999. 1997 National Resources Inventory. Internet site:
<http://www.nhq.nrcs.usda.gov/land/publs/97highlights.html>.
- U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, Bureau of the Census. 1997. 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation.
- _____, Environment Canada, and Secretaria de Medio Ambiente, Recursos Naturales, y Pesca. 1998. 1998 Update to the North American Waterfowl Management Plan: expanding the vision. Washington, D.C.
- U.S. Fish and Wildlife Service. 1975. Final Environmental Statement: Issuance of annual regulations permitting the sport hunting of migratory birds. U.S. Dept. Interior, Fish and Wildlife Service. Washington, D.C.
- _____. 1986. Refuge Manual: Public Use Management Section 5: Hunting. National Wildlife Refuge System. U.S. Dept. Interior, Fish and Wildlife Service. Washington, D.C.
- _____. 1988. Final Supplemental Environmental Impact Statement: Issuance of annual regulations permitting the sport hunting of migratory birds. U.S. Dept. of Interior, Fish and Wildlife Service. Washington, D.C.
- _____. 1993. Draft Environmental Impact Statement: Refuges 2003 – A plan for the future of the National Wildlife Refuge System. U.S. Dept. of Interior, Fish and Wildlife Service. Washington, D.C.
- _____. 1994. The Native American policy of the U.S. Fish and Wildlife Service. Washington, D.C. 9pp.
- _____. 1997a. Harvest and population survey data book, Central Flyway, compiled by D.E. Sharp. Office of Migratory Bird Management, Denver, CO. 123 pp.
- _____. 1997b. Productivity survey of geese, swans and brant wintering in North America. Office of Migratory Bird Management, Arlington, VA. 79 pp.
- _____. 1997c. Waterfowl population status, 1997. U.S. Dept. Interior, Fish and Wildlife Service, Arlington, VA. 32pp.
- _____. 1998a. Mid-continent Lesser Snow Goose Workshops: Central and Mississippi Flyways, Fall 1997. Office of Migratory Bird Management and Division of Refuges, Arlington, VA.
- _____. 1998b. Administrative Report July 1998. Office of Migratory Bird Management, Laurel, MD.
- _____. 1998c. Waterfowl Population Status, 1998. Department of Interior, U.S. Fish and Wildlife Service. Arlington, VA.
- _____. 1999a. Final Environmental Assessment: Alternative regulatory strategies to reduce overabundant populations of mid-continent light geese. U.S. Dept. Interior, Fish and Wildl. Serv. Washington, D.C. 98pp.
- _____. 1999b. Report of lands under control of the U.S. Fish and Wildlife Service as of September 30, 1999. U.S. Dept. Interior, Fish and Wildl. Serv. Washington, D.C. 45pp.
- _____. 1999c. Response of greater snow geese (*Chen caerulescens atlantica*) to hunting at Bombay Hook NWR and related wetland changes. Progress Report 11. U.S. Dept. Interior, Fish and Wildl. Serv., Smyrna, DE 22pp.

Literature Cited

- _____. 2000. Waterfowl Population Status, 2000. U.S. Dept. Interior, Fish and Wildl. Serv., Arlington, VA.
- _____. 2002. Waterfowl Population Status, 2002. U.S. Dept. Interior, Fish and Wildl. Serv., Arlington, VA.
- _____. 2003. Waterfowl Population Status, 2003. U.S. Dept. Interior, Fish and Wildl. Serv., Arlington, VA.
- _____. 2005. Waterfowl Population Status, 2005. U.S. Dept. Interior, Fish and Wildl. Serv., Arlington, VA.
- _____. 2006. Waterfowl Population Status, 2006. U.S. Dept. Interior, Fish and Wildl. Serv., Arlington, VA.
- _____ and Central Flyway Council. 2006. Aransas-Wood Buffalo Population Whooping Crane Contingency Plan, 2006. U.S. Dept. Interior, Fish and Wildl. Serv., Denver, CO. 42pp.
- Widjeskog, L. 1977. Geese eat-outs. Final Report. New Jersey Division of Fish and Game. Project W-53-R-5. 6pp.
- Widjeskog, L. 1978. Geese eat-outs. Performance Report. New Jersey Division of Fish and Game. Project W-58-R-1. 9pp.
- Williams, T.D., E.G. Cooch, R.L. Jefferies, and F. Cooke. 1993. Environmental degradation, food limitation and reproductive output: juvenile survival in lesser snow geese. *J. Animal Ecol.* 62:766-777.
- Wobeser, G., B. Hunter, B. Wright, D.J. Nieman, and R. Isbister. 1979. Avian cholera in Saskatchewan, spring 1977. *J. Wildl. Diseases* 15:19-24.
- _____, R. Kerbes, and G.W. Beyersbergen. 1983. Avian cholera in Ross' and lesser snow geese in Canada. *J. Wildl. Diseases* 19:12.
- Young, K.E. 1985. The effect of greater snow geese, *Anser caerulescens atlantica*, (Aves: Anatidae: Anserini) grazing on a Delaware tidal marsh. M.Sc. Thesis. University of Delaware. 63pp.
- Zellmer, I.D., M.J. Clauss, D.S. Hik, and R.L. Jefferies. 1993. Growth responses of arctic graminoids following grazing by captive lesser snow geese. *Oecologia* 93:487-492.

Appendix 1



Thursday
May 13, 1999

Part XII

**Department of the
Interior**

Fish and Wildlife Service

**Migratory Bird Hunting; Intent To Prepare
an Environmental Impact Statement on
White Goose Management; Notice**

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

Migratory Bird Hunting; Notice of Intent To Prepare an Environmental Impact Statement on White Goose Management

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of intent.

SUMMARY: The U.S. Fish and Wildlife Service (Service or "we") is issuing this notice to advise the public that we are initiating efforts to prepare an Environmental Impact Statement (EIS) that considers a range of management alternatives aimed at addressing population expansion of lesser snow geese, Ross' snow geese, and greater snow geese (white geese). This notice describes possible alternatives, invites public participation in the scoping process for preparing the EIS, and identifies the Service official to whom questions and comments may be directed. Potential sites of public scoping meetings in important white goose migration and wintering areas are yet to be determined. A notice of public meetings with the locations, dates, and times will be published in the **Federal Register**.

DATES: Written comments regarding EIS scoping should be submitted by July 12, 1999, to the address below.

ADDRESSES: Written comments should be sent to the Chief, Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Department of the Interior, ms 634—ARLSQ, 1849 C Street NW., Washington, DC 20240. The public may inspect comments during normal business hours in room 634—Arlington Square Building, 4401 N. Fairfax Drive, Arlington, Virginia.

FOR FURTHER INFORMATION CONTACT: Mr. Jonathan Andrew, Chief, Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Department of the Interior, (703) 358-1714.

SUPPLEMENTARY INFORMATION: With regard to Mid-continent light geese, because of the high population levels and habitat destruction described below, we believe that management action is necessary. In fact, we promulgated regulations on February 16, 1999, (64 FR 7507; 64 FR 7517) that

authorized additional methods of take of light geese and established a conservation order for the reduction of the Mid-continent Light Goose Population. In issuing those regulations, we indicated that we would initiate preparation of an EIS beginning in 2000 to consider the effects on the human environment of a range of long-term resolutions for the MCLG population problem. Those regulations were subsequently challenged in Federal District Court by several animal rights groups. Though the judge refused to preliminarily enjoin the program, he did indicate a likelihood that the plaintiffs might prevail on the EIS issue when the lawsuit proceeded. In light of our earlier commitment to prepare an EIS on the larger, long-term program and to preclude further litigation on the issue, we decided to withdraw the regulations and to begin preparation of the EIS now.

Mid-Continent Light Geese

Lesser snow (*Anser c. caerulescens*) and Ross' (*Anser rossii*) geese, that primarily migrate through the Central and Mississippi Flyways, are collectively referred to as Mid-continent light geese (MCLG) because they breed, migrate, and winter in the "Mid-continent" or central portions of North America. They are referred to as "light" geese due to the light coloration of the white-phase plumage form, as opposed to "dark" geese such as white-fronted geese or Canada geese. We include both plumage forms of lesser snow geese (white, or "snow" and dark, or "blue") under the designation light geese.

The total MCLG population is experiencing a high population growth rate and has substantially increased in size within the last 30 years. Potential reasons for this high growth rate include decreased harvest rates, availability of waste grains in agricultural areas, establishment of refuges, and higher survival rates. The total MCLG population is comprised of two population segments; namely the Mid-continent Population (MCP) and the Western Central Flyway Population (WCFP). We use operational surveys conducted annually on wintering grounds to derive a winter index to light goose populations. The winter index of MCP light geese has more than tripled within 30 years from an estimated 800,000 birds in 1969 to approximately

2.6 million birds in 1999 and has increased an average of 5% per year for the last ten years (Abraham et al. 1996, USFWS 1998). The 1999 MCP winter index of 2.6 million geese is comprised of approximately 2.4 million lesser snow geese and 147,000 Ross' geese. The winter index of WCFP light geese has quadrupled in 23 years from 52,000 in 1974 to 216,000 in 1997 (USFWS 1997), and has increased an average of 9% per year for the last ten years (USFWS 1998). Counts of light geese wintering in Mexico are obtained every 3 years, therefore 1997 represents the last year that a total WCFP count was made. The 1997 WCFP winter index of 216,000 geese is comprised of approximately 151,000 lesser snow geese and 65,000 Ross' geese.

The total MCLG population (MCP and WCFP combined), based on the 1997 and 1999 winter indices, is approximately 2.8 million geese (Table 1). In 1991, the Central and Mississippi Flyway Councils jointly agreed to set lower and upper management thresholds for the MCP of snow geese at 1.0 million and 1.5 million, respectively, based on the winter index. Therefore, the current winter index of MCP lesser snow geese far exceeds the upper management threshold established by the Flyway Councils. Segments of the total MCLG population have also exceeded North American Waterfowl Management Plan (NAWMP) population objectives, which are also based on winter indices. The MCP lesser snow goose winter index of 2.4 million birds far exceeds the NAWMP population objective of 1 million birds (USDOI et al. 1998). The lesser snow goose portion of the WCFP light goose winter index is estimated to be 151,000 birds, which exceeds the NAWMP population objective of 110,000 birds (USDOI et al. 1998). The estimate of the total MCLG population winter index (WCFP and MCP combined) is approximately 212,000 birds. This exceeds the NAWMP Ross' goose population objective of 100,000 birds (USDOI et al. 1998). We compare current population levels to NAWMP population objectives to demonstrate that the total MCLG population has increased substantially over what is considered to be healthy population level.

TABLE 1.—COMPONENTS OF THE MID-CONTINENT LIGHT GOOSE POPULATION (MCLG) WINTER INDEX

Species	MCP ^a	WCFP ^b	Total MCLG	Flyway council goal ^c	NAWMP goal ^d		
					MCP	WCFP	Total MCLG
Lesser snow goose	2,429,000	151,000	2,580,000	1.0–1.5 million	1,000,000	110,000	1,110,000

TABLE 1.—COMPONENTS OF THE MID-CONTINENT LIGHT GOOSE POPULATION (MCLG) WINTER INDEX—Continued

Species	MCP ^a	WCFP ^b	Total MCLG	Flyway council goal ^c	NAWMP goal ^d		
					MCP	WCFP	Total MCLG
Ross' goose	146,800	65,000	211,800	N/A ^e	N/A	N/A	100,000
Total	2,575,800	216,000	2,791,800	N/A	N/A	N/A	1,210,000

^a Mid-Continent Population (1999 index).

^b Western Central Flyway Population (1997 index).

^c Represents lower and upper management thresholds.

^d North American Waterfowl Management Plan goals.

^e Not applicable; goal not developed.

By multiplying the current MCLG December index of 2.8 million birds by an adjustment factor of 1.6 (Boyd et al. 1982), we derive an estimate of 4.5 million breeding birds in spring. This is corroborated by population surveys conducted on light goose breeding colonies during spring and summer, which suggest that the breeding population size of MCLG is in excess of five million birds (D. Caswell pers. comm.). The estimate of 4.5 million birds does not include non-breeding geese or geese found in unsurveyed areas. Therefore, the total MCLG population currently far exceeds 4.5 million birds.

We believe that the MCLG population has exceeded the long-term carrying capacity of its breeding habitat and must be reduced. These geese have become seriously injurious to their arctic and subarctic habitat and habitat important to other migratory birds. We have described previously (February 16, 1999; 64 FR 7517) how light geese have impacted breeding habitats through their feeding actions, which triggers a series of events that leads to long-term habitat destruction. Batt (1997) summarized the results of numerous studies that have investigated the dynamics of the MCLG population and the impacts it is having on breeding habitats. We believe that MCLG population reduction measures are necessary to prevent further habitat destruction and to protect the remaining habitat upon which numerous wildlife species depend.

Batt (1997) estimated that the MCLG population should be reduced by 50% by 2005. That would suggest a reduction from the 1999 MCLG winter index of approximately 2.8 million birds to approximately 1.4 million birds. Central and Mississippi Flyway Council management thresholds for MCP lesser snow geese (not including WCFP lesser snow or Ross' geese) rests between 1.0 and 1.5 million birds, based on the winter index. Therefore, our goal to reduce the MCLG population to 1.4 million birds by 2005 closely parallels

those established by Flyway Councils and the scientific community. Using previously mentioned conversion factors, a winter index of 1.4 million would translate to a minimum estimate of 2.24 million breeding MCLG in spring. The estimate of 2.24 million birds does not include non-breeding geese or geese found in unsurveyed areas. Therefore, the total MCLG spring population would be much higher. We plan to carefully analyze and assess the MCLG reduction on an annual basis, using the winter index and other surveys, to ensure that the populations are not over-harvested.

Greater Snow Geese

Greater snow geese (*Anser c. atlanticus*) breed in the eastern Arctic of Canada and Greenland and migrate southward through Quebec, New York, and New England to their wintering grounds in the mid-Atlantic U.S. The greater snow goose population has expanded from less than 50,000 birds in the late 1960s to approximately 700,000 today. These estimates are based on operational spring surveys conducted on staging areas in the St. Lawrence Valley. With a growth rate of about 9% per year, the population is expected to reach 1,000,000 by 2002 and 2,000,000 by 2010 (Batt 1998).

Although the greater snow goose population has experienced a high growth rate, studies in the Arctic have not documented extensive damage to breeding habitats as of yet. It is estimated that the population is only about one-half of the carrying capacity of the site of the largest breeding colony on Bylot Island. However, high populations of greater snow geese are negatively impacting natural marshes in the St. Lawrence estuary and some coastal marshes of the Mid-Atlantic U.S. (Batt 1998). The Arctic Goose Habitat Working Group recommended that the population be stabilized by the year 2002 at between 800,000 to 1,000,000 birds (Batt 1998). This strategy is intended to prevent the destruction of arctic habitat that is likely to occur if the

population exceeds the carrying-capacity of breeding areas.

Past Management Actions

We have attempted to curb the growth of white goose populations by increasing bag and possession limits and extending the open hunting season length for white geese to 107 days, the maximum allowed by the Migratory Bird Treaty between the U.S. and Canada. However, due to the rapid rise in white goose numbers and low hunter success rates, the harvest rate (the percentage of the population that is harvested) has declined. The decline in harvest rate indicates that current harvest regulations are not sufficient to stabilize or reduce population growth rates.

In cooperation with our State partners, we have developed several Regional Action Plans (Gulf Coast, Midwest, and Northern Prairie) in the central U.S. to implement land management activities that will assist in reduction of the MCLG population. Such activities include land management, water management, increasing accessibility of State and Federal lands to hunters, and development of public outreach programs. We do not believe that Regional Action Plans alone can achieve MCLG population reduction goals. However, the plans will compliment the management alternative chosen as a result of the EIS process.

On February 16, 1999, we published two rules that authorized new methods of take for white geese (electronic calls and unplugged shotguns; 64 FR 7507), and established a conservation order for the reduction of the MCLG population (64 FR 7517). The new regulations were made available only to States in the Mississippi and Central Flyways. Several animal rights groups subsequently filed a legal challenge to the Environmental Assessment and Finding of No Significant Impact upon which the implementation of the rules were based. Although the judge refused to issue an injunction, he did indicate

a likelihood that plaintiffs might succeed on their argument that an EIS should have been prepared. In order to avoid further litigation, we have decided to withdraw those regulations and initiate preparation of an EIS. The regulations will be withdrawn in a separate rulemaking notice in the **Federal Register**.

Alternatives

We are considering the following alternatives as a result of public comments received on the Environmental Assessment. After the scoping process, we will develop the alternatives to be included in the EIS and base them on the mission of the Service and comments received during scoping. We are soliciting your comments on issues, alternatives, and impacts to be addressed in the EIS.

A. No Action Alternative

Under the No Action Alternative, no additional regulatory methods or direct population control strategies would be authorized. Normal white goose hunting regulations that existed prior to February 16, 1999, would remain in place.

B. New Regulatory Alternatives (Proposed Action)

This alternative seeks to provide new regulatory options to wildlife management agencies that will increase the harvest of white geese above that which results from existing hunting frameworks. This approach may include legalization of additional hunting methods such as electronic calls, unplugged shotguns, expanded shooting hours, and baiting. This alternative also includes establishment of a conservation order in the U.S. to reduce and/or stabilize white goose populations. A conservation order would authorize taking of white geese after the normal framework closing date of March 10, through August 31.

The intent of this alternative is to significantly reduce or stabilize white goose populations without threatening their long-term health. We are confident that reduction or stabilization efforts will not result in populations falling below either the lower management thresholds established by Flyway Councils, or the NAWMP population objectives. Monitoring and evaluation programs are in place to estimate population sizes and will be used to

prevent over-harvest of these populations.

C. Direct Population Control on Wintering and Migration Areas in the U.S.

This alternative would involve direct population control strategies such as trapping and culling programs, market hunting, or other general strategies that would result in the killing of white geese on migration and/or wintering areas in the U.S. Some of these types of control measures could involve disposal of large numbers of carcasses.

D. Seek Direct Population Control on Breeding Grounds by Canada

This alternative, if successful, would involve direct population control strategies, such as trapping and culling programs, market hunting, or other general strategies, that would result in killing of white geese on breeding colonies in Canada. Some of these types of control measures could involve disposal of large numbers of carcasses. We do not have the authority to implement direct population control measures on migration or breeding areas in Canada. Therefore, this alternative would require extensive consultation with Canada in order to urge implementation of control measures on breeding areas. Such measures may or may not involve active U.S. participation.

Issue Resolution and Environmental Review

The primary issue to be addressed during the scoping and planning process for the EIS is to determine which management alternatives for the control of white goose populations will be analyzed. We will prepare a discussion of the potential effect, by alternative, which will include the following areas:

- (1) White goose populations and their habitats.
- (2) Other bird populations and their habitats.
- (3) Effects on other species of flora and fauna.
- (4) Socioeconomic effects.

Environmental review of the management action will be conducted in accordance with the requirements of the National Environmental Policy Act (NEPA), as appropriate. This Notice is being furnished in accordance with 40 CFR 1501.7, to obtain suggestions and

information from other agencies, tribes, and the public on the scope of issues to be addressed in the EIS. A draft EIS should be available to the public in the fall of 1999.

Public Scoping Meetings

A schedule of public scoping meeting dates, locations, and times is not available at this time. Notice of such meetings will be published in the **Federal Register**.

References Cited

- Abraham, K.F., R.L. Jefferies, R.F. Rockwell, and C. D. MacInnes. 1996. Why are there so many white geese in North America? 7th International Waterfowl Symposium, Memphis, TN.
- Batt, B.D.J., editor. 1997. Arctic ecosystems in peril: report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington, DC and Canadian Wildlife Service, Ottawa, Ontario. 120 pp.
- Batt, B.D.J., editor. 1998. The greater snow goose: report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington, DC and Canadian Wildlife Service, Ottawa, Ontario. 88 pp.
- Boyd, H., G.E.J. Smith and F.G. Cooch. 1982. The lesser snow goose of the eastern Canadian Arctic: their status during 1964-1979 and their management from 1982-1990. Canadian Wildlife Service Occasional Paper No. 46. 21 pp.
- U.S. Department of the Interior, Environment Canada, and Secretaria De Desarrollo Social. 1998. 1998 update to the North American Waterfowl Management Plan—fulfilling the legacy: expanding the vision. U.S. Fish and Wildlife Service, Washington DC.
- USFWS. 1997. Harvest and population survey data book, Central Flyway, compiled by D.E. Sharp. Office of Migratory Bird Management, Denver, CO. 123 pp.
- USFWS. 1998. Waterfowl populations status, 1998. Department of Interior, U.S. Fish and Wildlife Service, Arlington, VA. 31 pp.

Authorship. The primary author of this Notice is James R. Kelley, Jr., Office of Migratory Bird Management.

Dated: May 7, 1999.

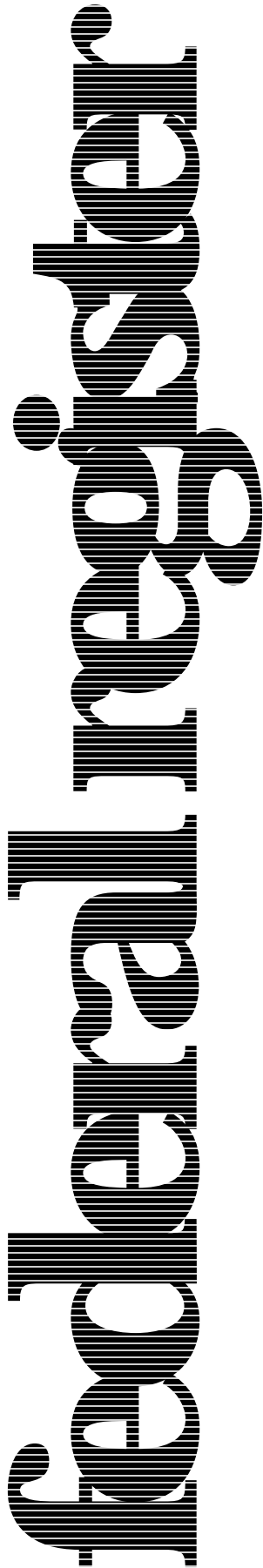
John G. Rogers,

Acting Director, U.S. Fish and Wildlife Service.

[FR Doc. 99-12141 Filed 5-12-99; 8:45 am]

BILLING CODE 4310-55-P

Appendix 2



Monday
August 30, 1999

Part V

**Department of the
Interior**

Fish and Wildlife Service

**Migratory Bird Hunting; Environmental
Impact Statement on White Goose
Management; Notice**

DEPARTMENT OF THE INTERIOR**Fish and Wildlife Service****Migratory Bird Hunting; Environmental Impact Statement on White Goose Management; Notice**

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of meetings.

SUMMARY: The U.S. Fish and Wildlife Service (Service or "we") is issuing this notice to invite public participation in the scoping process for preparing an Environmental Impact Statement (EIS) that considers a range of management alternatives aimed at addressing population expansion of lesser snow geese, Ross' geese, and greater snow geese (white geese). This notice invites further public participation in the scoping process, identifies the location, date, and time of public scoping meetings, and identifies the Service official to whom questions and comments may be directed.

DATES: Written comments regarding EIS scoping should be submitted by November 22, 1999, to the address below. Dates for nine public scoping meetings are identified in the

SUPPLEMENTARY INFORMATION section.

ADDRESSES: Written comments should be sent to the Chief, Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Department of the Interior, 4401 N. Fairfax Dr., Suite 634—Arlington, VA 22203. Alternatively, comments may be submitted electronically to the following address: white—goose—eis@fws.gov. The public may inspect comments during normal business hours in Room 634—Arlington Square Building, 4401 N. Fairfax Drive, Arlington, Virginia. Locations for nine public scoping meetings are identified in the **SUPPLEMENTARY INFORMATION** section.

FOR FURTHER INFORMATION CONTACT: Mr. Jon Andrew, Chief, Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Department of the Interior, (703) 358-1714, or James Kelley, Office of Migratory Bird Management (703) 358-1964.

SUPPLEMENTARY INFORMATION: On May 13, 1999, we published a Notice of Intent to prepare an EIS on white goose management (64 FR 26268). This action is in response to population expansion of white geese, which has resulted in habitat degradation in certain breeding, migration, and/or wintering areas of the three species of geese involved.

Lesser Snow Geese and Ross' Geese

We believe that the combined population of lesser snow geese and

Ross' geese in the mid-continent region has exceeded the long-term carrying capacity of its breeding habitat and must be reduced. These geese have become seriously injurious to their arctic and subarctic habitat and habitat important to other migratory birds. We believe that population reduction measures are necessary to prevent further habitat destruction and to protect the remaining habitat upon which numerous wildlife species depend. The Arctic Goose Habitat Working Group estimated that the combined population of lesser snow geese and Ross' geese in the mid-continent region should be reduced by 50% by 2005 (Batt 1997). That would suggest a reduction from the 1999 winter index of approximately 2.8 million birds to approximately 1.4 million birds.

Greater Snow Geese

The greater snow goose population has expanded from less than 50,000 birds in the late 1960s to approximately 700,000 today. With a growth rate of about 9% per year, the population is expected to reach 1,000,000 by 2002 and 2,000,000 by 2010 (Batt 1998). While researchers have not documented the damage to the breeding habitat of greater snow geese to the same degree as the mid-continent white geese, high populations of greater snow geese are negatively impacting natural marshes in the St. Lawrence estuary and some coastal marshes of the Mid-Atlantic U.S. (Batt 1998). The Arctic Goose Habitat Working Group recommended that the population be stabilized by the year 2002 at between 800,000 to 1,000,000 birds (Batt 1998). This strategy is intended to prevent the destruction of arctic habitat that is likely to occur if the population exceeds the carrying-capacity of breeding areas.

Alternatives

We are considering the following alternatives as a result of public comments we received previously. After the scoping process, we will develop the alternatives to be included in the EIS and base them on the mission of the Service and comments received during scoping. We are soliciting your comments on issues, alternatives, and impacts to be addressed in the EIS.

A. No Action Alternative

Under the No Action Alternative, no additional regulatory methods or direct population control strategies would be authorized. Existing white goose hunting regulations would remain in place.

B. New Regulatory Alternatives (Proposed Action)

This alternative seeks to provide new regulatory options to wildlife management agencies that will increase the harvest of white geese above that which results from existing hunting frameworks. This approach may include legalization of additional hunting methods such as electronic calls, unplugged shotguns, and expanded shooting hours. This alternative also includes establishment of a conservation order in the U.S. to reduce and/or stabilize white goose populations. A conservation order would authorize taking of white geese after the normal framework closing date of March 10, through August 31.

The intent of this alternative is to significantly reduce or stabilize white goose populations without threatening their long-term health. We are confident that reduction or stabilization efforts will not result in populations falling below either the lower management thresholds established by Flyway Councils, or the North American Waterfowl Management Plan population objectives. Monitoring and evaluation programs are in place to estimate population sizes and will be used to prevent over-harvest of these populations.

C. Direct Population Control on Wintering and Migration Areas in the U.S.

This alternative would involve direct population control strategies such as trapping and culling programs, market hunting, or other general strategies that would result in the killing of white geese on migration and/or wintering areas in the U.S. Some of these types of control measures could involve disposal of large numbers of carcasses.

D. Seek Direct Population Control on Breeding Grounds by Canada

This alternative, if successful, would involve direct population control strategies, such as trapping and culling programs, market hunting, or other general strategies, that would result in killing of white geese on breeding colonies in Canada. Some of these types of control measures could involve disposal of large numbers of carcasses. We do not have the authority to implement direct population control measures on migration or breeding areas in Canada. Therefore, this alternative would require extensive consultation with Canada in order to urge implementation of control measures on breeding areas. Such measures may or

may not involve active U.S. participation.

Issue Resolution and Environmental Review

The primary issue to be addressed during the scoping and planning process for the EIS is to determine which management alternatives for the control of white goose populations will be analyzed. We will prepare a discussion of the potential effect, by alternative, which will include the following areas:

- (1) White goose populations and their habitats.
- (2) Other bird populations and their habitats.
- (3) Effects on other species of flora and fauna.
- (4) Socioeconomic effects.

Environmental review of the management action will be conducted in accordance with the requirements of the National Environmental Policy Act (NEPA), as appropriate. This Notice is being furnished in accordance with 40 CFR 1501.7, to obtain suggestions and information from other agencies, tribes, and the public on the scope of issues to be addressed in the EIS. A draft EIS should be available to the public in the winter of 2000.

Public Scoping Meetings

Nine public scoping meetings will be held on the following dates at the indicated locations and times:

1. September 29, 1999; Pomona, NJ at the Richard Stockton College of New Jersey, A Wing Lecture Hall, Jimmie Leeds Road, 7 p.m. to 9:30 p.m.

2. September 30, 1999; Dover, DE at the Richardson and Robbins Auditorium, Delaware Department of Natural Resources and Environmental Control, 89 Kings Highway, 7 p.m. to 9:30 p.m.

3. October 3, 1999; Sacramento, CA at the Auditorium, Resource Building, 1416 Ninth St., 3 p.m. to 5:30 p.m.

4. October 5, 1999; Rosenberg, TX at the Texas Agricultural Extension Service Building, 1436 Band Road, 7 p.m. to 9:30 p.m.

5. October 6, 1999; Baton Rouge, LA at the Louisiana Room, First Floor, Louisiana Department of Wildlife and Fisheries Building, 2000 Quail Drive, 7 p.m. to 9:30 p.m.

6. October 12, 1999; Bismarck, ND at the North Dakota Game and Fish Department Auditorium, 100 N. Bismarck Expressway, 7 p.m. to 9:30 p.m.

7. October 13, 1999; Bloomington, MN at the Best Western Thunderbird Hotel and Convention Center, 2201 East 78th Street, 7 p.m. to 9:30 p.m.

8. October 14, 1999; Kansas City, MO at the Holiday Inn Sports Complex, 4011 Blue Ridge Cutoff, 7 p.m. to 9:30 p.m.

9. October 21, 1999; Washington, DC in the Auditorium of the Department of the Interior Building, 1849 C Street NW, 9 a.m. to 11:30 a.m.

Meeting participants may choose to submit oral and/or written comments on the EIS scoping process. To facilitate planning, we request that individuals or organizations that desire to submit oral comments at meetings to send us their name and the meeting location at which comments will be submitted. Name and

meeting location information should be sent to the location indicated under the **ADDRESSES** caption. However, submission of names prior to a particular meeting is not required in order to present oral comments at any meeting.

Written comments may also be submitted by November 22, 1999, to the location indicated under the **ADDRESSES** caption. Alternatively, comments may be submitted electronically by November 22, 1999, to the following email address:
white_goose_eis@fws.gov.

References Cited

- Batt, B.D.J., editor. 1997. Arctic ecosystems in peril: report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, DC and Canadian Wildlife Service, Ottawa, Ontario. 120pp.
- Batt, B.D.J., editor. 1998. The greater snow goose: report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U. S. Fish and Wildlife Service, Washington, DC and Canadian Wildlife Service, Ottawa, Ontario. 88pp.

Authorship

The primary author of this Notice is James R. Kelley, Jr., Office of Migratory Bird Management.

Dated: August 24, 1999.

Paul R. Schmidt,

Acting Director, U.S. Fish and Wildlife Service.

[FR Doc. 99-22382 Filed 8-27-99; 8:45 am]

BILLING CODE 4310-55-P

Appendix 3

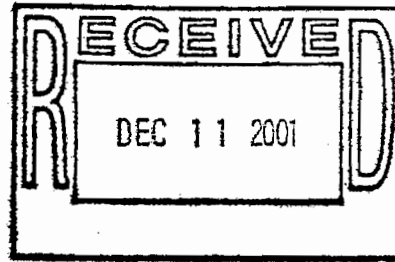


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 6 2001

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

Jon Andrew
Chief
Division of Migratory Bird Management
U.S. Fish and Wildlife Service
4401 North Fairfax Drive
Suite 634
Arlington, Virginia 22203



Dear Mr. Andrew:

The Environmental Protection Agency (EPA) has reviewed the U.S. Fish and Wildlife Service's (Service) Draft Environmental Impact Statement (DEIS) for the **Light Goose Management Plan** (CEQ Document # 010357). Our review is pursuant to the National Environmental Policy Act, Council on Environmental Quality regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act.

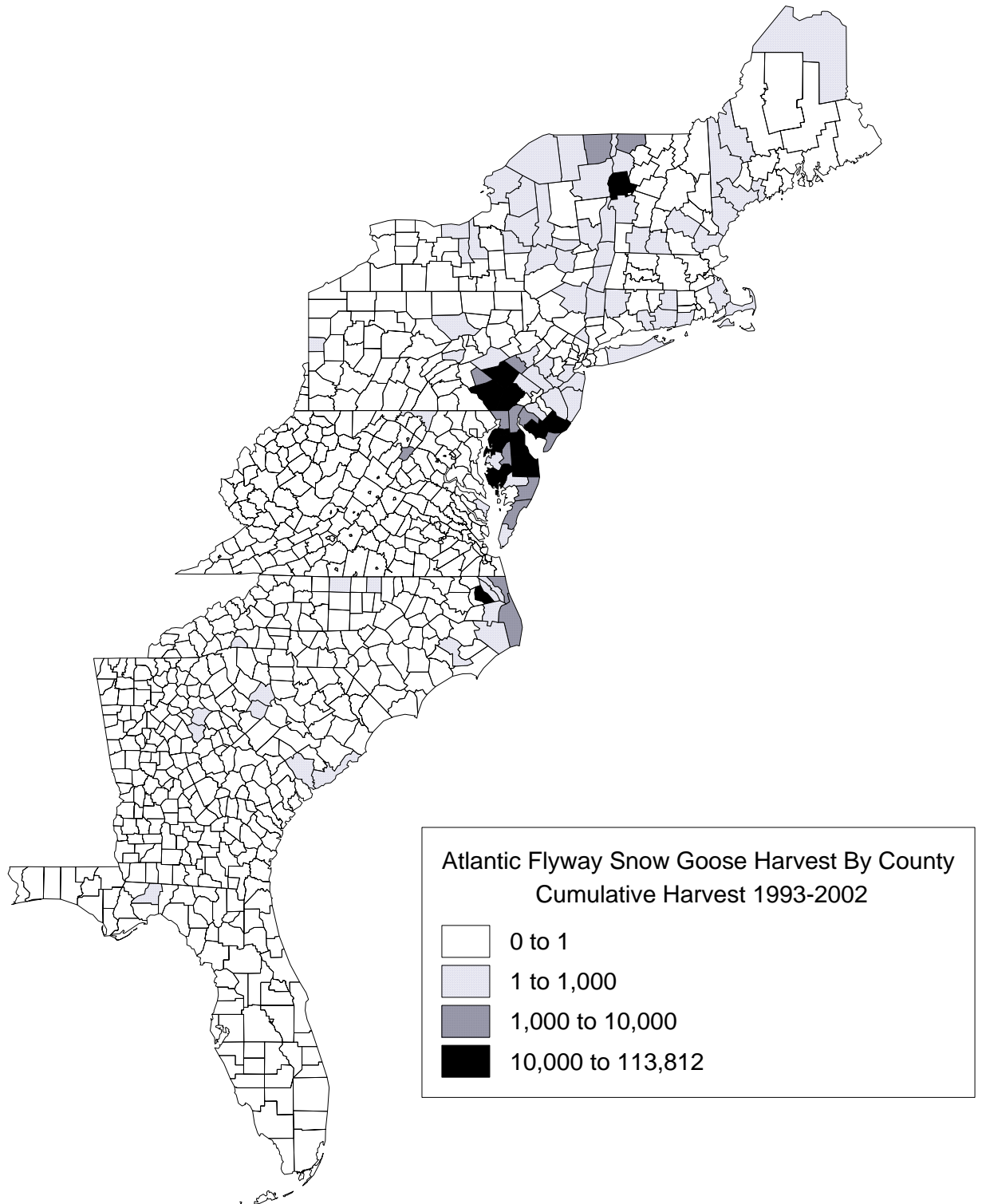
Based on our review, EPA has not identified any environmental concerns with the Service's preferred alternative of modifying harvest regulations and refuge management in order to reduce high population levels of light geese. We recognize that this effort is intended to reduce adverse impacts to arctic and sub-arctic habitats and light goose and other bird populations. However, we do recommend that following selection of a management approach, the Service should carefully monitor its implementation and remain open to exploring other options as necessary and appropriate. In our opinion, the DEIS provides adequate documentation of the potential environmental impacts. Accordingly, we have assigned a rating of **LO (Lack of Objections)** to the DEIS.

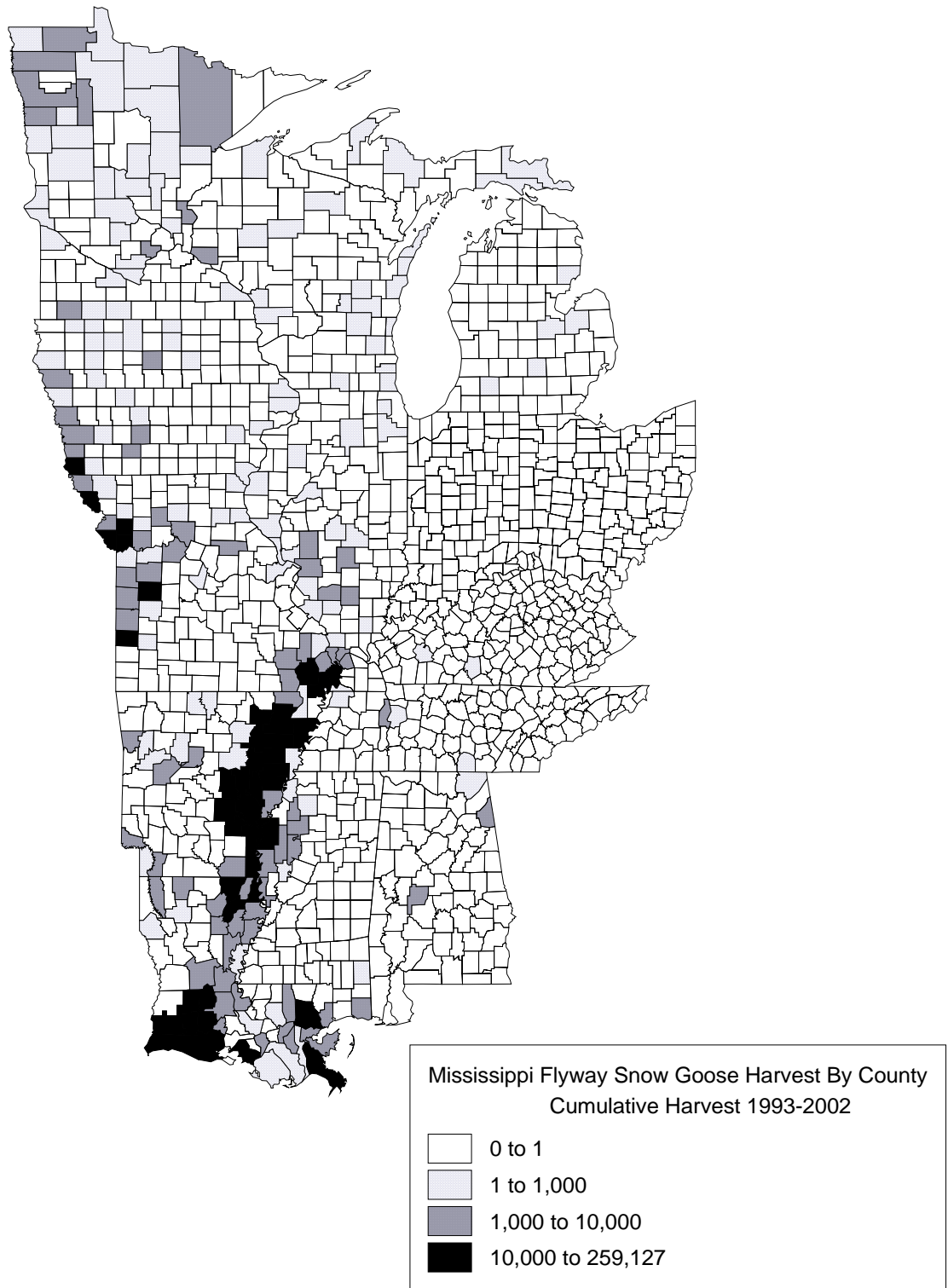
We appreciate the opportunity to review this DEIS. Should you have any additional questions please contact Cliff Rader of my staff at (202) 564-7159.

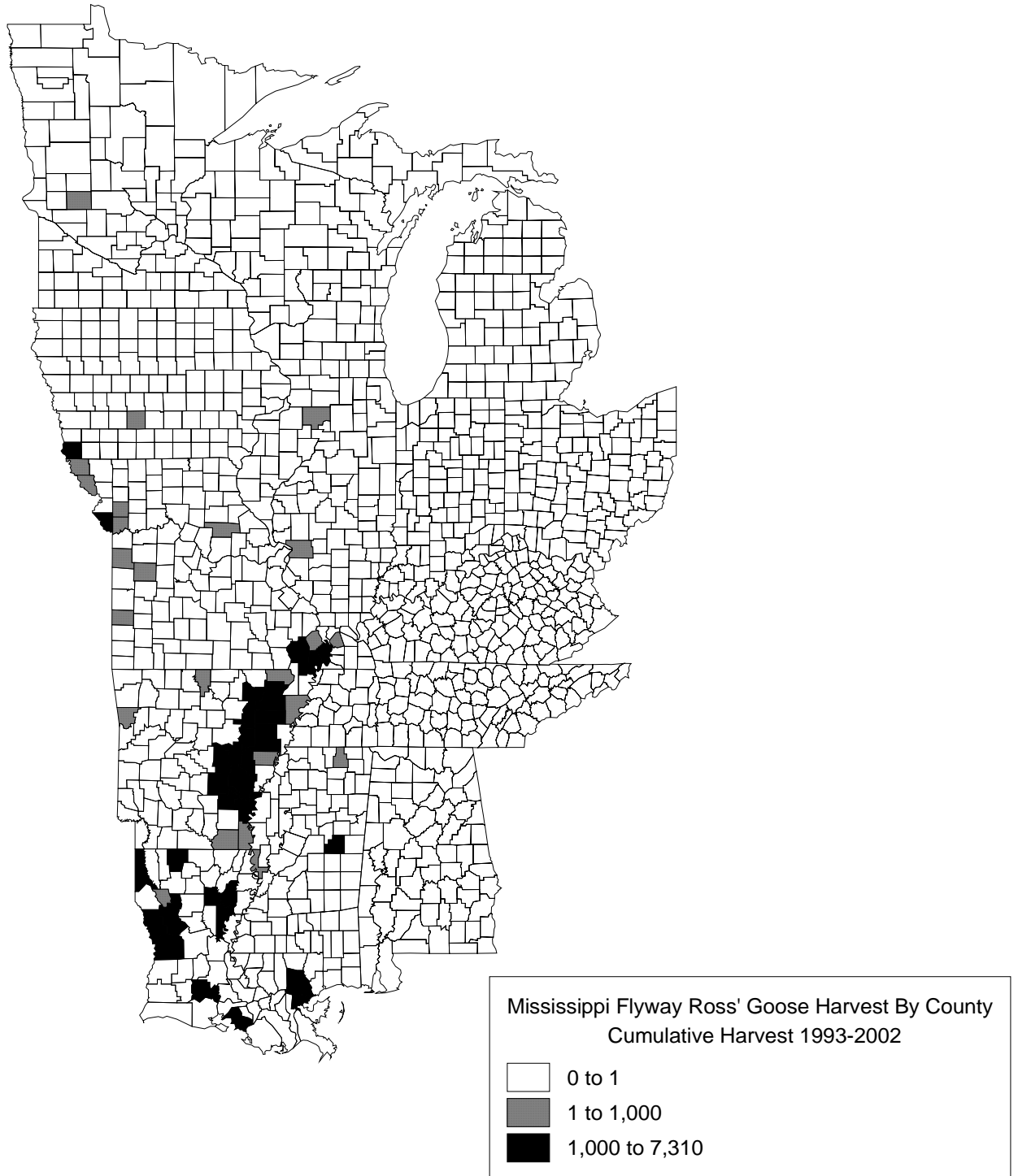
Sincerely,

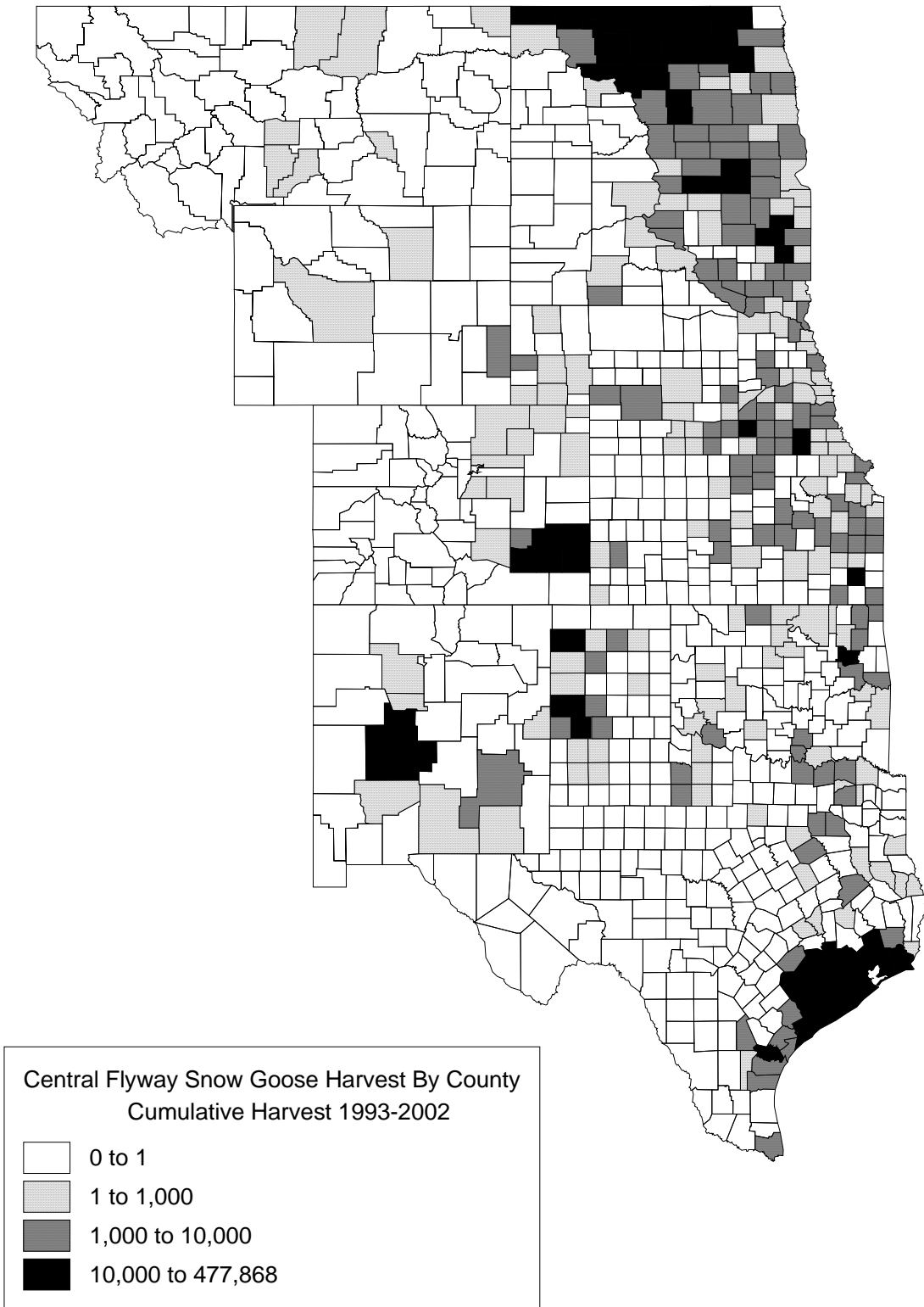
Anne Norton Miller
Director
Office of Federal Activities

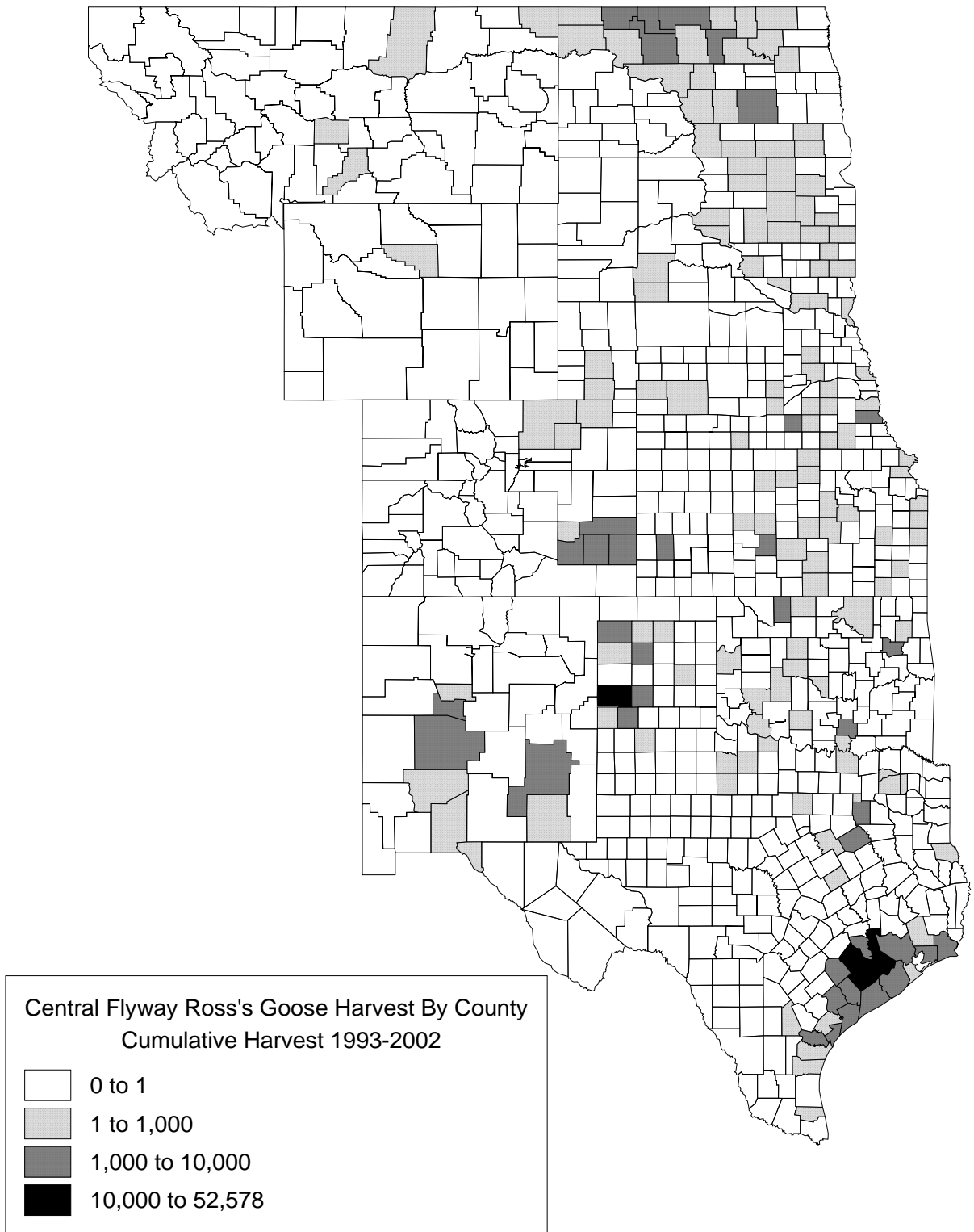
Appendix 4

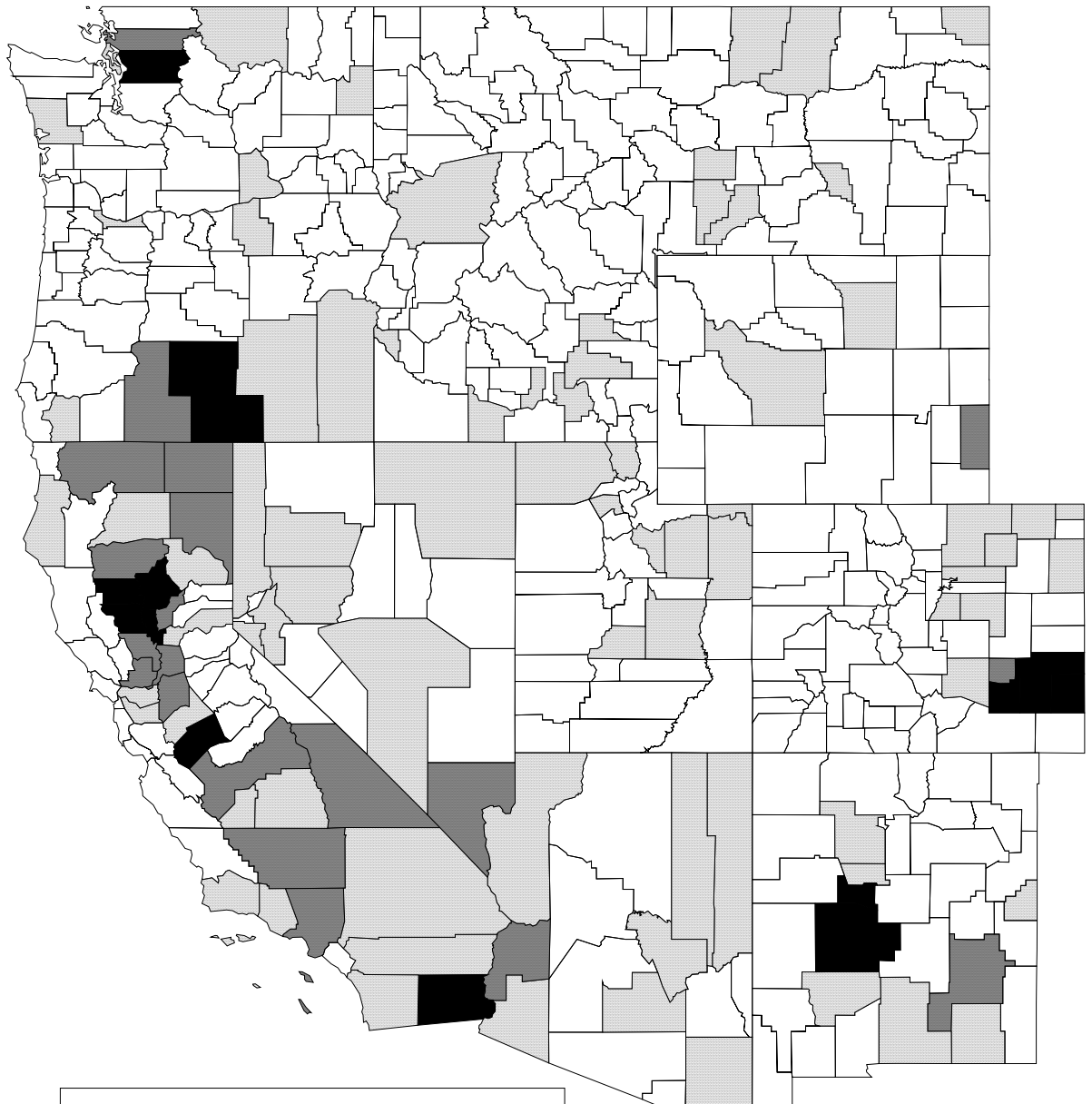






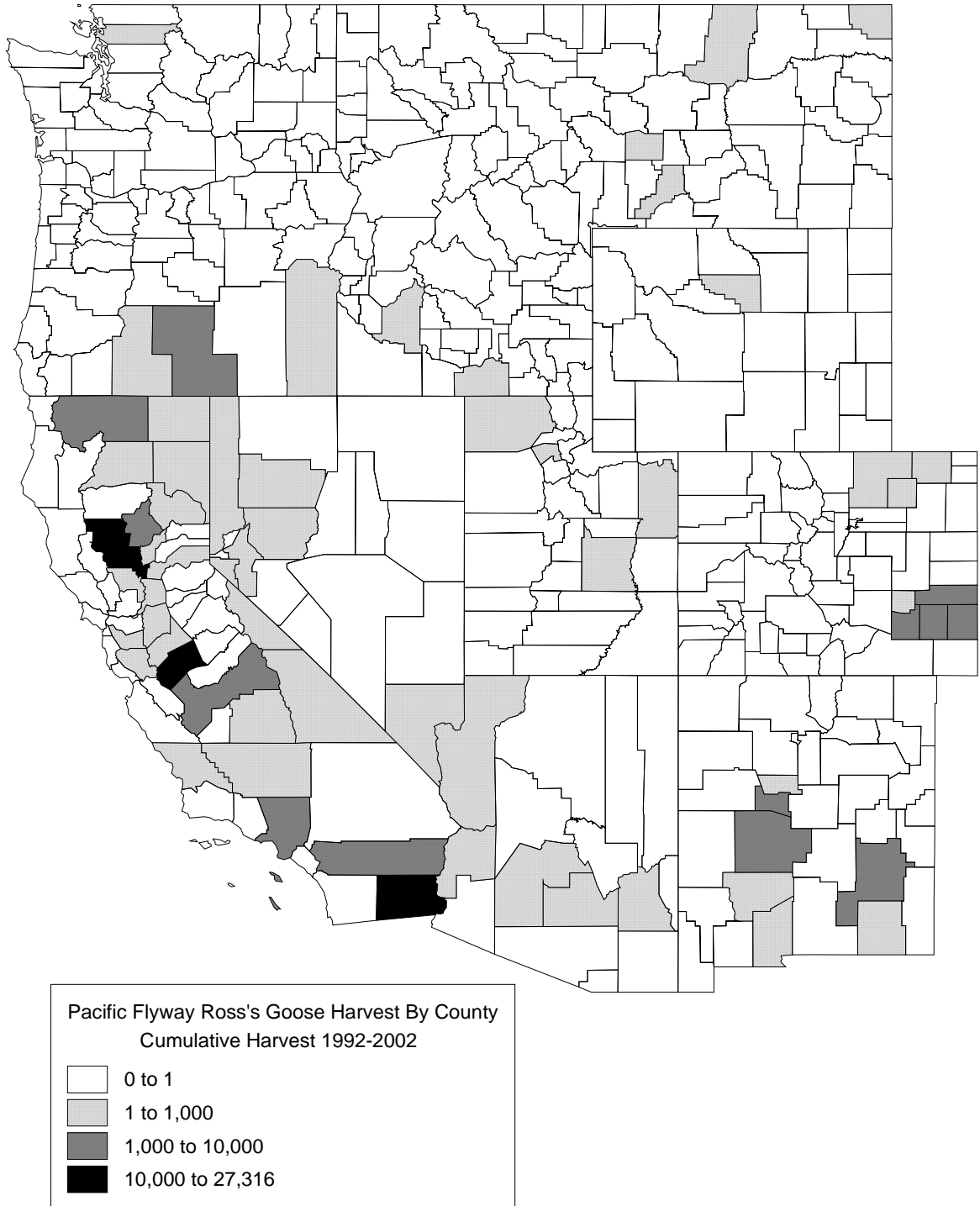






Pacific Flyway Snow Goose Harvest By County
Cumulative Harvest 1992-2002

White	0 to 1
Light Gray	1 to 1,000
Medium Gray	1,000 to 10,000
Black	10,000 to 81,254



Appendix 5

CFR Part 20

Revise paragraphs (b) and (g) of § 20.21 to read as follows:

§ 20.21 What hunting methods are illegal?

(b) With a shotgun of any description capable of holding more than three shells, unless it is plugged with a one-piece filler, incapable of removal without disassembling the gun, so its total capacity does not exceed three shells. This restriction does not apply during a light-goose-only season (greater and lesser snow geese and Ross's geese) when all other waterfowl and crane hunting seasons, excluding falconry, are closed.

(g) By the use or aid of recorded or electrically amplified bird calls or sounds, or recorded or electrically amplified imitations of bird calls or sounds. This restriction does not apply during a light-goose-only season (greater and lesser snow geese and Ross's geese) when all other waterfowl and crane hunting seasons, excluding falconry, are closed.

Revise § 20.22 to read as follows:

§ 20.22 Closed seasons.

No person shall take migratory game birds during the closed season except as provided in part 21.

Revise § 20.23 to read as follows:

§ 20.23 Shooting hours.

No person shall take migratory game birds except during the hours open to shooting as prescribed in subpart K of this part and subpart E of part 21.

CFR Part 21

Subpart E, consisting of §21.60, is revised to read as follows:

Subpart E - Control of Overabundant Migratory Bird Populations

§21.60 Conservation order for light geese

(a) What is a conservation order?

A conservation order is a special management action that is needed to control certain wildlife populations when traditional management programs are unsuccessful in preventing overabundance of the population. We are authorizing a conservation order under the authority of the Migratory Bird Treaty Act to reduce and stabilize various light goose populations. The conservation order allows new methods of taking light geese, allows shooting hours for light geese to end one-half hour after sunset, and imposes no daily bag limits for light geese inside or outside the migratory bird hunting season frameworks as described below.

(b) Which waterfowl species are covered by the order?

The conservation order addresses management of greater snow (*Chen caerulescens atlantica*), lesser snow (*C. c. caerulescens*) and Ross's (*C. rossii*) geese that breed, migrate, and winter in North America. The term light geese refers collectively to greater and lesser snow geese and Ross's geese.

(c) In what areas can the conservation order be authorized?

(1) The following States that are contained within the boundaries of the Atlantic Flyway: Connecticut, Delaware, Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, West Virginia.

(2) The following States, or portions of States, that are contained within the boundaries of the Mississippi and Central Flyways: Alabama, Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Mexico, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, Texas, Wisconsin, and Wyoming.

(3) The following States, or portions of States, that are contained within the boundaries of the Pacific Flyway: Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

(4) Tribal lands within the geographic boundaries in (1), (2), and (3) above.

(d) When will a conservation order be authorized in a particular Flyway?

(1) The Director may authorize a conservation order for the reduction of greater snow geese for any State or Tribe contained within the Atlantic Flyway by publishing a notice under subsection (e) when the May Waterfowl Population Status report indicates that the management goal of 500,000 birds has been exceeded and that special conservation actions conducted in Canada are insufficient to reduce the population. Authorization of the conservation order in the U.S. portion of the Atlantic Flyway will occur after the Director determines the degree to which the management goal has been exceeded, the trajectory of population growth, anticipated harvest that would result from implementation of the conservation order, and whether or not similar conservation actions will be conducted in Canada.

(2) The Director may authorize a conservation order for the reduction of mid-continent light geese (lesser snow and Ross's geese) for any State or Tribe contained within the Mississippi and Central Flyways by publishing a notice under subsection (e) when the May Waterfowl Population Status report indicates that the management goal of 1,600,000 birds (winter index for Mid-continent Population and Western Central Flyway Population, combined) has been exceeded. Authorization of the conservation order in the U.S. portion of the Mississippi and Central Flyways will occur after the Director determines the degree to which the management goal has been exceeded, the trajectory of population growth, anticipated harvest that would result from implementation of the conservation order, and whether or not similar conservation actions will be conducted in Canada.

(3) The Director may authorize a conservation order for the reduction of light geese (lesser snow and Ross's geese) for any State or Tribe contained within the Pacific Flyway by publishing a notice under subsection (e) when the Director determines that light goose numbers in the western Arctic have exceeded the ability of their breeding habitat to support them.

(e) How will the conservation order be authorized for a particular Flyway?

The Director will publish a notice in the Federal Register when a conservation order is authorized in a particular Flyway.

(f) What is required in order for State/Tribal governments to participate in the conservation order?

When authorized by the Director, any State or Tribal government responsible for the management of wildlife and migratory birds may, without permit, kill or cause to be killed under its general supervision, light geese under the following conditions:

- (1) Activities conducted under the conservation order may not affect endangered or threatened species as designated under the Endangered Species Act.
- (2) Control activities must be conducted clearly as such and are intended to relieve pressures on migratory birds and habitat essential to migratory bird populations only and are not to be construed as opening, re-opening, or extending any open hunting season contrary to any regulations promulgated under Section 3 of the Migratory Bird Treaty Act.
- (3) Control activities may be conducted only when all waterfowl (including light goose) and crane hunting seasons, excluding falconry, are closed.
- (4) Control measures employed through this section may be utilized only between the hours of one-half hour before sunrise to one-half hour after sunset.
- (5) Nothing in the conservation order may limit or initiate management actions on Federal land without concurrence of the Federal Agency with jurisdiction.
- (6) States and Tribes must designate participants who must operate under the conditions of the conservation order.
- (7) States and Tribes must inform participants of the requirements/conditions of the conservation order that apply.
- (8) States and Tribes must keep annual records of activities carried out under the authority of the conservation order. Specifically, information must be collected on:
 - (i) the number of individuals participating in the conservation order;
 - (ii) the number of days individuals participated in the conservation order;
 - (iii) the number of individuals that pursued light geese with the aid of a shotgun capable of holding more than three shells;
 - (iv) the number of individuals that pursued light geese with the aid of an electronic call;
 - (v) the number of individuals that pursued light geese during the period one-half hour after sunset;
 - (vi) the total number of light geese shot and retrieved during the conservation order;
 - (vii) the number of light geese taken with the aid of an electronic call;
 - (viii) the number of light geese taken with the fourth, fifth, or sixth shotgun shell;
 - (ix) the number of light geese taken during the period one-half hour after sunset; and
 - (x) the number of light geese shot but not retrieved.
- (9) The States and Tribes must submit an annual report summarizing activities conducted under the conservation order on or before September 15 of each year, to the Chief, Division of Migratory Bird

Management, U.S. Fish and Wildlife Service, 4401 N. Fairfax Drive, Mail Stop MBSP-4107, Arlington, Virginia 22203. Information from Tribes may be incorporated in State reports.

(g) What is required in order for individuals to participate in the conservation order?

Individual participants in State or Tribal programs covered by the conservation order are required to comply with the following requirements:

(1) Nothing in the conservation order authorizes the take of light geese contrary to any State or Tribal laws or regulations; and none of the privileges granted under the conservation order may be exercised unless persons acting under the authority of the conservation order possesses whatever permit or other authorization(s) as may be required for such activities by the State or Tribal government concerned.

(2) Participants who take light geese under the conservation order may not sell or offer for sale those birds nor their plumage, but may possess, transport, and otherwise properly use them.

(3) Participants acting under the authority of the conservation order must permit at all reasonable times including during actual operations, any Federal or State game or deputy game agent, warden, protector, or other game law enforcement officer free and unrestricted access over the premises on which such operations have been or are being conducted; and must promptly furnish whatever information an officer requires concerning the operation.

(4) Participants acting under the authority of the conservation order may take light geese by any method except those prohibited as follows:

(i) With a trap, snare, net, rifle, pistol, swivel gun, shotgun larger than 10 gauge, punt gun, battery gun, machine gun, fish hook, poison, drug, explosive, or stupefying substance;

(ii) From or by means, aid, or use of a sinkbox or any other type of low floating device, having a depression affording the person a means of concealment beneath the surface of the water;

(iii) From or by means, aid, or use of any motor vehicle, motor-driven land conveyance, or aircraft of any kind, except that paraplegics and persons missing one or both legs may take from any stationary motor vehicle or stationary motor-driven land conveyance;

(iv) From or by means of any motorboat or other craft having a motor attached, or any sailboat, unless the motor has been completely shut off and the sails furled, and its progress therefrom has ceased. A craft under power may be used only to retrieve dead or crippled birds; however, the craft may not be used under power to shoot any crippled birds;

(v) By the use or aid of live birds as decoys; although not limited to, it shall be a violation of this paragraph for any person to take light geese on an area where tame or captive live geese are present unless such birds are and have been for a period of 10 consecutive days before the taking, confined within an enclosure that substantially reduces the audibility of their calls and totally conceals the birds from the sight of light geese;

(vi) By means or aid of any motor-driven land, water, or air conveyance, or any sailboat used for the purpose of or resulting in the concentrating, driving, rallying, or stirring up of light geese;

(vii) By the aid of baiting, or on or over any baited area, where a person knows or reasonably should know that the area is or has been baited as described in 50 CFR § 20.11(j-k). Light geese may not be taken on or over lands or areas that are baited areas, and where grain or other feed has been distributed or scattered solely as the result of manipulation of an agricultural crop or other feed on the land where grown, or solely as the result of a normal agricultural operation as described in § 20.11(h and l). However, nothing in this paragraph prohibits the taking of light geese on or over the following lands or areas that are not otherwise baited areas: (A) standing crops or flooded standing crops (including aquatics); standing, flooded, or manipulated natural vegetation; flooded harvested croplands; or lands or areas where seeds or grains have been scattered solely as the result of a normal agricultural planting, harvesting, post-harvest manipulation or normal soil stabilization practice as described in § 20.11(g, i, l, and m); (B) from a blind or other place of concealment camouflaged with natural vegetation; (C) from a blind or other place of concealment camouflaged with vegetation from agricultural crops, as long as such camouflaging does not result in the exposing, depositing, distributing or scattering of grain or other feed; or (D) standing or flooded standing agricultural crops where grain is inadvertently scattered solely as a result of a hunter entering or exiting a hunting area, placing decoys, or retrieving downed birds.

(viii) Participants may not possess shot (either in shotshells or as loose shot for muzzleloading) other than steel shot, bismuth-tin, tungsten-iron, tungsten-polymer, tungsten-matrix, tungsten-nickel-iron, tungsten-nickel-iron-tin, or other shots that are authorized in 50 CFR 20.21(j).

(h) Under what conditions would the conservation order be suspended?

The Director will annually assess the overall impact and effectiveness of the conservation order on each light goose population to ensure compatibility with long-term conservation of this resource. The Director will suspend the conservation order if at any time evidence is presented that clearly demonstrates that an individual light goose population no longer presents a serious threat of injury to the area or areas involved. Suspension by the Director will occur by publication of a notice in the Federal Register. However, resumption of growth by the light goose population in question may warrant reinstatement of the conservation order to control the population. The Director will publish a notice of such reinstatement in the Federal Register. Depending on the status of individual light goose populations, it is possible that a conservation order may be in effect for one or more light goose populations, but not others.

(i) Can the conservation order be suspended?

The Director reserves the right to suspend or revoke a State's or Tribe's authority under this program if we find that the terms and conditions specified in the program have not been adhered to by that

State or Tribe. The criteria for suspension and revocation are outlined in 50 CFR § 13.27 and § 13.28 of this subchapter. Upon appeal, final decisions to revoke authority will be made by the Director.

Additionally, at such time that the Director determines that a specific population of light geese no longer poses a threat to habitats, agricultural crops, or other interests, or is within Flyway management objectives, the Director may choose to terminate part or all of the conservation order. In all cases, the Director will annually review the effectiveness of the program.

(j) Will information concerning the conservation order be collected?

The information collection requirements of the conservation order, as described in (f)(8) above, will be submitted for approval by OMB. Agencies may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The record-keeping and reporting requirements imposed under the conservation order will be utilized to administer this program, particularly in the assessment of impacts alternative regulatory strategies may have on light geese and other migratory bird populations. The information collected will be required to authorize State and Tribal governments responsible for migratory bird management to take light geese within the guidelines provided by the Service.

Appendix 6

Special light goose permit**(a) *What is the special light goose permit and what is its purpose?***

The special light goose permit is a permit issued by our Regional Offices to Service personnel and State wildlife agencies authorizing certain light goose management and control activities. The term light geese refers collectively to three taxa in North America: lesser snow geese (*Chen caerulescens caerulescens*), greater snow geese (*C. c. atlantica*), and Ross's geese (*C. rossii*). These taxa are generally referred to as "light" geese due to their light coloration; as opposed to "dark" geese such as Canada geese (*Branta canadensis*) and white-fronted geese (*Anser albifrons*). However, there are two color phases of lesser snow geese: the dark phase, typically referred to as "blue" geese, and white phase, typically referred to as "snow" geese or "white" geese. Both color phases are considered light geese for management purposes.

Regional Offices will only issue such a permit when it will contribute to the reduction of a particular light goose population that the Director has determined to be injurious to habitats or other interests on breeding, migration, and/or wintering areas. The management and control activities conducted under the permit are intended to relieve or prevent injurious situations only. No person should construe the permit as opening, reopening, or extending any hunting season contrary to any regulations established under Section 3 of the Migratory Bird Treaty Act.

(b) *Who may receive a light goose permit?*

Only Federal and State wildlife agencies (Agencies) are eligible to receive a permit to undertake light goose control activities. Additionally, only employees or designated agents of a permitted Agency may undertake activities for light geese in accordance with the conditions specified in the permit, conditions contained in 50 CFR part 13, and conditions specified in (d) of this section.

(c) *How does an Agency apply for a permit?*

Any wildlife agency wishing to obtain a permit must submit an application to the appropriate Service Regional Office, specified in 50 CFR 2.2, containing the general information and certification required by 50 CFR 13.12(a) plus the following information:

- (1) A statement showing that the light goose control activities will contribute to reduction of the light goose population(s) that the Director has determined to be injurious to habitats or other interests on breeding, migration, and/or wintering areas;
- (2) The requested annual take of light geese;
- (3) A statement indicating that the Agency will inform and brief all employees and designated agents of the requirements of these regulations and permit conditions.

(d) *What are the conditions of the permit?*

The special light goose permit is subject to the general conditions in 50 CFR part 13, and, unless otherwise specifically authorized by the Regional Office in the permit, the conditions outlined below:

(1) *What are the limitations on management and control activities?*

(i) Take of light geese as a management tool under this section may not exceed the number authorized by the Regional Office and specified in the permit.

(ii) Methods of take for the control of light geese are at the Agency's discretion. Methods may include, but are not limited to, firearms, alpha-chloralose, traps, and other techniques consistent with accepted wildlife management programs.

(iii) Activities conducted under the permit may not affect endangered or threatened species as designated under the Endangered Species Act.

(2) *When may an Agency conduct management and control activities?*

Agencies and their employees and agents may conduct control activities whenever light geese are present in the geographic area for which they have jurisdiction. In the Pacific Flyway, control activities should incorporate

Appendix 6

considerations for temporal and spatial aspects of migration of lesser snow geese from Wrangel Island, Russia, so as to avoid or minimize take of such birds.

(3) How must the Agency dispose or utilize geese taken under this permit?

Agencies and their employees and agents may possess, transport, and otherwise dispose of light geese taken under this section. Agencies must utilize such birds by donation to public museums or public institutions for scientific or educational purposes, by processing them for human consumption and distributing them free of charge to charitable organizations, or by burying or incinerating them. Agencies, their employees, and designated agents may not sell, offer for sale, barter, or ship for the purpose of sale or barter any light geese taken under this section, nor their plumage.

(4) How does the permit relate to existing State law?

No person conducting management and control activities under this section should construe the permit to authorize the killing of light geese contrary to any State law or regulation, nor on any Federal land without specific authorization by the responsible management agency. No person may exercise the privileges granted under this section unless they possess any permits required for such activities by any State or Federal land manager.

(5) When conducting management and control activities, are there any special inspection requirements?

Any Agency employee or designated agent authorized to carry out management and control activities must have a copy of the permit and designation in their possession when carrying out any activities. The Agency must also require the property owner or occupant on whose premises the Agency is conducting activities to allow, at all reasonable times, including during actual operations, free and unrestricted access to any Service special agent or refuge officer, State wildlife or deputy wildlife agent, warden, protector, or other wildlife law enforcement officer (wildlife officer) on the premises where they are, or were, conducting activities. Furthermore, any Agency employee or designated agent conducting such activities must promptly furnish whatever information is required concerning such activities to any such wildlife officer.

(6) What are the reporting requirements of the permit?

Any Agency employee or designated agent exercising the privileges granted by this section must keep records of all activities carried out under the authority of this permit, including the number of light geese killed and

their disposition. The Agency must submit to the issuing Regional Office an annual report detailing activities, including the dates, numbers and locations of birds taken and the techniques used, on or before September 15 of each year.

(7) What are the limitations of the special permit?

The following limitations apply:

(i) Nothing in this section applies to any Federal land within a State's boundaries without written permission of the Federal Agency with jurisdiction.

(ii) Agencies may not undertake any actions under any permit issued under this section if the activities adversely affect other migratory birds or species designated as endangered or threatened under the authority of the Endangered Species Act.

(iii) We will only issue permits to Federal and State wildlife agencies in the conterminous United States.

(iv) Agencies may designate agents who must operate under the conditions of the permit.

(v) How long is the special permit valid?

A special light goose permit issued or renewed under this section expires on the date designated on the face of the permit unless it is amended or revoked or such time that the Director determines that the light goose population in question no longer poses a threat to breeding, migration, and wintering habitats. In all cases, the term of the permit may not exceed five (5) years from the date of issuance or renewal.

(vi) Can we revoke the special permit?

We reserve the right to suspend or revoke any permit, as specified in 50 CFR 13.27 and 50 CFR 13.28.

(e) What are the OMB information collection requirements of the permit program?

Federal agencies may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. We will apply for an information collection permit and use the information to administer this program. We will require the information from Federal and State

Appendix 6

wildlife agencies responsible for migratory bird management in order to obtain a special light goose permit, and to determine if the applicant meets all the permit issuance criteria, and to protect migratory birds. We estimate the public reporting burden for this collection of information to average 8 hours per response, including the time for reviewing instructions, gathering and maintaining data needed, and completing and reviewing the collection of information.

Appendix 7

Appendix 7. Federal frameworks for light goose hunting seasons in the U.S., 1961-2006.

Year	Atlantic Flyway					Mississippi Flyway				
	Season dates			Limits		Season dates			Limits	
	Opening	Closing	Days	Daily Bag	Poss. ^a	Opening	Closing	Days	Daily Bag	Poss. ^a
1961	Closed season					Oct. 1	Jan. 8	60	5	5
1962	Closed season					Oct. 1	Jan. 13	60	5	5
1963	Closed season					Oct. 1	Jan. 15	70	5	5
1964	Closed season					Oct. 1	Jan. 15	70	5	5
1965	Closed season					Oct. 1	Jan. 15	70	5	5
1966	Closed season					Oct. 1	Jan. 15	70	5	5
1967	Closed season					Sep. 30	Jan. 14	70	5	5
1968	Closed season					Sep. 28	Jan. 12	70	5	5
1969	Closed season					Sep. 27	Jan. 11	70	5	5
1970	Closed season					Oct. 1	Jan. 24	70	5	5
1971	Closed season					Oct. 1	Jan. 23	70	5	5
1972	Closed season					Oct. 1	Jan. 20	70	5	5
1973	Closed season					Oct. 1	Jan. 20	70	5	5
1974	Closed season					Oct. 1	Jan. 20	70	5	5
1975	Oct. 1	Jan. 31	30	2	4	Oct. 1	Jan. 20	70	5	5
1976	Oct. 1	Jan. 31	30	2	4	Oct. 1	Jan. 20	70	5	5
1977	Oct. 1	Jan. 31	60	2	4	Oct. 1	Jan. 20	70	5	5
1978	Oct. 1	Jan. 31	70	2	4	Oct. 1	Jan. 20	70	5	5
1979	Oct. 1	Jan. 31	70	4	8	Sep. 29	Jan. 20	70	5	5
1980	Oct. 1	Jan. 31	70	4	8	Oct. 4	Jan. 20	70	5	10
1981	Oct. 1	Jan. 31	90	4	8	Oct. 3	Jan. 20	70	5	10
1982	Oct. 1	Jan. 31	90	4	8	Oct. 2	Jan. 20	70	5	10
1983	Oct. 1	Jan. 31	90	4	8	Oct. 1	Jan. 20	70	5	10
1984	Oct. 1	Jan. 31	90	4	8	Sep. 29	Jan. 20	70	5	10
1985	Oct. 1	Jan. 31	90	4	8	Sep. 28	Jan. 20	70	5	10
1986	Oct. 1	Jan. 31	90	4	8	Oct. 4	Jan. 20	70	5	10
1987	Oct. 1	Jan. 31	90	4	8	Oct. 3	Jan. 17	70	5	10
1988	Oct. 1	Jan. 31	90	4	8	Oct. 1	Jan. 22	70	5	10
1989	Oct. 1	Jan. 31	90	5	10	Sep. 30	Jan. 21	80	7	14
1990	Oct. 1	Feb. 10	107	5	10	Sep. 29	Jan. 20	80	7	14
1991	Oct. 1	Jan. 10	107	5	10	Sep. 28	Jan. 31	80	7	14
1992	Oct. 1	Feb. 10	107	5	10	Oct. 3	Jan. 31	80	7	14
1993	Oct. 1	Feb. 10	107	5	10	Oct. 2	Feb. 14	80	7	14
1994	Oct. 1	Feb. 10	107	5	10	Oct. 1	Feb. 14	107	7	14
1995	Oct. 1	Feb. 10	107	5	10	Oct. 1	Feb. 14	107	10	20
1996	Oct. 1	Mar. 10	107	8	24	Sep. 28	Mar. 10	107	10	30
1997	Oct. 1	Mar. 10	107	10	30	Oct. 4	Mar. 10	107	10	30
1998	Oct. 1	Mar. 10	107	15	none	Oct. 3	Mar. 10	107	20	none
1999	Oct. 1	Mar. 10	107	15	none	Oct. 2	Mar. 10	107	20	none
2000-06	Oct. 1	Mar. 10	107	15	none	Sep. 30 ^b	Mar. 10	107	20	none

^a Possession limit (none means no limit)

^b Saturday nearest September 24

Appendix 7

Year	Central Flyway ^b					Pacific Flyway				
	Season dates			Limits ^c		Season dates			Limits ^d	
	Opening	Closing	Days	Daily Bag	Poss. ^a	Opening	Closing	Days	Daily Bag	Poss. ^a
1961	Oct. 1	Jan. 8	60	5	5	Oct. 7	Jan. 7	75	6,0	6,0
1962	Oct. 6	Jan. 6	75	5	5	Oct. 6	Jan. 6	75	6,0	6,0
1963	Oct. 5	Jan. 5	90,75	5	5	Oct. 5	Jan. 5	90	6,1	6,1
1964	Oct. 10	Jan. 10	90,75	5	5	Oct. 10	Jan. 10	90	6,1	6,1
1965	Oct. 1	Jan. 15	75	5	5	Oct. 9	Jan. 9	90	6,1	6,1
1966	Oct. 1	Jan. 15	75	5	5	Oct. 8	Jan. 8	90	6,1	6,1
1967	Sep. 30	Jan. 14	75	5	5	Oct. 7	Jan. 14	90	6,1	6,1
1968	Oct. 1	Jan. 15	75	2,5	2,5	Oct. 5	Jan. 12	93	6,1	6,1
1969	Oct. 1	Jan. 15	86	2,5	4,5	Oct. 4	Jan. 11	93	6,1	6,1
1970	Oct. 1	Jan. 17	90,75	2,5	4,5	Oct. 3	Jan. 17	93	6,1	6,1
1971	Oct. 1	Jan. 16	90,75	2,5	4,5	Oct. 2	Jan. 16	93	6,1	6,1
1972	Oct. 1	Jan. 24	93,72	2,4	4,4	Oct. 1	Jan. 20	93	6,1	6,1
1973	Sep. 29	Jan. 20	93,72	2,5	4,5	Sep. 29	Jan. 20	93	6,1	6,1
1974	Sep. 28	Jan. 19	93,72	2,5	4,5	Sep. 28	Jan. 19	93	6,1	6,1
1975	Oct. 4	Jan. 18	93,72	2,5	4,5	Oct. 4	Jan. 18	93	3,1	6,1
1976	Oct. 2	Jan. 23	93,72	2,5	4,5	Oct. 2	Jan. 23	93	3,1	6,1
1977	Oct. 1	Jan. 22	93,86	2,5	4,5	Oct. 1	Jan. 22	93	3,1	6,1
1978	Sep. 30	Jan. 21	93,86	2,5	4,5	Sep. 30	Jan. 21	93	3,1	6,1
1979	Sep. 29	Jan. 20	93,86	2,5	4,5	Sep. 29	Jan. 20	93	3,1	6,1
1980	Oct. 4	Jan. 18	93,86	2,5	4,10	Oct. 4	Jan. 18	93	3,3	6,6
1981	Oct. 3	Jan. 17	93,86	2,5	4,10	Oct. 3	Jan. 17	93	3,3	6,6
1982	Oct. 2	Jan. 23	93,86	2,5	4,10	Oct. 2	Jan. 23	93	3,3	6,6
1983	Oct. 1	Jan. 22	93,86	2,5	4,10	Oct. 1	Jan. 22	93	3,3	6,6
1984	Sep. 29	Feb. 12	93,86	2,5	4,10	Sep. 29	Jan. 20	93	3,3	6,6
1985	Sep. 28	Feb. 16	93,86	5	10	Sep. 28	Jan. 19	93	3,3	6,6
1986	Oct. 4	Feb. 15	93,86	5	10	Oct. 4	Jan. 18	93	3,3	6,6
1987	Oct. 3	Feb. 14	93,86	5	10	Oct. 3	Jan. 17	93	3,3	6,6
1988	Oct. 1	Feb. 14	95,86	5	10	Oct. 1	Jan. 22	93	3,3	6,6
1989	Sep. 30	Feb. 18	95,100	5	10	Sep. 30	Jan. 21	93	3,3	6,6
1990	Sep. 29	Feb. 17	100,86 ^e	5 ^e	10 ^e	Sep. 29	Jan. 20	93	3,3	6,6
1991	Sep. 28	Feb. 16	107,86 ^e	5 ^e	10 ^e	Sep. 28	Jan. 19	93	3,3	6,6
1992	Oct. 3	Feb. 14	107	5,10	10,20	Oct. 3	Jan. 17	93	3,3	6,6
1993	Oct. 2	Feb. 13	107	5,10	10,20	Oct. 2	Jan. 23	100	3,3	6,6
1994	Oct. 1	Feb. 28	107	5,10	10,20	Oct. 1	Jan. 20	100	3,3	6,6
1995	Sep. 30	Mar. 10	107	5,10	10,20	Oct. 1	Jan. 21	100	3,3	6,6
1996	Sep. 28	Mar. 10	107	10	40	Sep. 29	Jan. 19	100	3,3	6,6
1997	Oct. 4	Mar. 10	107	10	40	Oct. 4	Jan. 18	100	3,3	6,6
1998	Oct. 3	Mar. 10	107	20	none	Oct. 3	Jan. 17	100	3,3	6,6
1999	Oct. 2	Mar. 10	107	20	none	Oct. 2	Jan. 23	100	3,3	6,6
2000	Sep. 30	Mar. 10	107	20	none	Sep. 30	Jan. 21	100	3,3	6,6
2001	Sep. 29	Mar. 10	107	20	none	Sep. 29	Jan. 20	100	3,3	6,6
2002	Sep. 21	Mar. 10	107	20	none	Sep. 21 ^f	Jan. 26	107 ^f	3,3	6,6
2003	Sep. 27	Mar. 10	107	20	none	Oct. 4	Jan. 25	100	3,3	6,6
2004	Sep. 25	Mar. 10	107	20	none	Oct. 2	Jan. 30	100	3,3	6,6
2005	Sep. 24	Mar. 10	107	20	none	Oct. 1	Jan. 29	100	4,4	8,8
2006	Sep. 23	Mar. 10	107	20	none	Sep. 30	Jan. 28	100	4,4	8,8

^a Possession limit^b Central Flyway: If 2 numbers are given for days, bag and/or possession limits the first number is for the western tier states and the second number is for eastern tier states.

Appendix 7

^c Bag/possession limit for Ross's geese is 1/1 during 1963-1978. Season closed 1961-62.

^d Pacific Flyway bag and possession limits are for lesser snow and Ross's geese, respectively.

^e In 1990 and 1991, eastern tier states had the days/daily bag/possession limit option of either 86/5/7 or 100/10/14.

^f In CA, OR, and WA season opening framework date was Sep. 28 and season length was 100 days.

Appendix 8

Regional listing of special status species that overlap in geographic range with various populations of light geese in Service Regions 1-7. Endangered (E), threatened (T), or experimental non-essential (XN) status of each species is indicated after scientific name.

Common name
Scientific name and status

Region 1 (Pacific)

Hawaiian goose	(<i>Brant sandvicensis</i>) [E]
Light-footed clapper rail	(<i>Rallus longirostris levipes</i>) [E]
California clapper rail	(<i>Rallus longirostris obsoletus</i>) [E]
Yuma clapper rail	(<i>Rallus longirostris yumanensis</i>) [E]
California least tern	(<i>Sterna antillarum</i>) [E]
Brown pelican	(<i>Pelicanus occidentalis</i>) (Pacific coast pop.) [E]
Southwestern willow flycatcher	(<i>Empidonax traillii extimus</i>) [E]
California condor	(<i>Gymnogyps californianus</i>) [E]
Least Bell's vireo	(<i>Vireo belli pusillus</i>) [E]
Western snowy plover	(<i>Charadrius alexandrinus nivosus</i>) [T]
Bald eagle	(<i>Haliaeetus leucocephalus</i>) [T]
California gnatcatcher	(<i>Polioptila californica</i>) [T]
Inyo California towhee	(<i>Pipilo crissalis eremophilus</i>) [T]
Marbled murrelet	(<i>Brachyramphus marmoratus</i>) [T]
Northern spotted owl	(<i>Strix occidentalis caurina</i>) [T]
Giant Garter Snake	(<i>Thamnophis gigas</i>) [T]
Mountain plover	(<i>Charadrius montanus</i>) [P]
Western sage grouse	(<i>Centrocercus urophasianus phaios</i>) [C]

Region 2 (Southwest)

Attwater's greater prairie-chicken	(<i>Tympanuchus cupido attwateri</i>) [E]
Masked bobwhite	(<i>Colinus virginianus ridgewayi</i>) [E]
Red-cockaded woodpecker	(<i>Picoides borealis</i>) [E]
Cactus ferruginous pygmy-owl	(<i>Glaucidium brasilainum cactorum</i>) [E]
Yuma clapper rail	(<i>Rallus longirostris yumanensis</i>) [E]
Least tern	(<i>Sterna antillarum</i>) [E]
Northern aplomado falcon	(<i>Falco femoralis septentrionalis</i>) [E]
Brown pelican	(<i>Pelicanus occidentalis</i>) [E]
Southwestern willow flycatcher	(<i>Empidonax traillii extimus</i>) [E]
Black-capped vireo	(<i>Vireo atricapillus</i>) [E]
Golden-cheeked warbler	(<i>Dendroica chrysoparia</i>) [E]
California condor	(<i>Gymnogyps californianus</i>) [XN]
Mexican spotted owl	(<i>Strix occidentalis lucida</i>) [T]
Bald eagle	(<i>Haliaeetus leucocephalus</i>) [T]
Piping plover	(<i>Charadrius melodus</i>) [T]
Whooping crane	(<i>Grus americana</i>) [E]
Mountain plover	(<i>Charadrius montanus</i>) [P]
Lesser prairie-chicken	(<i>Tympanuchus pallidicinctus</i>) [C]

Region 3 (Great Lakes-Big Rivers)

Piping plover	(<i>Charadrius melodus</i>) [T]
Least tern	(<i>Sterna antillarum</i>) (Interior population) [E]
Bald eagle	(<i>Haliaeetus leucocephalus</i>) [T]
Copperbelly water snake	(<i>Nerodia erythrogaster neglecta</i>) [T]

Region 4 (Southeast)

Red-cockaded woodpecker	(<i>Picoides borealis</i>) [E]
Puerto Rican parrot	(<i>Amazona vittata</i>) [E]
Puerto Rican nightjar	(<i>Caprimulgus noctitherus</i>) [E]
Puerto Rican Plain pigeon	(<i>Columba inornata wetmorei</i>) [E]
Mississippi sandhill crane	(<i>Grus canadensis pulla</i>) [E]
Piping plover	(<i>Charadrius melodus</i>) [E]
Least tern	(<i>Sterna antillarum</i>) (Interior population) [E]
Everglade snail kite	(<i>Rostrhamus sociabilis plumbeus</i>) [E]
Puerto Rican broad-winged hawk	(<i>Buteo platypterus brunnescens</i>) [E]
Puerto Rican sharp-shinned hawk	(<i>Accipiter striatus venator</i>) [E]
Wood stork	(<i>Mycteria americana</i>) [E]
Brown pelican	(<i>Pelicanus occidentalis</i>) [E]
Cape Sable sparrow	(<i>Ammodramus maritimus mirabilis</i>) [E]
Florida grasshopper sparrow	(<i>Ammodramus savanarum floridanus</i>) [E]
Yellow-shouldered blackbird	(<i>Agelaius xanthomus</i>) [E]
Roseate tern	(<i>Sterna douglalli</i>) [T]
Bald eagle	(<i>Haliaeetus leucocephalus</i>) [T]
Audubon's crested caracara	(<i>Polyborus plancus audubonii</i>) [T]
Florida scrub jay	(<i>Aphelocoma coerulescens</i>) [T]
Bog turtle	(<i>Clemmys muhlenbergii</i>) [T]

Region 5 (Northeast)

Piping plover	(<i>Charadrius melodus</i>) [T]
Roseate tern	(<i>Sterna douglalli</i>) [E]
Bald eagle	(<i>Haliaeetus leucocephalus</i>) [T]
Plymouth redbelly turtle	(<i>Pseudemys rubriventris bangsi</i>) [E]
Bog turtle	(<i>Clemmys muhlenbergii</i>) [T]

Region 6 (Mountain-Prairie)

Least tern	(<i>Sterna antillarum</i>) (Interior population) [E]
Piping plover	(<i>Charadrius melodus</i>) [T]
Mexican spotted owl	(<i>Strix occidentalis lucida</i>) [T]
Bald eagle	(<i>Haliaeetus leucocephalus</i>) [T]
Whooping crane	(<i>Grus americana</i>) [E]

Region 7 (Alaska)

Eskimo curlew	(<i>Numenius borealis</i>) [E]
Spectacled eider	(<i>Somateria fischeri</i>) [T]
Steller's eider	(<i>Polysticta stelleri</i>) [T]