MANAGEMENT GUIDELINES

for

CENTRAL FLYWAY ARCTIC NESTING CANADA GEESE

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FOREWORD

Guidelines for the cooperative management of the Short Grass Prairie (SGP) population of
Canada Geese were adopted unanimously by the Central Flyway Waterfowl Council in official
session March 28, 1982, at Portland, Oregon. Guidelines for cooperative management of the Tall
Grass Prairie (TGP) population of Canada geese were unanimously adopted by the Central
Flyway Council meeting officially on July 29, 1985, at Bismarck, North Dakota. As populations
have expanded and new demographic and genetic information has become available, the
importance of recognizing two separate populations has diminished while the regulatory
complexity has increased. This new plan combines the former SGP and TGP populations into
one population, the Central Flyway Arctic Nesting (CFAN) Canada geese, which will be
addressed with these management guidelines, jointly agreed on by the Central and Mississippi
Flyways.

This plan contains the following key elements:

1. Three-year averaged population estimates will be derived from a Lincoln (1930) estimate
using harvest estimates and hunter recoveries of geese banded on the breeding grounds.

2. To maintain a three-year running average harvest rate of adult geese at or below 10 percent.

3. Allowing each flyway to set hunting regulations independently of the other, within the
constraints of the maximum harvest rate.

4. Mid-winter surveys will be continued, at least in key areas in, order to track winter
distribution and numbers.

CFAN Canada geese migrate within a range that includes several jurisdictions within two
Nations. They are of great interest and value to many people. The Council has directed that this
plan be dynamic and include provisions for periodic review, and appropriate revision, to consider
new and improved information, to adapt to changing circumstances, and/or to accommodate new
intentions and desires. Revisions will be identified by the date they are approved and will be
distributed as amendments to this document. The Central Flyway Council solicits the
cooperation of all who are responsible and interested in the management of this international
resource. Inquiries or comments may be addressed to:

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TABLE OF CONTENTS

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INTRODUCTION

For the purposes of this management plan, the Central Flyway Arctic Nesting (CFAN) Canada goose population will include all Canada geese nesting north of the tree line in Canada, and wintering mainly in the Central Flyway (Fig. 1). According to band recovery data, birds banded in the westernmost nesting areas generally winter farther west than those from the central nesting areas, which in turn winter farther west than those from the easternmost nesting areas (Fig. 2). Canada geese nesting in the central and western arctic are most commonly recovered in eastern Alberta, western Saskatchewan, and western portions of the Central Flyway. Those nesting in the western Hudson Bay region between ~75-95°W longitude are mainly recovered in eastern Saskatchewan, southwestern Manitoba, and eastern portions of the Central Flyway, and Canada geese nesting on Baffin Island are recovered in southern Manitoba and in nearly equal proportions in the eastern Central Flyway and western Mississippi Flyway.

Historically, Canada goose populations were defined and managed based on their wintering grounds affiliations to ensure that hunting regulations for specific goose populations matched geographic variations in goose numbers and productivity, migration and wintering concentrations, and harvest pressure. Traditionally, midcontinent arctic nesting Canada geese were managed as two populations in the Central Flyway, the Short Grass Prairie Population (Marquardt 1962, Grieb 1970), and the Tall Grass Prairie Population (Marquardt 1962, MacInnes 1966). The Short Grass Prairie Population was harvested almost entirely in the Central Flyway, while the Tall Grass Prairie Population was harvested in nearly equal proportions in the Mississippi and Central Flyways. Due to the fact that these populations are comprised of geese that are demographically similar, and birds from across the breeding area overlap in winter, CFAN Canada geese should be managed as one population.

Management of previously defined goose populations is complicated by several factors. First, the boundary line separating populations is artificial and likely varies over time, so it is difficult to assess whether changes in population indices are a result of actual changes in numbers, temporal changes in distribution, or a combination of both. Second, on wintering areas, populations mix with each other and are difficult to distinguish during surveys, so winter indices may be inaccurate. Third, criteria used to distinguish "large" and "small" races of Canada geese in the harvest differ in Canada and the United States (and among flyways in the US), and methods used to assign population affiliation of harvested Canada geese do not account for possible temporal variation in winter distribution. Fourth, in 2004, the American Ornithologists' Union recognized cackling geese as a separate species from Canada geese (Banks et al. 2004). These limitations and changes in taxonomy complicate interpretation of harvest estimates and attempts to predict the relationship between harvest regulations and resulting harvest. This plan revision attempts to resolve these difficulties and provides recommended steps to move forward in managing these geese.

The purpose of this plan is to provide management guidelines for CFAN Canada geese by

identifying a goal and objectives toward which conservation interests may direct efforts.

GOAL

The management goal is maximum recreational opportunity consistent with the long-term welfare of the population, international treaties, habitat constraints, and the interests of all Central Flyway provinces and states.

OBJECTIVES

Recreational opportunities are affected by three primary factors; 1) the number of geese in the population, 2) their temporal and geographic distributions, and 3) opportunities for use. Accordingly objectives and guidelines for these three factors are presented in this document.
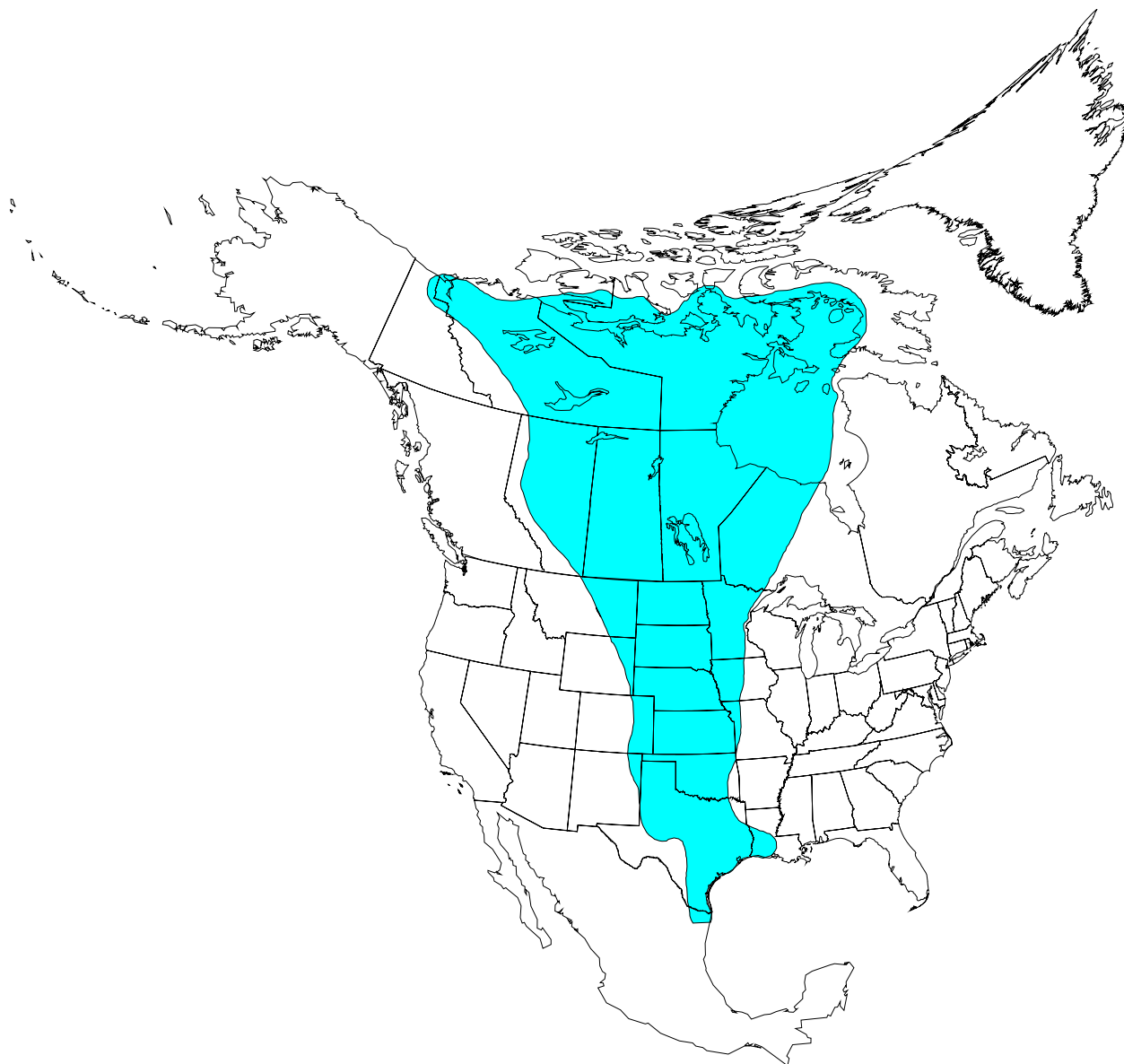

Figure 1: Approximate range of Central Flyway Arctic Nesting Canada Geese.

Central Arctic Cackling (Sm. Canada) Geese
Banded 2000-2009, shot, direct recoveries

Southampton Island Cackling (Sm. Canada) Geese
Banded 2000-2009, shot, direct recoveries

Baffin Island Cackling (Sm. Canada) Geese
Banded 2000-2009, shot, direct recoveries

• 1-3   recoveries
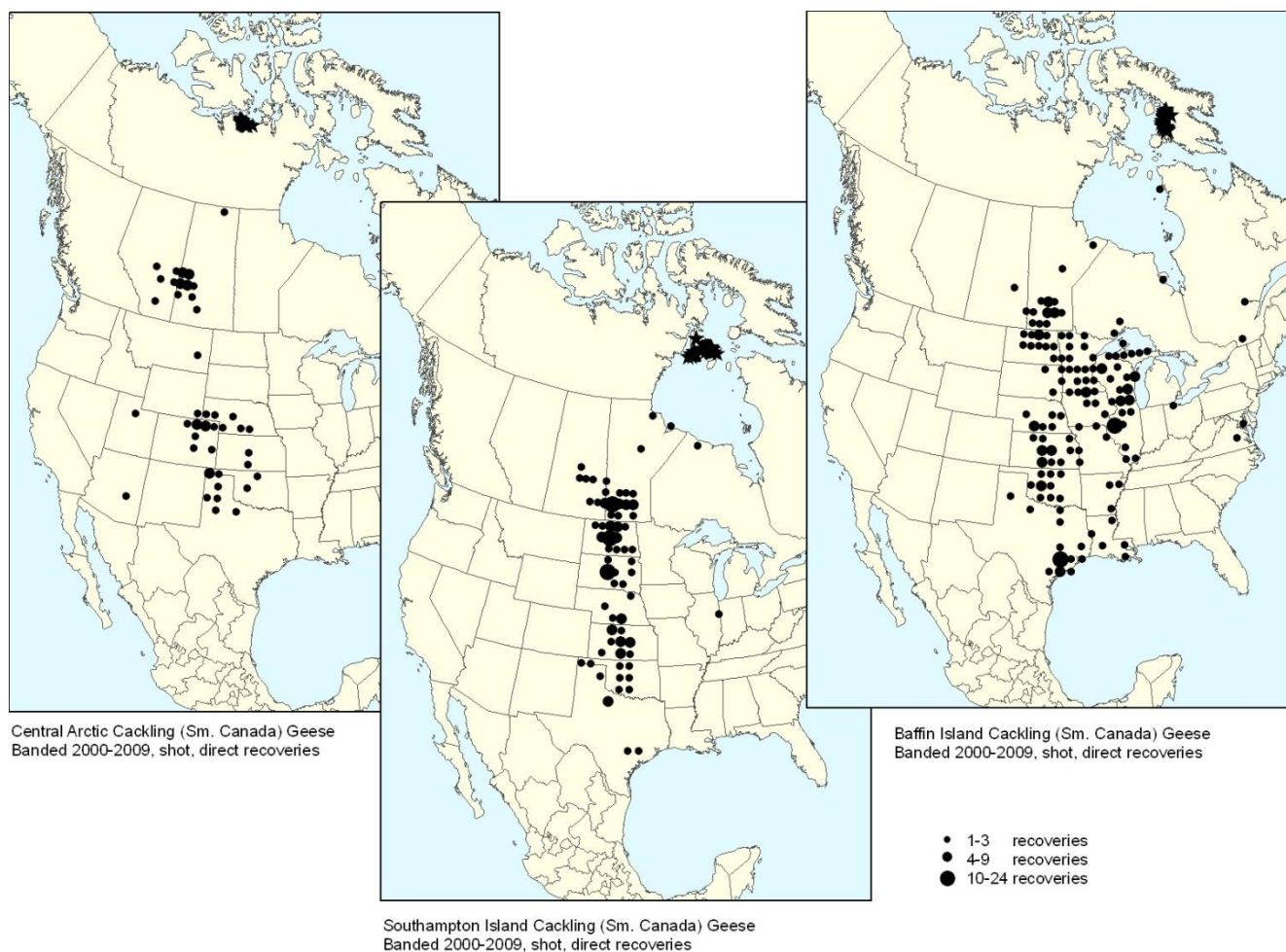● 4-9   recoveries
⬤ 10-24 recoveries

Figure 2: Longitudinal variation in band recovery distributions of CFAN Canada geese marked in different regions of the Canadian arctic. Only direct recoveries of shot birds that were banded from 2000-2009 are included.

Objective A: Maintain a population of at least 1,000,000 adult CFAN Canada geese based on a Lincoln estimate using 3-year averaged harvest estimates and band recoveries from hunter-harvested birds.

Rationale: Total numbers of CFAN Canada geese are difficult to estimate using annual population surveys on their breeding grounds due to the sheer size of the range, and on their wintering grounds due to intermixing with other Canada geese in the Central Flyway. An alternative approach is to monitor the status of these geese indirectly using data obtained from an operational banding program, similar to the manner in which wood duck populations are monitored (Garretson 2007, Balkcom et al. 2010). Hunter recoveries of geese banded annually on breeding areas provide information on distribution of harvest as well as annual survival and

harvest rates. Additionally, age-specific harvests are estimated annually in both the United States and Canada using tail feathers and wing-tips collected via the annual waterfowl parts collection survey. Age-specific harvest estimates, when combined with harvest rate estimates derived from banding data, allow estimation of the number of adult birds in the population, and these estimates could be used for population monitoring, as has been used for several other species of arctic-nesting geese (Alisauskas et al. 2009).

Although our use objective is based on a target harvest rate (see Objective C), it is useful to identify a minimum population level objective for CFAN Canada geese, below which managers would take steps to insure population growth can take place. Such a minimum population objective is also useful in the context of broader conservation initiatives (e.g., the North American Waterfowl Management Plan). Lincoln estimates indicate the population of CFAN Canada geese during the late 1980's was approximately 1,000,000 adult birds, and the population has had an increasing or stable trend since then (Fig. 3) under increasingly liberal hunting regulations. This information suggests that a CFAN Canada geese population size of ≥1,000,000 adults has the capacity to remain stable or increase and can meet distribution and recreational use objectives. We have little historical experience applying management guidelines to CFAN Canada geese at lower Lincoln-based population levels. Based on current information, therefore, we recommend using 1,000,000 adult geese (based on a Lincoln index using harvest and harvest rate information) as a minimum population objective for CFAN Canada geese.

Strategy A-1: Monitor the population of CFAN Canada geese by:

   a. continuing banding adequate numbers of CFAN Canada geese across their breeding range.
   b. continuing harvest surveys (parts collection survey (PCS) and harvest information program (HIP)) and band recovery analysis in the US and Canada.

Rationale: Lincoln's estimate requires data gained by both the marking and recovery of a representative and numerically adequate sample.

Responsibilities: All cooperating agencies.

Strategy A-2: Minimize non-hunting mortality, including losses to predators, diseases, starvation, poisoning and unregulated kill and sublethal effects of various agents including toxins by:

   a. controlling application of lethal and sublethal substances through legislation and enforcement.
   b. dispersal of large numbers of geese concentrated in small areas, especially in situations where stress-related disease outbreaks and die-offs may occur.
   c. developing and implementing a disease contingency plan to monitor conditions for disease outbreaks and to enable wildlife agencies to react to potential die-offs.
   d. controlling illegal kill through enforcement and protective legislation.

POPULATION GUIDELINES

Strategy A-3: Promote the conservation of seasonal habitats used by breeding, brood-rearing, molting, staging, migrating and wintering CFAN Canada geese by:

    a.   encouraging landowners to appreciate wildlife, to retain wetlands and grasslands used by wild geese, and to leave suitable crop residues on the surface available to geese especially during winter and early spring periods.

    b.   discouraging developments in key habitats, especially in the river alluvial valleys used by nesting and brooding geese.

    c.   preserving, through appropriate means, (e.g., designation of sanctuaries and purchase of conservation easements) key habitats that otherwise would be degraded or destroyed.

Rationale: Although the range of CFAN Canada geese is extensive, suitable habitats are not always abundant (e.g., generally only river valleys and deltas are fertile enough for rearing goslings). Recent energy development may affect habitats throughout their range through development of infrastructure, support centers, and recreational camps. Other landscape and system changes, particularly caused by urbanization, agriculture and energy development, can have permanent and negative effects throughout the CFAN Canada goose range. Regular monitoring of both habitats and programs likely to affect those habitats will enable forestalling degradation and destruction that, once started, are difficult to reverse.

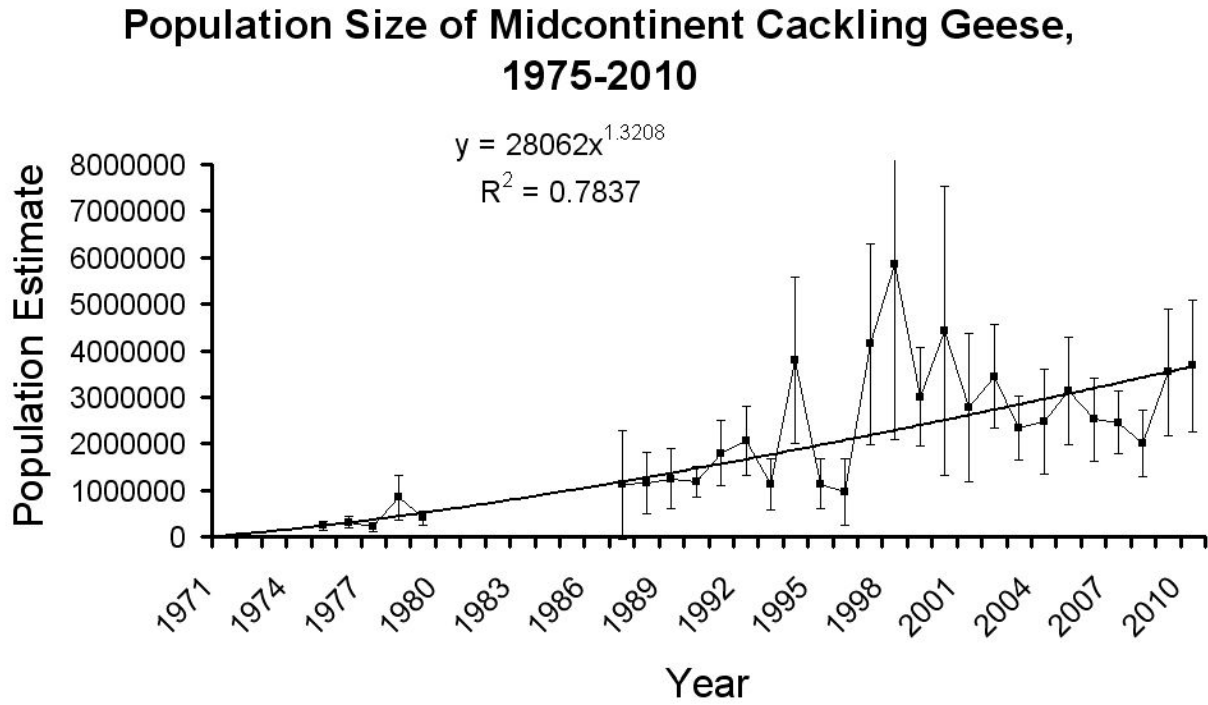Responsibilities: All cooperating agencies.

Population Size of Midcontinent Cackling Geese, 1975-2010

$$y = 28062x^{1.3208}$$
$$R^2 = 0.7837$$

Figure 3: Preliminary Lincoln estimates of adult CFAN Canada geese, 1975-2010

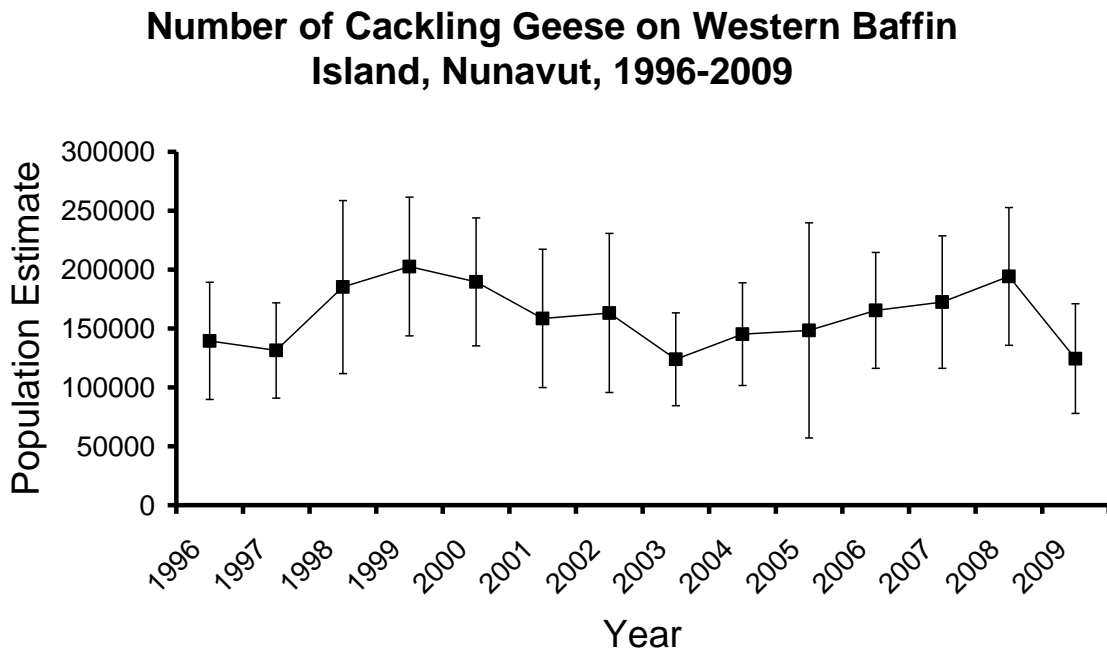## Number of Cackling Geese on Western Baffin Island, Nunavut, 1996-2009

Figure 4: Estimated number of adult CFAN Canada geese on the Great Plain of the Koukdjuak, Baffin Island, Nunavut based on August helicopter surveys, 1996-2009.

DISTRIBUTION GUIDELINES

Objective B: Maintain temporal and geographic distributions consistent with the welfare of CFAN Canada geese.

Rationale: CFAN Canada geese breed, migrate and winter across a large expanse of Canada and the U.S. There are a number of factors, both anthropogenic and abiotic, that can and do affect the quantity and quality of suitable habitat available for these geese. However, due to the expanse of their range, CFAN Canada geese will be capable of finding suitable habitat should localized areas be compromised. There is no planned management actions aimed to alter the traditional distribution of these geese across their range.

Strategy B-1: Maintain the distribution of CFAN Canada geese on the breeding grounds by:

    a. continued analyses of recoveries of banded CFAN Canada geese.
    b. continuing habitat conservation efforts of USFWS, State and Provincial partners, as well as other key habitat initiatives.
    c. developing and implementing periodic monitoring programs to directly assess population status in different portions of the breeding range.

Rationale: Managers have an interest in maintaining the distribution of CFAN Canada geese in North America (Dickson 2000). The CFAN population has historically settled in specific breeding locations (Alisauskas 2002, Hines et al. 2002). Breeding population surveys have been conducted periodically in some portions of the CFAN Canada goose range. On western Baffin Island, annual helicopter transect surveys were flown in August, from 1996 through 2009. The estimated number of adult Canada geese that occupied the Great Plain of the Koukdjuak on Baffin Island ranged from about 124,000 to about 202,000 birds, and averaged approximately 160,000 birds, with no apparent trend over that time (Fig. 4).

Responsibilities: All cooperating agencies.

Strategy B-2: Maintain the distribution of CFAN Canada geese during their migration by:

    a. continuing habitat management efforts of USFWS National Wildlife Refuges, and State and Provincial controlled lands, as well as other key habitat initiatives.

Rationale: Managers have an interest in maintaining the distribution of CFAN Canada geese in North America (Dickson 2000). The CFAN population has historically migrated through specific corridors between wintering and breeding locations (Alisauskas 2002, Hines et al. 2002).

Responsibilities: All cooperating agencies.

Strategy B-3: Maintain the distribution of CFAN Canada geese on the wintering grounds by:

    a. continuing habitat management efforts of USFWS National Wildlife Refuges, and State and Provincial controlled lands, as well as other key habitat initiatives.
    b. continuing the Midwinter Waterfowl Survey, at least in areas traditionally used by

DISTRIBUTION GUIDELINES

        significant numbers of CFAN Canada geese.

c.   maintaining a total midwinter survey count of at least 350,000 CFAN Canada geese, with at least 150,000 from the west tier of the Central Flyway and 200,000 from the east tier of the Central Flyway.

Rationale: Managers have an interest in maintaining the distribution of CFAN Canada geese in North America (Dickson 2000). The CFAN population has historically settled in specific wintering locations (Alisauskas 2002, Hines et al. 2002). In the former TGP and SGP population management guidelines, populations were established based on three-year averages of midwinter survey indices, of 200,000 for TGP and 150,000 for SGP. Maintaining a midwinter survey index will help managers track the numbers and distribution of CFAN Canada geese. This independent source of data would be essential if other data streams are interrupted or seasons closed.

Responsibilities: All cooperating agencies.

Objective C: Provide Flyway independent recreational opportunities for hunting, bird watching, photography and other uses consistent with population and distribution objectives.

Rationale: "Use" means days of hunting or non-hunting recreation. The Flyway Council recognized hunting as the primary recreational use of the CFAN population and sport harvest is the greatest means available to manage goose populations. Regulations greatly restricting hunting opportunities in the Central Flyway were adopted in 1967 in response to concerns about the declining status of Canada geese (Appendix). Some of those restrictions have since been removed in response to burgeoning Canada goose populations. Currently there are no recognized factors limiting population growth; therefore, it may be assumed that the population will continue to increase. These strategies are designed to provide additional hunting opportunities to address further population increases, while preventing over harvest if the population stabilizes or declines.

Strategy C-1: Maximize harvest opportunities for CFAN Canada geese in the Central Flyway while maintaining a three year running average for adult harvest rates (direct recovery rate/reporting rate) at or below 10% by:

   a. allowing the flyway to independently set season structures without required approval of the other flyway(s) as long as the overall harvest rate goal is not exceeded or unduly constrained.
   b. implementing appropriate regulatory changes when recent harvest patterns indicate it is necessary (e.g., if the 10% adult harvest threshold is exceeded).

Rationale: From 2001 through 2010, annual harvest rates of adult CFAN Canada geese averaged 3.6%, and appear to have declined since the late 1980s (Fig. 5). Adult harvest rates have exceeded 6% only 3 times since 1987 (in 1990, 1995, and 1996), but the latter two were years in which the number of birds banded was very low, and therefore confidence intervals were wide. At the same time, juvenile harvest rates (mainly from birds banded at Baffin Island) averaged only 2.3% between 2001 and 2010, and also appear to have undergone a long term decline (Fig. 6). Estimated harvests of cackling geese in states of the Central Flyway averaged 148,898 birds per year from 2001-2010, and appear to have increased over time (Fig. 7); estimated harvests of adult and juvenile cackling geese appeared to follow similar trends (Fig. 8). Harvests in prairie Canada have been relatively stable, averaging 85,178 birds per year from 2001-2010 (Fig. 9); harvests of adult and juvenile birds exhibited similar trends (Fig. 10).

Annual survival and recovery rates for 1988-2011 were estimated using Brownie models as implemented in program MARK. Input data for the analysis involved 24,789 adult cackling geese marked on arctic nesting/molting areas in Canada, of which 2,622 were subsequently recovered. The candidate set of models considered for this analysis included the four standard Brownie models for an analysis involving one group:

(1) Full time-dependency (i.e., annual variation) in both survival and recovery probability (model $S(t)f(t)$);
(2) Constant survival, annual variation in recovery probability (model $S()f(t)$);
(3) Annual variation in survival, constant recovery probability (model $S(t)f()$);
(4) Constancy in both survival and recovery probability (model $S()f()$)

Additionally, models in which survival was constrained to vary as a linear-logistic or quadratic function of calendar year (i.e., linear and quadratic time trend models) were also considered. Model selection was based on minimization of AIC. Model-averaged parameter estimates were computed, averaging over all models in the candidate set after weighting each estimate by the appropriate AIC-based model weight.

Model selection results (e.g., AIC ranking, model weights) indicated that the best model was one in which survival was constrained to vary as a quadratic (curvilinear) function of time (Table 1). Under this model, survival declined from a value of about 0.85 in the late 1980s to a low of 0.80 in 1997, then increased sharply during the 2000s, reaching a high of 0.90 in 2010. Because the quadratic time trend model was strongly supported by the data (model weight = 0.86; Table 1), model-averaged survival rate estimates showed a similar pattern of declining survival during the late 1980s and early 1990s, a period of stabilization during the late 1990s, and a subsequent increase between 1999 and 2010 (Table 2; Figure 15). Over all years, model-averaged survival rate estimates ranged from 0.804 to 0.893 (Table 2). Model-averaged recovery rate estimates varied considerably among years but showed a general pattern of increase between 1992 and 2003, followed by an apparent decline (Table 2; Figure 16). It is worth noting, however, that the terminal recovery rate estimate (2011) may be biased low due to incomplete reporting (at the time of analysis) of birds recovered during the 2011/2012 hunting season. Over all years, recovery rate estimates ranged between 0.015 and 0.037 (Table 2).

The 10% objective harvest rate was selected because harvest rates higher than this have been sustainable for the management of several Canada goose populations in North America, including several in the Mississippi and Central Flyways (e.g., see Table 3 in Zimmerman et al. 2009). Also, there is evidence that harvest rates were likely much higher in the past; from 1975-1979, direct recovery rates (DRR) of adult cackling geese banded in the Canadian arctic averaged ~ 4.7%. At that time, reporting rates (r) for midcontinent mallards were likely in the range between 0.26 and 0.39 (Henny and Burnham 1976, Nichols et al. 1991). If we assume that band reporting rates were similar for cackling geese, and recent studies suggest that band reporting rates do not vary appreciably between species (Zimmerman et al. 2009), then it is likely that adult harvest rates (h) at that time were at least 12% (i.e., h = DRR/r = 0.047/.39 = 0.121). Under existing harvest rates, the number of cackling geese on western Baffin Island remained relatively stable from 1996 through 2009 (Fig. 4). Until harvest rates for adult cackling geese exceed 10%, harvest opportunities for Canada geese in the Flyways could be liberalized, and no additional population monitoring programs need to be implemented. Harvest rates at or below 10% would not be expected to reduce the Lincoln population estimate below 1,000,000 birds.

Strategy C-2: Establish and/or refine standardized procedures for determining the amount and distribution of use and benefits derived from the CFAN Canada geese by:

    a.   developing and implementing a range-wide harvest survey that will provide comparable information from all areas (including Canada).
    b.   using parts collection survey information to adjust goose harvest data for population composition.
    c.   improving methods for defining populations in range-wide harvest data (band

        recoveries, tail fans).
d.   encouraging initiation of waterfowl harvest surveys in Mexico.
e.   examining the social and economic benefits (consumptive and non-consumptive) provided by the population.

Rationale: The aesthetic or non-consumptive use of the population has not been quantified, but may be substantial. Economic benefits derived are also poorly understood. Some harvest estimates are conducted differently and may not be comparable. Therefore, most estimates of the current use and value of the population may need to be improved.

Responsibilities: All cooperating agencies.

Strategy C-3: Minimize wounding losses and wanton waste by:

a.   encouraging educational and training programs designed to increase hunter proficiency.
b.   discouraging beyond-range shooting, especially on public hunting areas, by reducing competition in "firing lines," etc.
c.   closely monitoring commercialized hunting to assure that all geese are retrieved and included in bag limits.

Responsibilities: All cooperating agencies.

Strategy C-4: Encourage hunting, bird-watching, photography, and educational programs:

a.   maintaining and expanding hunting and viewing access.
b.   conducting outreach advising the public of opportunities for recreation.
c.   providing access for hunting, viewing sites, and "self-guiding tours" where geese concentrate.
d.   encouraging initiatives that allow non-consumptive users to contribute to habitat conservation.

Responsibilities: All cooperating agencies.

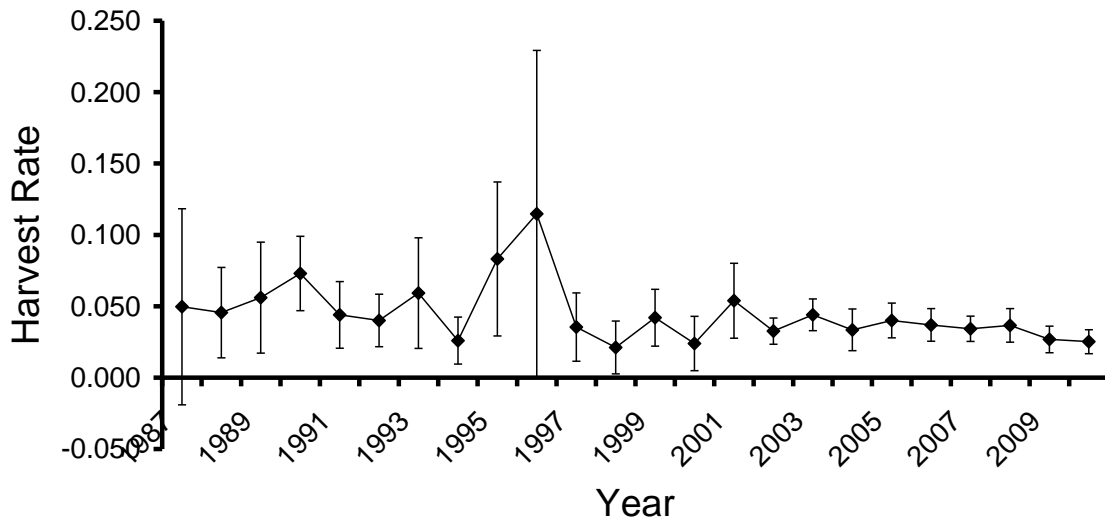## Harvest Rate of Adult Midcontinent Cackling Geese, 1987-2010

Figure 5: Annual harvest rate (+ 95% CL) of adult midcontinent cackling geese, banded 1987-2010.

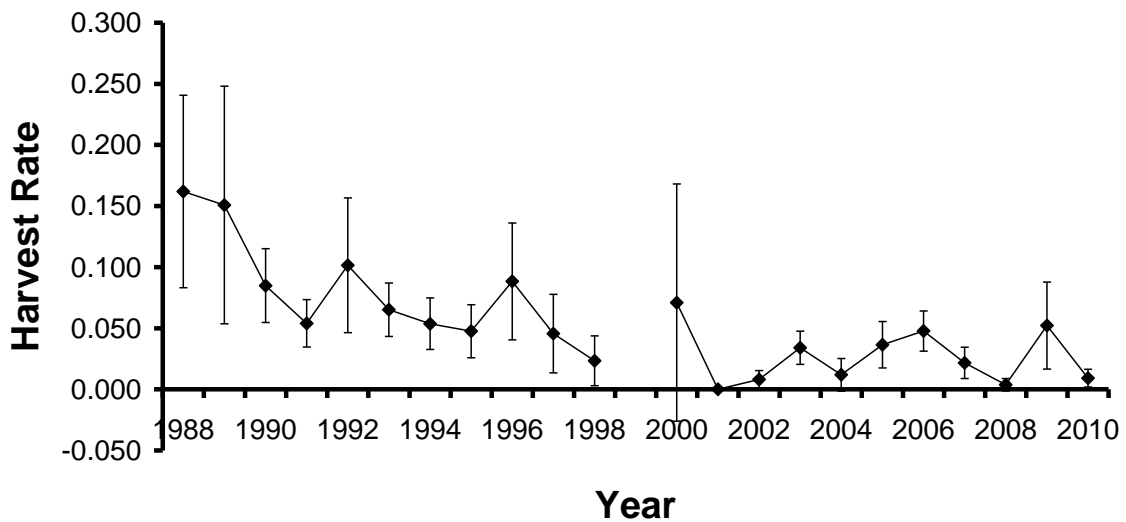## Harvest Rate of Juvenile Midcontinent Cackling Geese, 1987-2010

Figure 6: Annual harvest rate (+ 95% CL) of juvenile midcontinent cackling geese banded mainly on Baffin Island and the west coast of Hudson Bay, Nunavut, 1988-2010.

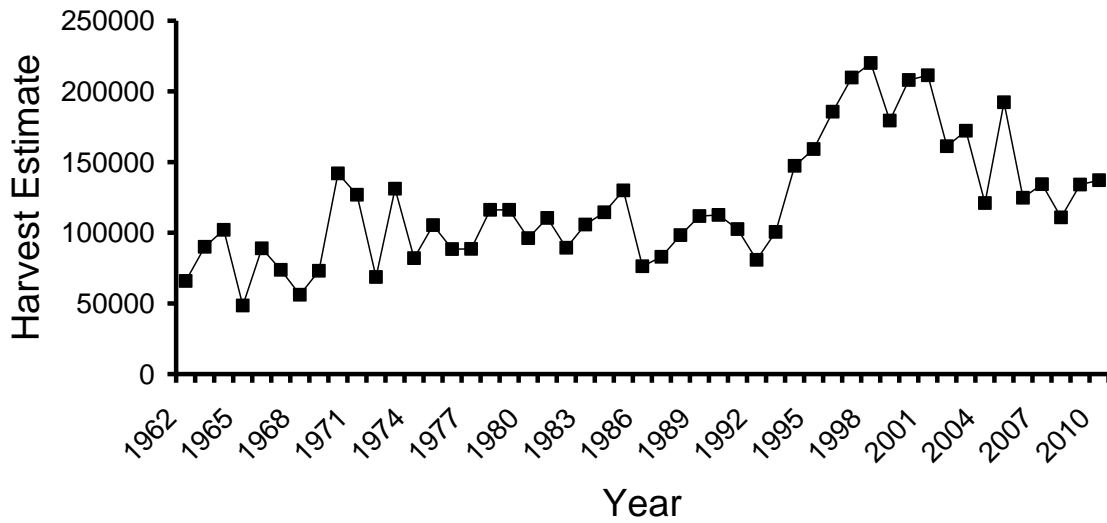## Harvest of Cackling Geese in the Central Flyway, 1962-2010

Figure 7:Annual harvests of cackling geese in states of the Central Flyway, 1962-2010.

Harvest of Adult and Juvenile Cackling Geese in the Central Flyway, 1962-2010
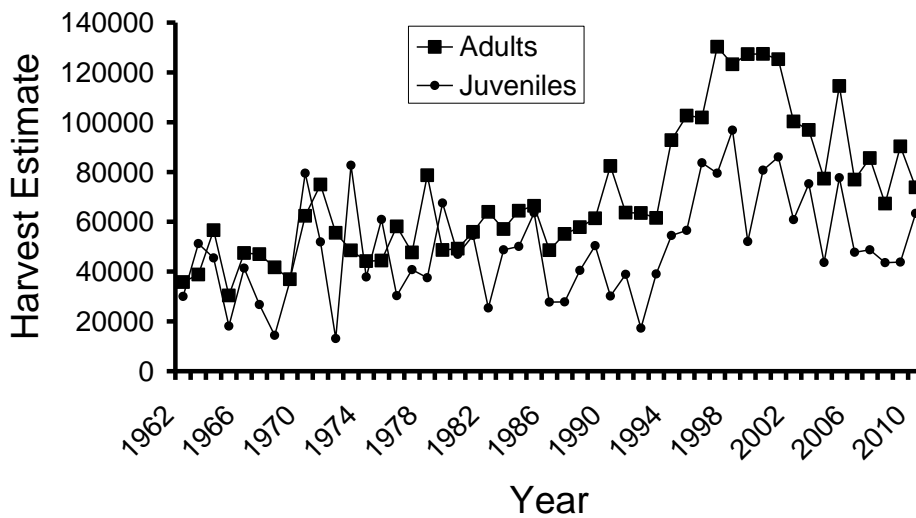
Figure 8:Annual estimated harvest of adult and juvenile cackling geese in states of the Central Flyway, 1962-2010.

Harvest of Cackling Geese in Prairie Canada, 1971-2010
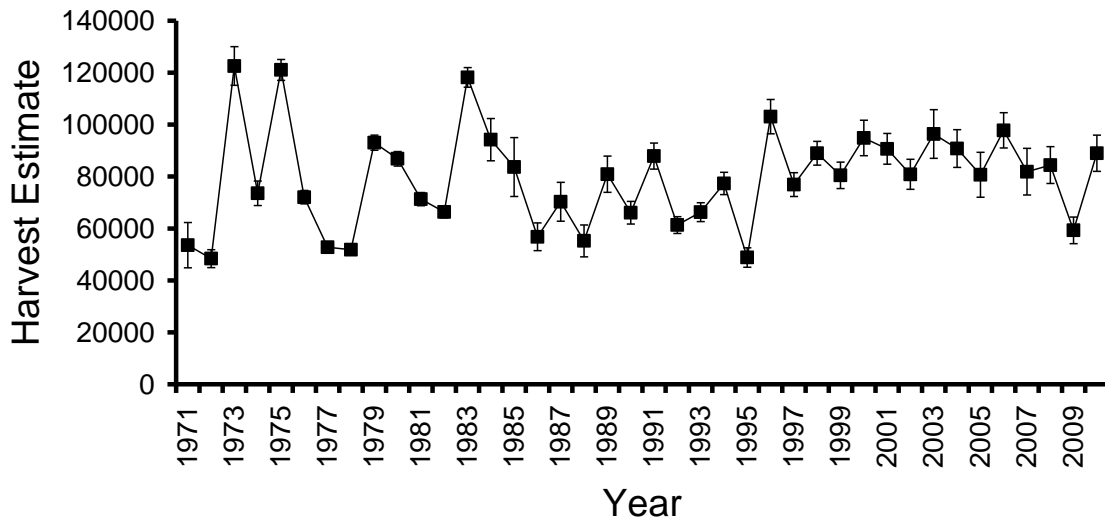
Figure 9:Annual harvests (+ SE) of midcontinent cackling geese in prairie Canada, 1971-2011.

Harvest of Adult and Juvenile Cackling Geese in Prairie Canada, 1971-2010
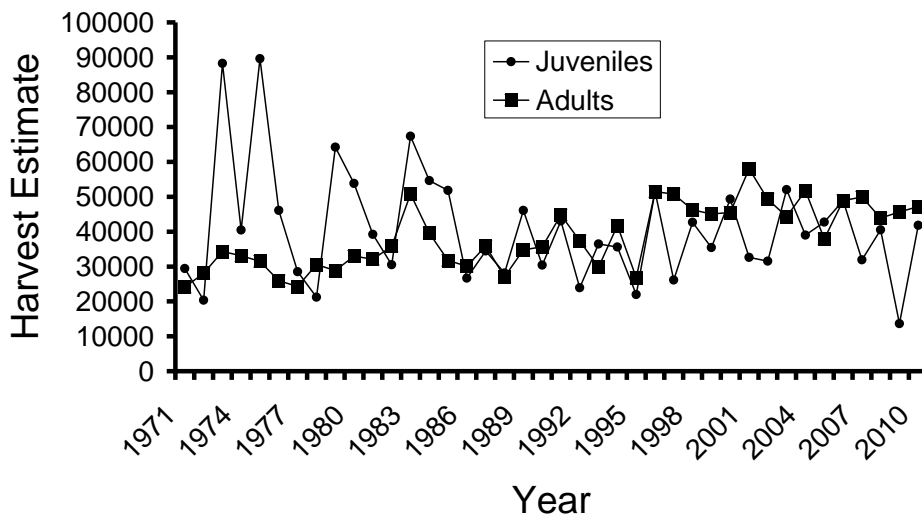
Figure 10:Harvest of juvenile and adult cackling geese in prairie Canada, 1971-2011.
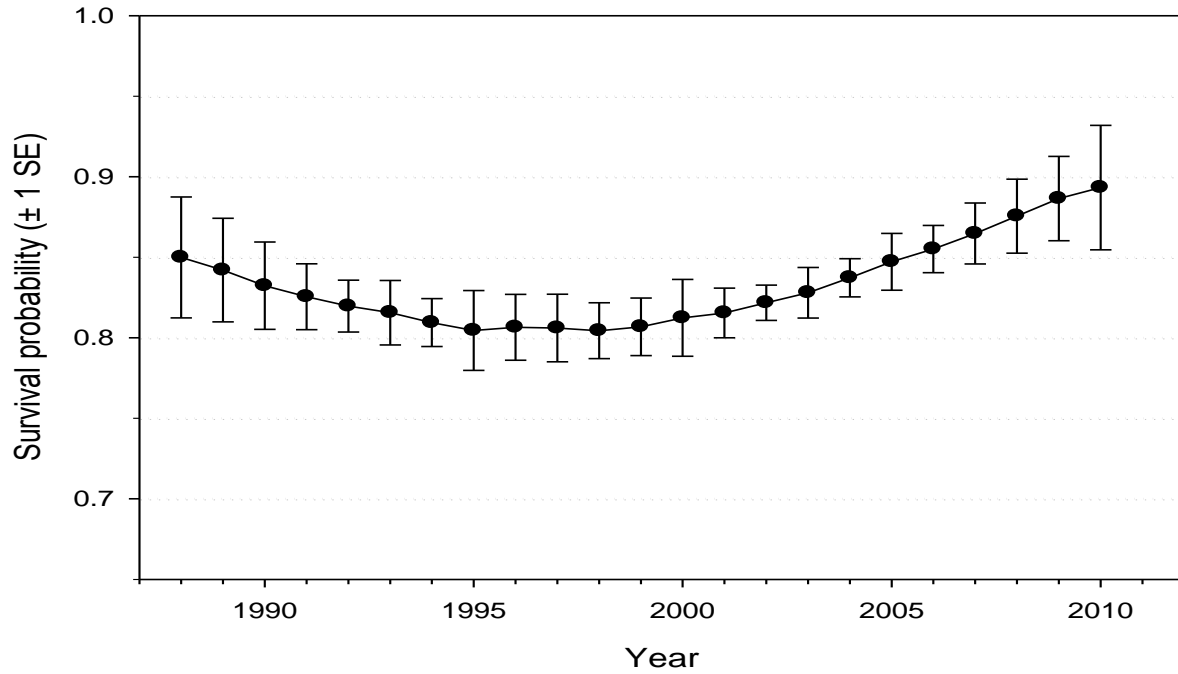
Figure 11:Model-averaged survival rate estimates (Ŝ) for adult cackling geese captured and marked in Canada's eastern and central arctic, 1988-2011.
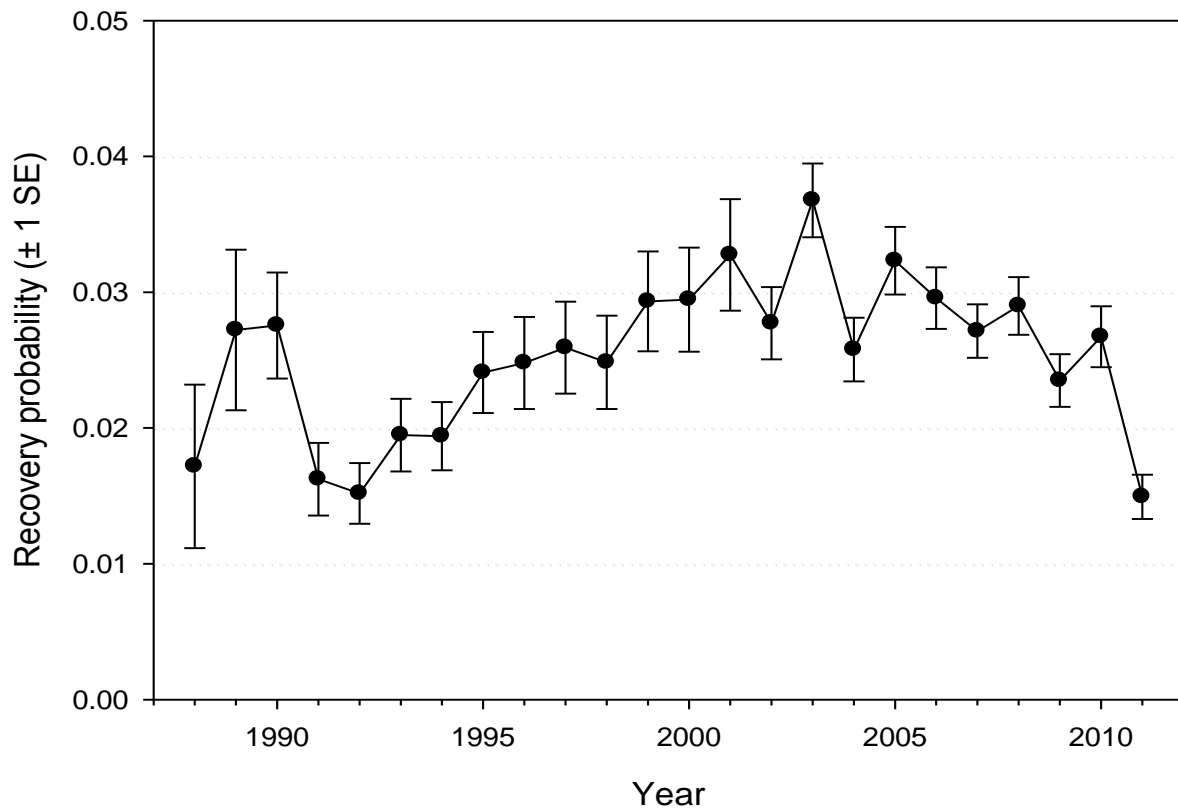
Figure 12:Model-averaged recovery rate estimates (f) for adult cackling geese captured and marked in Canada's eastern and central arctic, 1988-2011.

Table 1. Summary output from competing band-recovery models developed to estimate annual survival and recovery probabilities for adult cackling geese captured and marked in Canada's eastern and central arctic, 1988-2011.

Model[a]	Number of Parameters	AIC_c[b]	ΔAIC_c[c]	AIC_c weight[d]
$S_{quadratic}, f_t$	27	26883.91	0.00	0.86
S_{linear}, f_t	26	26887.91	4.00	0.12
S, f_t	25	26891.80	7.87	0.02
S_t, f_t	47	26893.07	9.16	0.01
S_t, f	24	26933.16	49.25	0.00
$S_{quadratic}, f$	4	26945.64	61.73	0.00
S_{linear}, f	3	26954.40	70.49	0.00
S, f	2	26965.82	81.90	0.00

[a]   Model notation: S = survival probability, f = recovery probability; subscript "t" denotes time-dependency (i.e., annual variation), "linear" denotes linear-logistic trend over time, "quadratic" denotes quadratic time trend, no subscript denotes constancy.

[b]   Akaike's Information Criterion with small-sample bias adjustment (Burnham and Anderson 2002).

[c]   Difference between AIC_c of the current model and the minimum observed value.

[d]   Normalized Akaike weight (Burnham and Anderson 2002).

Table 2. Model-averaged survival and recovery rate estimates for adult cackling geese captured and marked in Canada's eastern and central arctic, 1988-2011.

Year	Survival[a]		Recovery[b]	
	S	SE	f	SE
1988	0.850	0.038	0.017	0.006
1989	0.842	0.032	0.027	0.006
1990	0.832	0.027	0.028	0.004
1991	0.826	0.020	0.016	0.003
1992	0.820	0.016	0.015	0.002
1993	0.816	0.020	0.019	0.003
1994	0.809	0.015	0.019	0.003
1995	0.805	0.025	0.024	0.003
1996	0.806	0.020	0.025	0.003
1997	0.806	0.021	0.026	0.003
1998	0.804	0.017	0.025	0.003
1999	0.807	0.018	0.029	0.004
2000	0.812	0.024	0.029	0.004
2001	0.815	0.015	0.033	0.004
2002	0.822	0.011	0.028	0.003
2003	0.828	0.016	0.037	0.003
2004	0.837	0.012	0.026	0.002
2005	0.847	0.018	0.032	0.002
2006	0.855	0.015	0.030	0.002
2007	0.865	0.019	0.027	0.002
2008	0.876	0.023	0.029	0.002
2009	0.886	0.026	0.023	0.002
2010	0.893	0.039	0.027	0.002
2011	-	-	0.015	0.002

[a]   Survival from year i to year i+1.

[b]   Recovery during the interval year i - year i+1.

RESEARCH and INFORMATION NEEDS

The following are recognized needs for information essential to improved management of CFAN Canada geese:

1. Maintain or improve the geographic representation of the banded samples from the 3 primary nesting areas for cackling geese in Canada – western, central, and eastern.
2. Evaluate tail fan criteria used to separate CFAN geese and temperate nesting Canada geese in the harvest in different harvest regions. Accurate estimates of harvest are important for monitoring the midcontinent population of cackling geese and may be useful for estimating the population size and/or trends in abundance using the Lincoln estimator. Analytical methods to deal with large numbers of 'unknown' age-sex tail fans may need to be developed.
3. Evaluate the effectiveness and precision of using Lincoln's method to estimate the size of the CFAN Canada goose population using age-specific harvest estimates and band recovery data.
4. Complete the evaluation of the exploratory arctic surveys conducted from 2005-2011 to determine their potential as a monitoring tool for CFAN Canada geese.
5. Investigate the effect of bag limit changes on harvest rate.
6. Examine the social and economic benefits (consumptive and non-consumptive) provided by the population.

MAINTENANCE OF PLAN

This plan will be reviewed annually, or upon request, by the Central Flyway Waterfowl Technical Committee. The Committee will update appended tables, etc., as appropriate, and recommend to the Central Flyway Council any modifications necessary to accommodate new information or changing management. Any changes in overall management objectives will be coordinated with the Mississippi Flyway.

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APPENDICES

Appendix A
CFAN geese counted in arctic breeding surveys.

	Banks Island	Tuktoyaktuk	Coppermine	Western Victoria Island	Central Victoria Island	Eastern Victoria Island	Queen Maud Gulf	Adelaide Penninsula
2005						94,534		
2006			31,797				115,914	
2007		2,776				138,279	178,418	26,971
2008				113,312				
2009			18,899		5,278	137,013	117,256	27,312
2010	14,103	4,195						

Appendix B

Estimated Tall Grass Prairie and Short Grass Prairie Canada Geese Observed in Mid-Winter Surveys.

YEAR	C. FLYWAY[1]	M. FLYWAY[1]	MEXICO[2,4]	TOTAL	3-yr AVG.	SHORT GRASS PRAIRIE	3-yr AVG
1969/70						151,200	
1970/71	131,100	2,100		133,200		148,500	
1971/72	159,600	1,300		160,900		160,900	
1972/73	147,200	1,200		148,400		259,400	
1973/74	158,500	2,000		160,500		153,600	
1974/75	125,600	2,000	5,900	133,500		123,700	
1975/76	201,500	2,000	200	203,700		242,500	
1976/77	167,900	1,900	1,500	171,300		210,000	
1977/78	211,300	3,100	1,100	215,500		134,000	
1978/79	180,500	4,900	2,200	187,600		163,700	
1979/80	155,200	5,700	5,000	165,900		213,000	
1980/81	244,900	3,500	9,300	257,700	203,733	168,200	181,633
1981/82	268,600	12,000	4,100	284,700	236,100	156,000	179,067
1982/83	165,500	6,300		171,800	238,067	173,200	165,800
1983/84	260,700	4,200		264,900	240,467	143,500	157,567
1984/85	197,300	8,100	1,600	207,000	214,567	179,100	165,267
1985/86	189,400	8,800		198,200	223,367	181,000	167,867
1986/87	159,000	4,200		163,200	189,467	190,900	183,667
1987/88	306,100	8,300	1,400	315,800	225,733	139,100	170,333
1988/89	213,000	11,200		224,200	234,400	284,800	204,933
1989/90	146,500	12,515		159,015	233,005	378,100	267,333
1990/91	305,100	10,237	200	315,537	232,917	508,500	390,467
1991/92	276,300	4,065		280,365	251,639	620,200	502,267
1992/93	235,328	3,398		238,726	278,209	328,194	485,631
1993/94	224,200	12,555	0	236,755	251,949	434,113	460,836
1994/95	244,988	2,819		247,807	241,096	697,781	486,696
1995/96	263,996	6,314		270,310	251,624	559,940	563,945
1996/97	262,864	9,424	0	272,288	263,468	460,721	572,814
1997/98	331,813	3,438		335,251	292,616	440,570	487,077
1998/99[4]	548,206	NA		548,206	385,248	403,197	434,829
2000	295,662	NA	0	295,662	393,040	200,021	347,929
2001	149,090	NA		149,090	330,986	164,084	255,767
2002 [5]	504,708	NA		504,708	316,487	160,873	174,993
2003 [5]	611,842	NA	NA	611,842	421,880	156,661	160,539
2004 [5]	458,680	NA	NA	458,680	525,077	203,586	173,707
2005 [5]	400,766	NA	NA	400,766	490,429	177,195	179,147
2006 [5]	499,801	NA	NA	499,801	453,082	234,737	205,173
2007 [5]	680,301	NA	NA	680,301	526,956	190,531	200,821
2008 [5]	402,718	NA	NA	402,718	527,607	212,421	212,563
2009 [5]	309,909	NA	NA	309,909	464,309	221,590	208,181
2010 [5]	417,044	NA	NA	417,044	376,557	290,724	241,578
2011 [5]	427,063	NA	NA	427,063	384,672	310,657	274,324
2012 [5]	450,786	NA	NA	450,786	431,631	292,795	298,059
2013 [5]	263,271	NA	NA	263,271	380,373	256,268	286,573

[1] Column entries reflect official December surveys (when available) from 1969/70 to 1997/98. December surveys and the separation of MF wintering Canada geese into populations were discontinued after December 1997. Subsequent entries reflect January surveys.

[2] Column entries reflect January counts (when available) which are the official counts for these populations or population segments.

[3] Surveys in Mexico have been conducted at 3-year intervals since 1981-82. For estimation of 3-year averages after 1980/81-1982/83, we used the most recent Mexico count. Estimates of TGP geese in this column include only geese counted on the East Coast survey (not counted in 2003).

[4] Beginning in 1998/99, estimates of TGP and SGP Canada geese are based on newly defined wintering range boundaries.

[5] In TX, SGP based on cruise surveys, TGP cruise/transect.