

Atlantic Flyway Resident Canada Goose Management Plan



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**ATLANTIC FLYWAY
RESIDENT CANADA GOOSE MANAGEMENT PLAN**

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ATLANTIC FLYWAY RESIDENT CANADA GOOSE MANAGEMENT PLAN

EXECUTIVE SUMMARY

Local-nesting or ‘resident’ Canada geese were introduced into the Atlantic Flyway (AF) during the early 1900s and now comprise the largest population of geese in the flyway, with an estimated 1.1 million birds in spring 1999. This plan describes the status and values (positive and negative) of resident Canada geese and summarizes the consensus of wildlife agencies in the AF with respect to management of these birds. As such, it is an internal guidance document that provides direction and objectives for cooperative efforts. Direct actions resulting from implementation of the plan must still go through normal regulatory procedures, where additional environmental assessment and public input can occur.

The overall management goal with respect to resident Canada geese in the AF is to:

Manage resident Canada goose populations in the AF to achieve an optimal balance between the positive values and conflicts associated with these birds.

Specific management objectives to achieve this goal are as follows:

1. Reduce resident Canada goose populations in the AF to 650,000 birds (spring estimate) by 2005, distributed in accordance with levels prescribed by individual states and provinces.
2. Permit a wide variety of effective and efficient options for relief of damage and conflicts associated with resident Canada geese.
3. Provide maximum opportunities for use and appreciation of resident Canada geese, consistent with population goals.
4. Ensure compatibility of resident goose management with management of migrant goose populations in the AF, and vice versa.
5. Annually monitor populations, harvest, and damage/conflict levels to evaluate effectiveness of management actions.

For each objective, specific strategies are identified which represent activities or policies to be undertaken or supported by state and federal wildlife agencies. Strategies include: increasing sport harvest of resident geese (without adversely affecting migrant geese); allowing capture and euthanasia of geese in problem areas; reducing production on public and private lands; allowing a wide variety of damage control techniques by private and municipal property owners; adopting a depredation or conservation order to give states authority to manage resident geese; monitoring population size, distribution, harvest, and damage complaints; conducting research; and effectively communicating with the public about the need for balance rather than eradication of resident geese. In addition to member agencies of the Atlantic Flyway Council, USDA Wildlife Services (WS) has a primary role in resident goose management, and were full partners in development of this plan. Their assistance here and in providing programs to alleviate goose damages in the AF are acknowledged and appreciated.

ATLANTIC FLYWAY RESIDENT CANADA GOOSE MANAGEMENT PLAN

INTRODUCTION

For purposes of this plan, Atlantic Flyway (AF) “resident” Canada geese are defined as geese that were hatched or nest in any AF state, or in Canada at or below 48° N latitude and east of 80° W longitude, excluding Newfoundland (Fig. 1). As their name implies, resident geese spend most of the year near their breeding areas, although many in northern latitudes do migrate. Population dynamics vary across the breeding range and local flocks exhibit a high degree of site fidelity, so management of sub-populations at the state or provincial level is possible. However, because all Canada geese, including non-migratory resident geese, are protected by federal laws and regulations, coordinated management within the flyway is necessary.

AF resident geese are distinctly different from Canada geese that nested in the flyway historically. The original stock in pre-colonial times was primarily *Branta canadensis canadensis* (Delacour 1954), but they were extirpated long ago. The present-day population was introduced and established during the early 20th century, and is comprised of various subspecies or races of Canada geese, including *B. c. maxima*, *B. c. moffitti*, *B. c. interior*, *B. c. canadensis*, and possibly other subspecies, reflecting their diverse origins (Dill and Lee 1970, Pottie and Heusmann 1979, Benson et al. 1982). The first resident geese were birds released by private individuals in the early 1900s. When use of live decoys for hunting was prohibited in 1935, captive flocks of domesticated or semi-domesticated geese were numerous (estimated at more than 15,000 birds), and many were liberated in parks or allowed to wander at large (Dill and Lee 1970). From the 1950s through the 1980s, wildlife agencies in many AF states were actively involved in relocation and stocking programs to establish resident populations, primarily in rural areas. These programs were highly successful and most were discontinued by 1990.

Populations of resident Canada geese have increased dramatically in recent years across North America (Ankney 1996, Nelson and Oetting 1998). The dramatic growth and importance of resident goose populations in the AF was not fully recognized until recently. The first management plan for these birds was developed in 1989, when it became apparent that they were contributing significantly to sport harvests, and human/goose conflicts were becoming more common, especially in urban/suburban areas. In the 1980s, biologists became concerned also that increasing numbers of resident geese might be masking a decline in number of migratory Atlantic Population (AP) Canada geese wintering in the flyway. Banding studies have confirmed that resident geese are not AP geese that simply stopped migrating north to breed; they are distinct populations with very different management needs and opportunities.

Now, just 10 years after the first management plan was developed, resident Canada geese are the most numerous goose population in the flyway, and concerns about their overabundance are widespread. Resident Canada geese have negatively impacted property and agricultural resources throughout the eastern U.S. High densities of goose feces reduce the aesthetic value and recreational use of parks, beaches, golf courses, athletic fields, and residential lawns and are often perceived as health hazards (Conover and Chasko 1985). The increasing numbers of resident geese, while migrant populations have declined, has complicated traditional Canada

goose management and created new challenges where human/goose conflicts have occurred.
Figure 1. Breeding range (for management purposes) of Atlantic Flyway resident Canada geese.

This plan provides objectives and strategies to guide management of resident Canada geese in the AF during 1999-2005. State, provincial and federal agencies responsible for management of resident Canada geese in the AF have cooperatively drafted this plan and agreed to support the basic goals and objectives as guidelines for management of this resource. It does not prescribe specific regulations or dictate management policies or programs. The plan allows for adjustments and flexibility as more is learned about the size and distribution of resident

Canada geese, their biology and harvest, the nature and extent of damage and conflicts, and the interactions they have with management of other goose populations in the flyway. The plan will likely need to be updated again before another decade passes.

DISTRIBUTION AND STATUS

Breeding Distribution

As noted earlier, AF resident Canada geese are defined as geese that were hatched or nest in any AF state or in Canada at or below 48° N latitude and east of 80° W longitude, excluding Newfoundland (Fig. 1). Over the past 50 years, the resident population has expanded from just a few early releases to where the breeding range now includes every state and province in the flyway (Hindman and Ferrigno 1990). Their range continues to expand at both ends of the flyway and within most states and provinces. The resident population may someday merge with migrant geese nesting in the boreal forest zone of Quebec above 48° N latitude. Throughout this range, breeding habitats of AF resident Canada geese vary widely from agricultural landscapes to forested wetlands to urban and suburban environments.

Highest densities ($>2/\text{km}^2$ in spring) of resident geese occur in Atlantic coastal regions, such as southern New England, southeastern New York, New Jersey, southeastern Pennsylvania, Delaware, Maryland and eastern Virginia. This may reflect the longer history of resident geese nesting in those areas. Densities as high as $5/\text{km}^2$ occur in some localities. Moderate densities ($1-2/\text{km}^2$) occur in interior regions of the AF, from southern Ontario to Georgia, and low densities ($<0.5/\text{km}^2$) occur in mountainous areas of northern New England, northern New York, and in the southern Maritime provinces (H Heusmann, Mass. Div. Fisheries and Wildl., unpub. data; J. Goldsberry, USFWS, unpub. data).

Migration and Winter Distribution

Most AF resident Canada geese are non-migratory or undergo short local movements between breeding and wintering areas. Nearly 99% of resident geese neck-banded in the mid-Atlantic region (NY-NJ-PA) during the early 1990s remained in that region throughout the year (Hestbeck 1995). Geese nesting inland in northern states and provinces tend to exhibit more regular “migration” behavior than those nesting in coastal regions or at mid or southern latitudes. Some local flocks, especially in northern and interior parts of the flyway, travel several hundred kilometers between breeding and wintering areas, but most travel much shorter distances (<35 km) or remain year-round in local areas (Johnson and Castelli 1998). These movements are small compared to the 2,000+ km that AP and North Atlantic Population (NAP) geese make during migration. Most resident geese are reluctant to leave their breeding areas, **and** move to other areas only when severe winter weather makes it necessary to find open water and feeding areas. Resident geese that migrate typically move to wintering areas in late November or December and return to nest in March.

The winter distribution of AF resident geese is similar to their breeding distribution, with wintering flocks found from southern Canada to northern Florida. In northern states, concentrations occur inland in agricultural areas near large unfrozen water bodies, such as the Finger Lakes and Hudson River Valley in New York, and water supply reservoirs. In southern

New England and states to the south, where ice and snow cover are less common, wintering resident geese are more widely distributed throughout the Atlantic Coastal Plain.

Resident geese use a variety of habitats in winter, including rural agricultural fields, parks, golf courses and other open lawns in densely populated urban and suburban areas. Resident geese often remain in urban areas during winter because those areas are typically not hunted, contain good roosting sites in the form of rivers, ponds or lakes that remain ice-free well into winter, and have readily available foods, such as lawn grasses, supplemental feeding by local citizens, or waste grain on crop fields nearby.

There is some evidence that a molt migration occurs among AF resident geese. Goslings banded during the summer in AF states have been reported shot in subsequent years in Ontario and Quebec (USGS Bird Banding Lab, unpubl. data). Most of these geese are believed to be non-breeding (sub-adult) birds that fly north to molt in late May or early June. Northward flights of high-flying geese have been noted during early June in some AF states (B. Swift, NYSDEC, pers. commun.). AF resident Canada geese have also been observed during summer banding operations in southern James Bay (Abraham et al. 1999), and some may molt in northern Quebec, where AP Canada geese breed. The extent to which molt migrations occur in the AF, where the birds go, and when they return, is largely unknown.

Population Trends

Numbers of resident geese in the AF have increased dramatically since their establishment. Breeding waterfowl surveys conducted in the northeastern U.S. (from New Hampshire to Virginia), aerial surveys in eastern Canada and Maine, and estimates provided by biologists in other states and provinces indicate a total spring population of approximately 1.1 million resident Canada geese in the flyway in 1999, including 1 million in the U.S. (Table 1). Pairs annually account for about one-half to two-thirds of the total population, with the remainder in groups of non-breeding or subadult birds (H Heusmann, Mass. Div. Fisheries and Wildl., unpub. data).

Table 1. Estimated spring populations of resident Canada geese (1,000s of birds) in the AF^a.

State/Province	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Connecticut	9.1	15.1	17.2	16.5	22.7	23.2	23.3	31.1	30.8	23.7
Delaware	1.1	0.5	1.1	4.1	1.3	4.7	1.8	4.8	7.2	5.5
Florida	na	na	na	na	na	na	na	na	na	na
Georgia	na	na	na	na	na	28.7	35.3	43.7	na	na
Maine	na	na	na	na	na	na	7.5	9.6	14.1	48.0
Maryland	16.8	35.1	18.1	33.2	75.7	62.7	66.9	69.9	93.4	58.9
Massachusetts	11.6	13.0	12.8	16.3	13.2	16.1	25.7	16.8	19.8	18.3
New Jersey	28.0	43.4	30.9	37.7	61.1	67.4	69.6	85.3	86.0	82.3
N Hampshire	2.9	2.5	11.5	7.6	3.1	13.5	36.0	16.6	24.2	23.1
New York	64.0	58.6	108.1	167.7	91.9	78.4	199.5	119.5	133.4	158.8
N Carolina	na	na	na	na	na	na	na	na	na	na
Pennsylvania	66.3	65.0	74.3	196.5	177.0	208.1	219.2	194.6	210.8	262.0
Rhode Island	2.2	1.4	2.7	1.9	na	2.5	1.6	3.4	2.9	3.4
S Carolina	na	na	na	na	na	na	na	na	na	na
Vermont	0.8	2.5	18.9	na	2.8	1.4	0.3	18.2	3.0	3.7
Virginia	35.0	353.7	81.5	128.6	129.4	207.6	208.1	332.5	253.6	198.2
West Virginia	na	na	na	na	na	na	na	na	na	na
Total - U.S.^b	237.8	590.8	377.1	610.1	578.2	714.3	894.8	946.0	879.2	885.9
N Brunswick	na	na	na	na	na	na	5.2	1.4	5.9	9.8
Nova Scotia	na	na	na	na	na	na	3.8	0.7	1.4	3.8
Ontario	na	na	na	na	na	na	na	21.5	24.8	na
Prin Ed Island	na	na	na	na	na	na	2.3	0.5	0.9	3.2
Quebec	na	na	na	na	na	na	na	5.3	4.1	na
Total - Can	na	na	na	na	na	na	na	29.4	37.1	na

a Sources: ground plot surveys for NH to VA; aerial surveys for Canadian provinces and ME; na = no annual estimate available; state biologists estimate an additional 196k in those states in 1999 (WV-28k, NC-97k, SC-22k, GA-44k, AND FL-<5k).

b Totals of state estimates differ from flyway totals calculated by physiographic strata (Fig. 2).

The estimated number of resident Canada geese in the northeastern U.S. increased more than 3-fold between 1990 and 1999 (Table 1). The estimated annual growth rate over this period was approximately 15% per year, similar to what is predicted by population models that assume moderate recruitment (2.4 young per nesting female) and 80% adult survival, as are typical of resident geese (S. Sheaffer, USGS, unpub. data). However, spring population estimates have leveled off since 1997 after special seasons were established throughout the flyway (Fig. 2). Population growth in other states and provinces is not as well documented, but similar growth rates were indicated by Breeding Bird Survey (BBS) data, which provide a larger geographic and longer term perspective (Fig. 2). BBS indices for every physiographic region of the eastern U.S. and Canada increased dramatically between 1990 and 1996 (J. Sauer, USGS, unpub. data).

Midwinter counts of Canada geese must be interpreted with caution because resident and

migrant geese cannot be distinguished on these surveys. However, neckband observation data indicate that resident Canada geese comprise the largest proportion of geese wintering in the mid-Atlantic and New England regions. Total midwinter counts of Canada geese in those two regions increased from an average of approximately 29,000 birds during 1966-1970 to nearly 350,000 during 1996-1999 (Serie and Vecchio 1999), due largely to the growth of resident populations. Traditional winter surveys in the southernmost AF states (SC, GA, FL), where very few migrant geese winter, do not cover areas typically used by resident geese and do not accurately reflect population trends. Local area winter counts, such as Christmas Bird Counts, are available for many areas and may be useful where resident birds comprise most of the Canada geese counted.

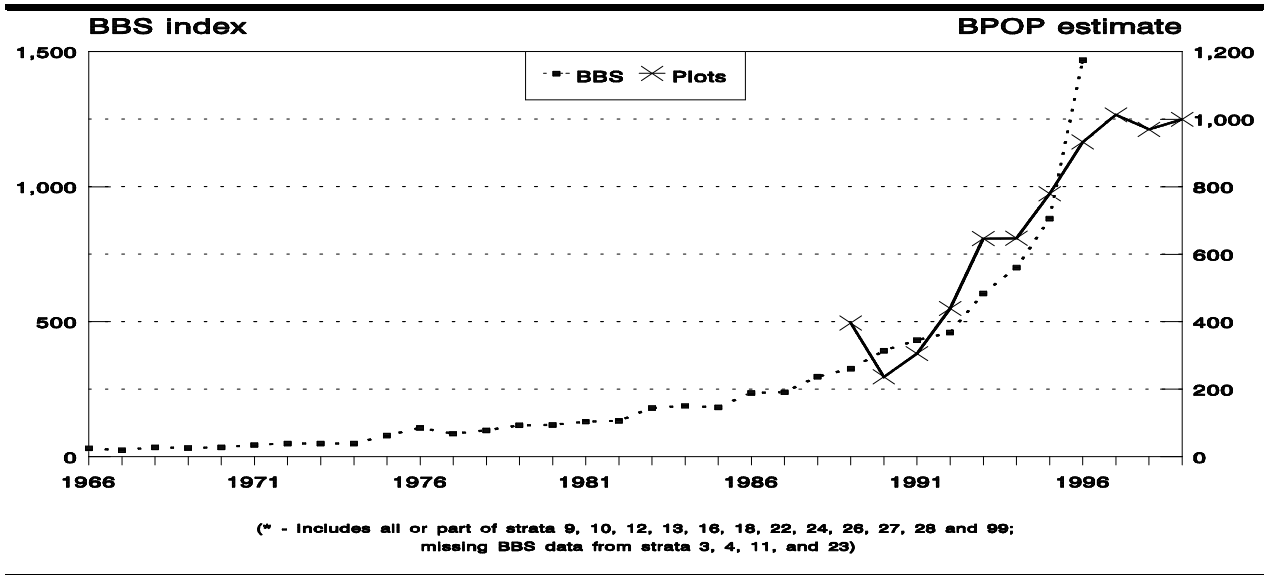


Figure 2. Weighted Breeding Bird Survey (BBS) index (relative number of geese observed on standardized roadside counts) and spring breeding population (BPOP) estimates for resident Canada geese in the northeastern U.S. (based on plot surveys from NH to VA).

POSITIVE VALUES AND USE

Aesthetic Values

For much of the 20th century, Canada geese were a symbol of northern wilderness, and migrating flocks were harbingers of the changing seasons. Resident geese provide distinctly different aesthetic benefits, and are valued by many people for the non-consumptive recreational opportunities the birds provide. Due to their wide distribution, year-round presence, and usual tolerance of people, resident geese have become very popular for wildlife observation, especially for young, elderly, and amateur bird watchers and naturalists. In many situations, resident geese may be an ideal subject for nature study or environmental education, and often appear in local media, because they are easily observed and often occur in close proximity to people. This may be especially true in areas that are not frequented by significant numbers of migrant geese, adding wildlife diversity to those areas.

Despite the growing number of conflicts associated with resident Canada geese, most

people enjoy seeing or hearing some birds, and would not want the population eliminated. In a 1993 survey of people from 10 metropolitan areas across the U.S. (including 4 in the AF where resident geese occurred), approximately 26% of respondents said they wanted more geese, 54% wanted no change in numbers, and 19% wanted fewer geese in their neighborhood (Conover 1997). Apparently, problems were not so widespread that most residents viewed them as pests, although support for population reduction went beyond the 5% of respondents who had experienced a problem with Canada geese in the previous year (and goose populations have increased since then). In a public attitude survey about geese in a Long Island (NY) community, 78% of respondents said they enjoyed the presence of resident Canada geese, even though half of those were concerned about problems the birds may cause. Only 11% said they did not enjoy geese and regarded them entirely as nuisances (Loker 1996). Long-term management of all geese in the AF could be seriously impacted if resident geese become so abundant that Canada geese, in general, become devalued and perceived primarily as pests.

Sport Hunting and Harvest

Resident geese have become an important part of the sport harvest of Canada geese in the AF, supplementing migrant goose harvest in some regions and providing the only Canada goose harvest in other regions. The harvest of resident geese has increased sharply as the population has grown and regulations were modified to direct more hunting pressure at these birds.

Before 1986, harvest regulations did not differentiate between resident and migrant populations. Since then, criteria have been developed to allow special hunting seasons in the U.S. to increase harvest of resident Canada geese at times and places where migrant goose populations would not be affected. These seasons were initially permitted on an experimental basis, with a requirement that effects on migrant geese be assessed. Special late winter seasons began in 1986 in Connecticut and special September seasons began in North Carolina in 1989 (Table 2). Suspension of the regular Canada goose hunting season in 1995 prompted many AF states to offer early and late seasons to reduce damage associated with resident Canada geese and to maintain as much recreation and harvest opportunity as possible. Similar seasons have been established in Canada, but without formal criteria. During 1998-99, September seasons were held in 14 states and two provinces, and late seasons were offered in 10 states and one province.

During the mid 1980s, it was estimated that resident geese composed 27-42% of the regular season harvest in mid-Atlantic states (NY-NJ-PA), but only 5-6% in the Chesapeake region (MD-DE), with migrant (mostly AP) geese making up the difference (Sheaffer and Malecki 1998). Applying these proportions to total goose harvest estimates suggests that about 50,000-75,000 resident geese were harvested annually during regular seasons in those states during the mid 1980s, representing about 15-20% of the total flyway goose harvest at that time.

Use of special seasons is largely responsible for the increased harvest of resident geese during the 1990s. In 1990, when only 3 states in the AF held September seasons, a total of 4,200 geese were harvested in September, but by 1998 the total AF goose harvest in September was 195,000 birds (Table 3). In recent years, late season harvests (mid January to mid February) averaged about 60,000 birds. Special seasons in the AF now result in annual harvests of more than 250,000 Canada geese per year, of which at least 90% are resident birds.

Most harvest of resident geese occurs in the state or province where the birds breed or spend the summer, reflecting their limited movements. For example, >80% of all recoveries of geese pre-season banded in Massachusetts and Connecticut occurred in the respective states (H H Heusmann, unpub. data; Chasko and Merola 1989). In New York, approximately 75% of resident goose band returns during the 1990s came from within the state and another 20% came from nearby areas in neighboring states and provinces (B. Swift, NYSDEC, unpub. data).

Table 2. Special early, regular, and late resident Canada goose seasons offered in the AF^a.

	86	87	88	89	90	91	92	93	94	95	96	97	98
ME											E	E	E
NH											E	E	E
VT													E
MA		L	L	L	E, L	E, L	E, L	E, L	E, L	E, L	E, L	E, L	E, L
RI										E	E, L	E, L	E, L
CT	L	L	L	L	L	L	L	L	L	L	E, L	E, L	E, L
NY					E	E	E	E, L	E	E, L	E, L	E, L	E, L
NJ								E	E, L	E, L	E, L	E, L	E, L
PA							E, L	E, L	E, L	E, L	E, L	E, L	E, L
DE										E	E	E	E
MD								E	E	E	E, L	E, L	E, L
VA								E	E	E	E, L	E, L	E, L
WV	R	R	R	R	R	R	R	R	E, R	E, R	E, R	E, R	E, R
NC				E	E	E	E	E	E	E	E	E	E
SC						L	L	L	R	R	E, R	E, R	E, R
GA				L	L	L	R	R	R	R	R	R	R
FL												R	R
ON						E	E	E	E	E, L	E, L	E,	E, L
PQ											E	E	E

^a E - Early (September) season offered in all or part of state or province.
R - Regular (November-January) season for resident geese in all or part of state or province.
L - Late season (January 15-February 15) offered in all or part of state or province.

The impact of sport harvests on survival and population growth rates of resident geese has not recently been studied. During the 1980s, direct recovery rates for resident geese

Table 3. Canada goose harvest estimates for special resident goose seasons in AF states.^a

Season	September	Regular*	Late	Total
1990	4,200	4,600	na	8,800
1991	1,900	2,300	na	4,200
1992	16,500	5,200	na	21,700
1993	35,400	11,400	na	46,800
1994	58,100	15,600	na	73,700
1995	109,200	13,100	19,800	142,100
1996	136,900	23,400	65,100	225,400
1997	189,100	23,100	64,100	276,300
1998	195,900	18,700	57,700	272,300

^a USFWS harvest estimates (P. Padding, unpubl. data)

* Regular season estimates only for WV, SC, GA, and FL, which harvest negligible numbers of migrant geese.

preseason banded in the AF generally ranged from 5-10% annually, varying among locations and age classes (Sheaffer et al. 1987; Chasko and Merola 1989; Johnson and Castelli 1992; G. Balkcom, Georgia DNR, pers. commun.). Since waterfowl hunters may only report about 32% of bands they encounter (Nichols et al. 1991), actual harvest rates may have been 15-30% during those years.

Band recovery rates for AF resident geese have not been estimated since the regular season was closed in 1995, but would not be directly comparable to earlier years because band solicitation efforts have probably increased reporting rates. However, the total special season harvests of resident geese in 1997 and 1998 (250,000 birds) would be near 20% of the predicted fall flight (1.2 million birds) from a spring population of one million birds, assuming 0.2 young/adult in the fall. Harvest rates are not uniform, however. Biologists in some states believe that harvest rates as high as 25% may be occurring during special seasons in some rural areas, while geese in many urban-suburban areas experience no harvest at all in some years.

Indirect evidence of the effect that sport harvest can have on population growth is suggested by the BBS data, which show an accelerated growth rate following regular season restrictions in 1992-1994, and an even larger increase after the season was closed in 1995 (Fig. 2). This suggests that the current population of AF resident geese could sustain significantly higher harvest, although population growth seems to have slowed since special seasons were established throughout the flyway in 1997.

DAMAGE AND CONFLICTS

AF resident Canada geese are often involved in damage to property, agriculture, or natural resources, and conflicts with public health and safety (Conover and Chasko 1985). The problems are most numerous in urban and suburban areas where large numbers of geese occur in parks, golf courses, corporate properties, private residences, swimming facilities, marinas, and water supply reservoirs. Damage is costly to repair or prevent, may compromise public health, and results in loss of aesthetic values and diminished public tolerance of geese.

Goose damage information in the U.S. is uniformly collected by the USDA Wildlife Services (WS) program. Between 1994 and 1998, WS offices in the AF received 8,587 requests for assistance with Canada goose damage (Table 4). Some of these requests pertained to migratory geese, so it is impossible to determine the exact number attributed to resident geese. However, most requests were received during April-September, when migrant geese are out of the U.S., and 84% involved property damage or human health and safety (Table 5), which typically involve resident geese. Additionally, in many states, calls received during autumn and winter often pertained to damage that occurred during spring and summer. The number of complaints received does not fully reflect the extent of problems; many conflicts are not reported, and others may continue for years before and after they are reported. Comparable data on goose

Table 4. Number of requests for technical assistance to alleviate damage involving Canada geese in the AF during Federal Fiscal Years 1994-1998 received by USDA Wildlife Services.

damage and conflicts in Canada is not available.

<u>State</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>Total</u>	<u>Rank</u>
New Jersey	190	342	338	400	392	1,662	1
North Carolina	285	211	299	244	205	1,244	2
Maryland	142	195	232	264	272	1,105	3
Pennsylvania	77	210	277	333	187	1,084	4
New York	173	184	201	198	217	973	5
Virginia	102	60	142	198	194	696	6
Massachusetts	88	114	111	96	119	528	7
Georgia	50	37	62	87	70	306	8
Connecticut	50	47	60	52	94	303	9
New Hampshire	27	30	47	49	45	198	10
West Virginia	41	35	31	40	34	181	11
Maine	5	18	11	10	21	65	12
Vermont	0	4	18	21	15	58	13
Delaware	2	2	9	13	28	54	14
Rhode Island	8	5	8	15	16	52	15
South Carolina	10	6	7	7	11	41	16
Florida	1	10	10	5	7	33	17
District of Columbia	0	2	0	0	2	4	18
TOTAL	1,151	1,512	1,863	2,032	1,929	8,587	

Property Damage

Property damage accounted for 70% of complaints (5,988 calls) received by WS in AF states during FY94-98 (Table 5). Most (82%, 4,895 calls) involved excessive accumulations of goose feces on landscaping and walkways at parks, private residences, businesses, schools, golf courses, and athletic fields. Property damage complaints regarding feces involved damaged lawns, cleanup costs, loss of property use for intended purpose, and diminished quality of life for complainants.

Property damage can also occur when geese graze excessively on lawns or turf areas (1,418 calls), which also reduces aesthetics, can be expensive to repair, and contributes to soil erosion. Damage to golf courses occurs most often in late summer, when cool season grasses become dormant due to warmer temperatures, and during spring in newly seeded or planted areas. Occasionally, geese destroy flower gardens by grazing and trampling. A negative aesthetic appearance of commercial property caused by excessive grazing or accumulation of feces may discourage business clients and guests, resulting in economic loss to those businesses.

Table 5. Annual mean number of requests for assistance by resource type during Federal Fiscal Years 1994 through 1998 received by USDA Wildlife Services.

<u>State</u>	<u>Property</u>	<u>Human Health and Safety</u>	<u>Agriculture</u>	<u>Natural Resources</u>
New Jersey	256	34	41	2
North Carolina	205	12	31	1
Maryland	61	97	63	<1
Pennsylvania	179	6	31	1
New York	161	13	19	2
Virginia	92	25	20	2
Massachusetts	66	13	25	2
Georgia	43	7	11	<1
Connecticut	48	8	5	<1
New Hampshire	24	12	3	0
West Virginia	27	1	8	0
Maine	5	2	4	2
Vermont	7	2	2	0
Delaware	6	3	1	<1
Rhode Island	8	1	1	0
South Carolina	5	2	<1	<1
Florida	5	1	0	0
District of Columbia	<1	<1	0	0
Total mean no.	1,198	239	271	14
Total no. requests	5,988	1,194	1,332	73

Human Health and Safety Concerns

A total of 1,194 calls regarding Canada geese impacts on human health and safety were received by WS in AF states between FY94 and FY98 (Table 5). Concerns included disease transmission to humans, collisions with aircraft, aggressive behavior towards people, and traffic hazards. Although the incidence of serious harm may seem low to those not involved with the incident, management to prevent or reduce human health and safety risks associated with resident geese is warranted.

The potential for human illness from goose feces is a common concern, especially on public use areas and where children or elderly people are present. Various potential human pathogens have been found in Canada goose feces, including *Giardia*, *Cryptosporidium*, *Salmonella*, *Shigella*, *Proteus*, *Pseudomonas*, *Yersinia*, *Enterobacter*, and *Chlamydia psittaci*, (Bigus 1996; Graczyk et al. 1998). Most of these pathogens cause intestinal disorders or respiratory problems that are not easily diagnosed as to the causal agent or source of infection. Although the risk of infection is believed to be low, it is probable that some cases have gone unreported.

Two recent cases of humans contracting Giardiasis have been linked to their exposure to goose feces in New Jersey (L. Jargowsky, Monmouth Co., NJ Board of Health, pers. commun.). *Giardia* cysts and *Cryptosporidium parvum* oocysts are not killed by water chlorination procedures, and are viable in the environment for up to one year. The U.S. Center for Disease Control considers *Giardia* and *Cryptosporidiosis* to be emerging, highly-infectious disease

threats. The Monmouth County Board of Health, Johns Hopkins University, and the USFWS, in partnership with 3 AF states (RI, NJ, VA), are conducting field studies during 1999 to further determine the extent and nature of disease threats to humans from Canada goose feces.

Fecal coliform bacteria (*Escherichia coli*) from waterfowl, including Canada geese, have been linked to high fecal coliform counts at beaches, drinking water supplies and small ponds (Hussong et al. 1979, Jamieson 1998, Samadpour 1998, C. Nadareski, NYCDEP, pers. commun.). Most public health agencies interpret high coliform counts as evidence of fecal contamination, with possible human pathogens involved, and respond by prohibiting swimming, drinking or other direct contact uses of the water (Damare et al., 1979; Standridge et al. 1979). Consequently, the presence of large numbers of geese in a small body of water with little or no flushing can preclude those uses even if specific pathogens are not found (Simmons et al. 1998).

The presence of Canada geese on and around airports creates a significant threat to aviation and human safety. The most recent high profile loss of lives caused by a wildlife-aircraft collision was the September 1995 crash of a military aircraft that struck Canada geese at Elmendorf Air Force Base in Alaska. The strike resulted in 24 human fatalities and total destruction of the aircraft, which was valued at \$190 million. The large and expanding resident Canada goose population in the AF similarly presents significant safety hazards to metropolitan airports along the east coast. During April-September, 1990-1998, Canada geese were involved in at least 60 strikes with civil aircraft in AF states (S. Wright, USDA WS, pers. commun.). Due to their large body size, flocking characteristics, and abundance and behavior near airports, Canada geese are considered a very hazardous species. Waterfowl (geese and ducks) were involved in 12% of all bird-aircraft strikes to U.S. civil aviation between 1991 and 1997 and 31% of bird-aircraft strikes where civil aircraft were damaged. Waterfowl-aircraft strikes accounted for 59% of reported monetary losses resulting from wildlife strikes to civil aircraft in the U.S. (Cleary et al. 1998).

Resident Canada geese pose localized but serious public safety problems during the nesting season when they aggressively defend a nest, nest site, and/or goslings. Aggressive geese will attack children, the elderly, clients, employees, students, and others, and have caused human injuries in the form of falls and bites. These encounters have also resulted in lawsuits, inaccessible areas, and declining public tolerance of geese. Geese nesting near roadways create traffic hazards when they cross the roadway or defend a nest site from cars and pedestrians, potentially resulting in accidents and human injuries.

Agricultural Resources

A total of 1,332 instances of Canada goose damage to agriculture were reported to WS in AF states during FY94-98 (Table 5). Grazing of pastures, grain fields and cover crops reduces crop yields, deprives livestock of food, and increases costs of agricultural production. Resident Canada geese graze a variety of crops, including alfalfa, barley, beans, corn, soybeans, wheat, rye, oats, spinach, and peanuts. A single intense grazing event by Canada geese in fall, winter or spring can reduce the yield of winter wheat by 16-30% (Flegler et al. 1987), and reduce growth of rye plants by >40% (Conover 1988). However, some have reported that grazing by geese during winter may increase rye or wheat seed yields (Clark and Jarvis 1978, Allen et al. 1985). In spring, geese can cause significant damage to sprouting corn, soybeans, or other crops.

Resident Canada geese are also a concern to some livestock producers. Goose droppings in and around water supply ponds for livestock can affect water quality and are a potential source of pathogenic bacteria. Although no direct links have been made, State veterinarians in Virginia are concerned that Canada geese may have contributed to *Salmonella* outbreaks on cattle farms in that state (M. Lowney, USDA WS, pers. commun.). *Salmonella* causes shedding of the intestinal lining and severe diarrhea in cattle, and if undetected and untreated, can be fatal. Canada geese have been suspected of causing bovine coccidiosis in calves, but the coccidia which infect cattle is a different species than that which infects Canada geese (Doster 1998).

Wild and domestic waterfowl are natural reservoirs for a variety of avian influenza viruses. Avian influenza circulates among these birds without clinical signs and is not an important mortality factor in wild waterfowl. However, the potential for avian influenza to produce devastating disease in domestic poultry makes its occurrence in waterfowl an important issue (USDA APHIS Veterinary Services 1993, Davidson and Nettles 1997). An outbreak of avian influenza in 1983-84 resulted in the slaughter of 1.7 million domestic turkeys and chickens at a loss of \$63 million in Virginia (Trice 1999). Farmers are warned to keep poultry away from wild or migratory birds or water contaminated by wild or migratory birds (USDA Veterinary Services 1993).

Natural Resources

Flocks of Canada geese can reduce water quality in ponds, lakes, and in wetlands that have limited flushing. Congregations of resident geese on pond shores can remove vegetation by feeding and trampling, resulting in bank erosion and soil sediments being carried by rainwater into lakes, ponds, reservoirs, and wetlands. Goose feces can also be a significant source of phosphorus and nitrogen in surface waters, which can stimulate algae blooms and cause ecosystem changes (loss of aquatic macrophytes) and diminished aesthetics (Manny et al. 1994). Oxygen levels are depleted when the algae dies, resulting in stress or death of aquatic organisms. Coliform bacteria can increase acidity of the water and also lower dissolved oxygen, with harmful effects on aquatic life (Cagle 1998). Geese grazing on newly planted wetland vegetation (or grassland seedings on dikes and upland fields near wetlands) has interfered with habitat restoration efforts in some areas. A total of 73 instances of Canada goose damage to natural resources were reported to WS in AF states during FY94-98 (Table 5).

Goose Damage Management

Goose damage management has evolved considerably over the past 30 years. During the 1970s and through the mid-1980s, complaints about resident goose damage in the AF were concentrated in the northeast (primarily NJ, CT, MA, and NY). Sport hunting and various hazing techniques were traditionally suggested as remedies, but were not often practical in urban-suburban areas. During that same period, USFWS and states also captured and relocated tens of thousands of geese from northeastern states to help establish resident populations in other states (e.g., ME, NC, SC, GA, AL, and AR). These operations were costly and had mixed results for reducing conflicts, largely because other measures to prevent population growth and immigration were not employed. Relocated geese sometimes returned to their capture areas, while others became involved in damage at release sites. The program was curtailed in 1984 due to concerns

that it could spread diseases, such as avian influenza, to domestic poultry.

Relocation of geese is generally not permitted now because it does little to suppress population size, and there are few areas where additional geese are desired. With resident goose populations established and conflicts occurring in virtually every state and province, there are no known unoccupied areas where releases are desired. Relocating adult geese is often ineffective because they have a strong tendency to return to areas where they previously nested or may create conflicts in release areas. However, relocating geese, especially goslings, to public hunting areas can result in some harvest of birds in the release area (Smith et al. 1999).

In recent years, there has been much interest and research into alternative damage management techniques. Harassment with dogs, use of non-toxic repellents, reproductive control by egg addling, and capture and euthanasia have all seen increasing use in recent years (Smith et al. 1999). Federal permits are needed to handle or destroy geese or their nests or eggs, and issuance of permits by USFWS has also increased tremendously in recent years (USFWS 1999). During the late 1980s and 1990s, goose damage management consisted primarily of providing technical assistance (instructions on techniques and methods, supply sources, assistance with permit process) and some direct involvement in integrated goose damage management programs by WS under contract (for a fee) with property owners. These programs, conducted primarily on airports and corporate/municipal properties, include harassment, elimination of nesting, limited shooting, and in a few cases, capture and euthanizing geese.

INTERACTIONS WITH MIGRANT GOOSE POPULATIONS

Resident geese share wintering areas with migrant Canada geese in many areas of the AF. The mixing of resident and migrant goose stocks has confounded winter surveys to the extent that they can no longer be used to monitor the status and distribution of migrant stocks in most areas of the AF. Additionally, molt migrants from resident populations in the Mississippi and Atlantic Flyways have confounded waterfowl managers' ability to accurately estimate the size of the Southern James Bay Population (SJB) and AP on breeding areas. Increasing numbers of molt migrant resident geese may be competing with migrant stocks for preferred food resources on breeding and brood-rearing areas (Abraham et al. 1999). Resident flocks may also act as decoys to migrant geese during fall, although neckband studies suggest that relatively few migrant geese have changed wintering areas as a result (Hestbeck et al. 1991).

On the other hand, management of resident Canada geese has been constrained by concerns about the status of migrant goose populations, particularly the SJB and AP, which reached historic population lows in the 1990s. Conservative hunting regulations used to protect migrant stocks have prevented managers from achieving maximum sport harvests of resident geese. Mixing of resident and migrant Canada goose stocks has also made it difficult to estimate harvests, and evaluate effects of harvest regulations, on each population.

The increasing number of resident geese as migrant populations declined in the AF has been confusing to the general public. Many people believe that resident geese are migrant birds that simply stopped migrating back to Quebec. This remains a major communication challenge. Without a clear understanding by the public that there are different stocks of geese in the flyway that require different management strategies, it will be difficult to garner their support, especially

during periods when recreational opportunities must be reduced to offset population declines.

MANAGEMENT GOAL

The goal of wildlife management agencies in the AF, with respect to resident Canada geese, is to:

Manage resident Canada goose populations in the AF to achieve an optimal balance between the positive values and conflicts associated with these birds.

Although we believe that most people would support this general goal, it may be difficult to achieve. Our success will be challenged by the high survival and productivity of resident geese, and by the fact that most geese reside on private or municipal properties beyond wildlife agencies' direct control. Some strategies, including population reduction, reduced regulation of control activities, expanded hunting seasons and harvest of flightless geese in problem areas, will likely be controversial, which could prevent or delay some actions (Conover 1997). Another management constraint is the presence of multiple Canada goose populations in the AF that are not easily distinguished at certain times of the year, and which have very different needs.

Despite these challenges, objectives and strategies in this plan identify what must be accomplished to achieve the management goal. A combination of techniques that help control, reduce, or redistribute resident geese must be encouraged on public and private properties. Activities that promote population growth (e.g., nesting platforms) should be replaced with activities that help control population growth and alleviate goose problems in nearby areas. After years of work to establish resident goose populations, this may be hard for many conservationists, public and private, to accept, so effective communication is needed to gain public understanding, support, and involvement in management efforts. Cooperative efforts by wildlife agencies, bird conservation groups, and many new stakeholders (e.g., local governments, park managers, etc.), will be necessary to be successful.

MANAGEMENT OBJECTIVES AND STRATEGIES

A. Population Management

Objective: Reduce resident Canada goose populations in the AF to 650,000 birds (spring estimate) by 2005, distributed in accordance with levels prescribed by individual states and provinces (Table 6).

Strategies:

1. Annually harvest approximately 400,000 resident geese through sport hunting and capture/removal of geese from areas experiencing damage or conflicts.
2. Reduce productivity of AF resident geese to 0.2 immatures/adult, as indexed by September harvest age ratios.
3. Develop population models to simulate management alternatives.
4. Support basic research, as needed, on population ecology of resident geese.

Discussion: The AF resident goose population increased 15% per year during the 1990s,

and most state and provincial wildlife agencies consider their current populations to have exceeded the “social carrying capacity” (public tolerance) with regard to damage and conflicts associated with the birds. The desired population size, i.e., the long-term population goal, is a spring population of approximately 650,000 resident Canada geese in the AF, distributed in accordance with objectives of individual states and provinces (see Table 6 and Appendix A). A more uniform distribution of geese is needed also in most areas to provide a better balance between the positive and negative values associated with resident geese. Lower and more evenly distributed populations would reduce severity of problems in many areas and help prevent new problems from occurring.

Population goals for individual states and provinces were derived independently based on their respective management needs and capabilities. In some cases, the goals were an approximation of population levels at an earlier time when problems were less frequent and less severe. In other cases, goals were calculated from what was judged to be a more desirable or acceptable density of birds. For states and provinces where resident geese have just recently become established, goals are near current population levels. Unlike traditional population goals for waterfowl, these represent an optimal size, not a minimum number where being above the goal is desirable. Population goals presented here may be revised periodically in response to changes in goose populations, damage levels, public input, or other factors.

To effectively reduce resident goose populations, an increase in adult and immature mortality rates, combined with reproductive control, is necessary. Reproductive control (e.g., egg treatment or sterilization) alone can not reduce the population in an acceptable time; treatment of 95% of all eggs each year would result in only a 25% reduction over 10 years (Allan et al. 1995). In contrast, reducing annual survival of resident geese by just 10% (e.g., from 80% to 70%) would reduce a predicted growth rate of +15%/year to a stable population, assuming moderate recruitment (R. Malecki and S. Sheaffer, NYCWRU, pers. commun.; Fig. 3).

Table 6. Spring population estimates (“BPOP”, in 1,000s of geese), population goals, and preseason banding goals for resident Canada geese in states and provinces of the AF.

State/Province	Land (km ²)	Current BPOP ^a	BPOP per km ²	BPOP Goal	Goal per km ²	Goal per mi ²	Banding Goals ^b
Connecticut	12,593	29	2.3	15	1.2	3.1	428
Delaware	5,135	6	1.1	1	0.2	0.5	100
Florida	140,158	<5	0.0	<5	0.0	0.1	na
Georgia	150,259	44	0.3	30	0.2	0.5	656
Maine	80,215	24	0.3	15?	0.2	0.5	359
Maryland	25,618	74	2.9	30	1.2	3.0	1,112
Massachusetts	20,267	18	0.9	≤ 20	1.0	2.6	275
New Jersey	19,477	85	4.3	41	2.1	5.5	1,268
N Hampshire	23,378	21	0.9	≈16	0.7	1.8	320
New York	124,730	137	1.1	85	0.7	1.8	2,000
N Carolina	126,406	97	0.8	<30	0.2	0.6	1,448
Pennsylvania	116,461	223	1.9	≈100	0.9	2.2	2,000
Rhode Island	2,717	3	1.2	3	1.1	2.9	100
S Carolina	78,176	22	0.3	20	0.3	0.7	330
Vermont	24,002	8	0.3	5	0.2	0.5	125
Virginia	103,021	261	2.5	180	1.7	4.5	2,000
West Virginia	62,433	28	0.4	24	0.4	1.0	413
Total - U.S.	1,111,838	1,084	1.0	620	0.6	1.4	12,929
N Brunswick	73,380	6	0.1	6	0.1	0.2	100
Nova Scotia	55,448	2	0.0	2	0.0	0.1	na
SE Ontario	84,201	23	0.3	20	0.2	0.6	348
Prin Ed Island	5,652	2	0.3	2	0.4	0.9	na
S Quebec	56,231	5	0.1	0	0.0	0.0	100
Total - Can	274,912	37	0.1	30	0.1	0.3	548
TOTAL - All	1,386,750	1,121	0.8	650	0.5	1.2	13,477

a Mean annual estimate for 1997-1999 or best estimate of wildlife agency staff.

b Banding goals calculated as 1.5% of current BPOP, with no less than 100 and no more than 2,000 for any state or province except FL, NS, and PEI, where no banding is recommended at this time. AHY geese should comprise about 67% of each total.

Table 2. Preseason banding

Adult resident Canada geese are long-lived and subject to negligible mortality other than hunting. Current harvest rates (≤20%) through sport hunting are far below what is needed to maintain a stable population (≈30%). Hunting is a well-established and practical way to reduce survival on a large-scale, so hunting regulations should be designed to maximize potential harvest rates, especially in problem areas. A 50% increase in annual sport harvests to approximately 375,000 birds would be desirable. However, additional harvest may be difficult to

achieve since special seasons (and hunter effort) are close to the maximum possible under existing regulatory criteria. Restoration of regular fall-winter seasons throughout the AF will result in some additional harvest of resident geese, but those seasons may be restricted for several more years to ensure continued recovery of AP geese. Banding studies should be used to identify

potential harvest areas for overabundant goose flocks that cannot be hunted locally.

Figure 3. Predicted population growth for a resident goose population with moderate recruitment (2.4 young per nesting female) and varying annual survival rates for adults (AD) and immatures (IM) (from R. Malecki and S. Sheaffer, NYCWRU, pers. comm.).

Where hunting is not practical, or cannot achieve desired harvest rates, other removal options, including capture and euthanasia of geese from problem areas, would accomplish population objectives. Capturing adult geese during the summer flightless period in problem areas, and processing the birds so they can be used by local food bank programs, has been shown to be a cost efficient way to directly reduce local goose populations (Keefe 1996). This practice may be especially effective in urban areas where hunting is not allowed, because geese can be efficiently captured and specific geese causing problems can be removed. Standard guidelines for capturing, handling, processing and distributing geese to the public through food banks would be useful, based on the experience gained through existing programs. During 1996-1999, nearly 4,000 geese were captured and processed to provide meat for local food banks in New York, Virginia, Delaware, Maryland, Rhode Island and Connecticut. Public demand for, and acceptance of, these programs will likely increase in the future. Annual harvests of $\geq 10,000$ geese per year from problem areas throughout the AF are conceivable in the next few years.

Reproductive control by wildlife agencies is not practical on a large scale, but can be carried out in high density nesting areas, such as wildlife management areas, parklands, and islands in lakes and reservoirs. Property owners experiencing damage or providing attractive nesting habitat should be encouraged to conduct or allow nest destruction or egg treatment

programs, and releases of captive-reared geese by private game breeders should be prohibited.

Annual productivity of resident geese can be assessed from harvest age ratios for geese shot during special seasons (e.g., September). Although harvest age ratios based on tail fans may underestimate production, relative changes should be detected. Age ratios of geese shot in the AF during 1995-1997 (when regular seasons were closed) averaged about 0.30 immatures/adult, so reduction to 0.20 would complement efforts to increase mortality. Reducing survival through harvest can, in turn, help reduce productivity by increasing the proportion of sub-adults (non-breeders) in the population. Productivity of flocks that are not subject to harvest can be assessed through special surveys during spring or early summer, if desired.

Population management would be enhanced by development of population models for AF resident geese. Models could be used to simulate effects of population management options and would help evaluate efforts (and alternative strategies) to achieve population goals. Much of the data needed may already be available from past research, including the recently completed neckband study (Hestbeck 1998), and other field research in various flyway states (e.g., NJ, CT, PA). Likewise, new field studies or data analysis may be warranted as information needs arise. Of particular interest would be studies documenting effects of population management programs, and research on molt migration by AF resident geese. We do not know the extent to which molt migrations occur, where the birds go, when they return, or how it may affect management of all Canada goose populations in the AF.

B. Relief of Damage and Conflicts

Objective: **Permit a wide variety of effective and efficient options for relief of damage and conflicts associated with resident Canada geese.**

Strategies:

1. Allow property owners and municipalities to use a full range of effective and legal techniques to reduce damages and conflicts.
2. Adopt a federal depredation order or conservation order to give interested states and provinces the authority to manage resident Canada geese when migrant populations would not be affected.
3. Continue to develop and distribute information on lethal and non-lethal control methods.
4. Support research documenting the nature and extent of goose damage, and evaluating alternative damage management techniques.

Discussion: Population management alone will not necessarily eliminate all human-geese conflicts. Many complaints concerning resident geese can be resolved by using standard abatement techniques such as scare devices (shell crackers, dogs, mylar tape), aversive agents and/or fencing. Habitat manipulation, reducing public feeding, and permanent fences can be effective long-term solutions for solving individual human/goose conflict situations. Sport hunting is a cost-effective technique that should be used wherever possible and practical, but it is not an option in many situations. A wide variety of techniques are available and must be used in comprehensive, integrated programs to alleviate conflicts associated with resident Canada geese. Increasing problems, especially in urban and suburban areas, demands continued research on practical and effective lethal and non-lethal alternatives.

There are relatively few restrictions on use of non-lethal controls. However, those methods are not always practical, effective, and affordable, and most simply move problem birds to other locations. More effective population controls that involve direct handling or taking of geese or eggs, including egg treatments, nest destruction, shooting outside of the hunting season, capture and euthanasia, or relocation, are strictly regulated by the USFWS. Current federal regulations require property owners to possess depredation permits to handle or take geese or their nests or eggs. In many situations where human/goose conflicts have arisen, the public has been shuffled from one agency to another in their attempts to alleviate the problems. Obtaining permits can take a month or more after submitting a detailed application and processing fee. Often, unacceptable damage occurs before control action can be taken. To date, the total take of geese and eggs has had negligible effects on goose populations in AF states.

Given the current status of resident geese, and the growing demand for relief of goose damage and conflicts, the current level of federal oversight is unnecessary and inefficient. A depredation order or conservation order should be established to allow individual states and provinces to determine what control methods for resident geese are allowed, and the extent to which those activities need to be regulated. At a minimum, the need for federal permits for nest destruction, egg treatment, and shooting or capturing small numbers of geese causing damage during spring or summer (March 11 - August 31) should be eliminated. This would reduce the administrative burden on state and federal wildlife agencies and property owners experiencing damage or conflicts with resident geese. This transfer of authority should be available to all interested states, and should be maintained even when resident populations are at or below prescribed goals for any state. The depredation order should limit activities only to the extent necessary to ensure that migrant geese are not affected.

C. **Public Use and Enjoyment**

Objective: Provide maximum opportunities for use and appreciation of resident Canada geese, consistent with population goals.

Strategies:

1. Develop more flexible hunting regulations that allow states and provinces to maximize sport hunting opportunities for resident geese.
2. Maintain public appreciation and tolerance of resident geese for viewing, nature study, and other aesthetic values, despite the need for population reduction.

Discussion: Sport harvest is an essential tool for management of resident goose populations, and the recreation and consumptive use benefits that the birds provide are also valuable to tens of thousands of people who hunt geese. Approximately 70,000 people harvested one or more geese in AF states during the 1997 and 1998 hunting seasons. Resident goose populations throughout the flyway currently provide annual harvests in excess of 200,000 birds, reflecting high hunter participation and success. Resident geese provide harvest opportunities in many areas that were not historically frequented by migrants. Even if the AF population was reduced to the goal of 650,000 birds, with production of 0.1 young per adult, annual harvests of nearly 200,000 birds ($\approx 30\%$) could be sustained on a long-term basis.

Effective harvest management will require more flexible hunting regulations, including

special seasons that allow states and provinces to achieve desired harvests of resident geese while minimizing harvests of Canada goose populations of concern. It is unlikely that substantially higher harvests can be achieved with current hunter numbers and current regulations, including restrictive regular seasons. Wherever possible, special resident goose seasons should be expanded, and regular seasons designed, to help achieve population goals and provide additional recreational opportunity. Maximum allowable season lengths (107 days) and framework dates (September 1 - March 10) should be considered where it would help achieve desired harvests of resident geese and migrant geese would not be affected. Additional splits, special hunting zones, and differential bag limits within the season are other options available to manage harvests. Consideration should be given also to allowing non-traditional hunting methods, including seasons that extend later into spring, as long as ethical standards for sport hunting are maintained. The criteria for special seasons should be revised to provide greater flexibility for increasing sport harvest of resident geese, and evaluation requirements should be standardized and coordinated throughout the AF to minimize administrative burden on states and provinces.

Despite the need to reduce and redistribute resident goose populations in most areas of the AF, managers must be careful to not foster negative public attitudes toward geese. Small numbers of geese are enjoyed by most people, and the birds provide opportunities for birdwatching and incidental observation that add to quality of life and help maintain public support for wildlife conservation. Negative attitudes can also lead to lower tolerance for geese, which will increase demand for population reduction and relief from perceived damages or conflicts with even very small numbers of birds. Communications about geese should always note both the positive and negative aspects, and emphasize the need for balance rather than eradication. Likewise, managers need to be sensitive to the aesthetic benefits that geese can provide, while also providing options to relieve conflicts when they occur. There is currently little information on the general public's attitude toward resident geese and the acceptability of available control methods. Surveys to determine public attitudes toward this issue would enable managers to more effectively design, and communicate with the public about the need for, effective population management programs.

D. Compatibility With Other Goose Populations

Objective: Ensure compatibility of resident goose management with management of migrant goose populations in the AF, and vice versa.

Strategies:

1. Establish hunting regulations for regular and special seasons to maximize the overall number and proportion of resident geese in the harvest.
2. Develop or refine techniques to differentiate, or estimate proportions of, resident and migrant Canada geese in harvest or banding samples.
3. Investigate molt migration in AF resident geese to assess potential impacts on monitoring programs and habitats for migrant Canada geese.

Discussion: Resident Canada geese are the most abundant geese in the AF and can sustain higher harvest rates than most migrant populations. To date, it has been necessary to restrict harvest more when migrant populations may be present in an area. It appears that suspension of regular seasons accelerated growth of resident goose populations throughout the AF, although growth has slowed with expanded use of special seasons. We need to develop new ways to

increase the sport harvest of resident geese, especially in areas with severe conflicts, that also provide adequate protection of migrant populations. Even regular season regulations should be designed to maximize the number and proportion of resident geese taken relative to the allowable harvest of migrant geese to help achieve management objectives for both. This requires reliable information on when and where migrant geese occur in the flyway, and techniques to distinguish residents from migrants in harvest, banding, or observation samples. Likewise, other waterfowl hunting regulations and land management activities should consider how they may affect the relative vulnerability of resident and migrant Canada geese in the AF.

Reliable methods for differentiating resident geese from migrants during banding operations, hunter bag checks, parts collection surveys, and field observations would greatly enhance management capabilities. Neckband observations during the 1990s helped define when and where migrant and resident geese occurred in the AF, but banding and survey efforts were not uniform throughout the flyway, and observation efforts were discontinued in 1998. Band recoveries from pre-season banding of migrant and resident Canada geese will provide current information on population distribution and harvest derivation on a regional scale. However, other methods are needed to determine population affiliations of individual birds harvested in local areas or captured at other times of the year. Morphological measurements (e.g., skull and culmen length) may be used to classify and estimate proportions of geese derived from different populations (T. Moser, unpub. data), but precision of results may not be adequate for management needs. Genetic and chemical (stable isotope) analyses have also shown some promise, but additional work is needed to confirm their accuracy and to lower costs for operational use.

Research on molt migration by AF resident geese was suggested earlier to investigate implications for management of that population. It would also be of value to determine if such movements are affecting management of migrant Canada goose populations in the AF. Resident geese molting in breeding areas of AP or SJBP geese may be confounding population surveys in those areas, and may be competing for food resources during the critical brood-rearing period.

E. **Monitoring and Evaluation**

Objective: Annually monitor populations, harvest, and damage/conflict levels to evaluate effectiveness of management actions.

Strategies:

1. Monitor breeding population size and distribution through various surveys.
2. Monitor annual sport harvest and harvest rates through hunter surveys and an operational leg-banding program.
3. Determine reporting rates for leg-banded Canada geese recovered by hunters.
4. Monitor numbers of complaints or other indicators of public demand for relief from conflicts associated with resident geese.

Discussion: Population monitoring programs are needed to evaluate progress towards the management goal. Population size and distribution will be assessed primarily by annual breeding waterfowl surveys in 11 northeastern states (New Hampshire to Virginia). These surveys provide estimates of total Canada geese (and indicated breeding pairs) with a 95% confidence interval of $\pm 20\%$ at the flyway level. Population goals for many states were based on data from these

surveys, but annual estimates may vary widely, especially for smaller states, and should be used with caution (e.g., 3-year averages may be more reliable). In addition, USFWS conducts aerial surveys across the breeding range in southern Canada that provide annual estimates of total Canada geese for AF provinces and Maine. Breeding Bird Survey (BBS) data can be used also to assess population trends in most areas of the flyway. Mark-recapture estimates from band recovery or neck-band observation data have also been used to estimate populations in some states (GA, MA). Special surveys could be conducted in local areas to obtain more reliable estimates of resident goose numbers than regional surveys described above.

Harvest assessment is also important for evaluating management success. Existing migratory bird harvest surveys in the U.S. and Canada provide adequate estimates of total goose harvest during all hunting seasons offered. However, to obtain information on survival, direct recovery rates, harvest rates, harvest distribution, and the impacts of hunting and other population controls on resident Canada geese, a coordinated preseason banding program is needed. Most states already leg-band some resident geese, but the effort has been inconsistent and, in some cases, not distributed in proportion to population densities. A more strategic operational banding program that reflects the population distribution should be designed and implemented. Initially, every state and province with a resident goose population >5,000 birds should attempt to band at least 1% of their spring population of adult (AHY) birds (Table 6), and distribute banding effort to reflect relative abundance of geese within the state. At least half that number of hatching-year (HY) birds should be banded annually also. A reward band study to estimate hunter reporting rates for leg-banded Canada geese is a high priority so harvest rates can be calculated from band recovery data (Sheaffer and Malecki 1995).

Continued documentation and assessment of damage or complaint levels is desirable. USDA WS has systematically documented the number of requests for assistance for many years, which provides a useful measure of program demand and effectiveness. However, the volume of complaints they receive could be affected by changes in federal regulations, such as a depredation order, or if states assume greater management authority for resident geese. Public attitude surveys in areas where goose management programs have been implemented would help determine and document success of those efforts.

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APPENDIX A
Resident Canada Goose Status and Management
in States and Provinces of the AF

UNITED STATES

Connecticut

The Canada goose was not described as a summer resident at the turn of the century. The establishment of resident geese is not well documented. During the period 1920-1940 the State Board of Fisheries and Game and the White Memorial Foundation in Litchfield maintained a winter waterfowl feeding program at the Foundation in an effort to maintain and increase the low wood duck population. A small flock of Canada geese took advantage of this winter feeding program and remained during the spring and summer months and reared young. The winter population grew to 80 Canada geese. Early in the 1940s the winter feeding program was discontinued. These geese began to disperse and nest throughout northwest Connecticut. Then in 1960 the state established a small breeding population of Canada geese at Charter Marsh WMA in northeast Connecticut. Also, goslings and adults captured during the summer molt at Brigantine NWR (NJ) were transplanted throughout eastern Connecticut during the 1960's.

The population is monitored through the AF Waterfowl Breeding Survey (AFWBS) plots. In 1989-1990 the population estimate was 10,000 adults in the spring. In 1997-1998 the estimate was 31,000 adults. The highest densities are in Fairfield County in southwest Connecticut. The Connecticut Breeding Bird Atlas shows a breeding distribution throughout the state.

Nuisance problems occur at private residences, golf courses, swimming beaches, public parks and recreation areas. The most common complaints from these areas is excessive fecal droppings and aggressive behavior. There are some health concerns particularly at swimming beaches where high coliform bacterial counts have closed the beaches to swimming. Agricultural damage is reported in the spring when corn seedlings are emerging and in the fall when winter cover crops are planted. Safety problems occur at several airports where there is the potential for bird/plane strikes. Complaints are now recieved throughout the state.

A desired population objective is 15,000 adults as measured by the AFWBS. This was the population size of 1991. The current population level (30,000 birds) is causing significant problems where more aggressive lethal methods are necessary to control damage.

Delaware

Resident Canada geese have been present in Delaware in significant numbers for more than 30 years. Resident populations in the early 1970s were mostly confined to northern Delaware in New Castle County, north of the cities of Newark and Wilmington. These birds were probably the progeny of captive birds released by landowners. As late as 1985, the total resident population in Delaware was estimated at approximately 600 birds. At that time, all but about 100 birds were still located on estates, golf courses and industrial sites in northern New

Castle County. Control efforts in the early 1980s consisted of capture and transport to other states which relieved the problem at that time.

Since the 1980s, resident geese have increased in numbers and spread across the state, partially due to in state movement of captured nuisance birds (other states would no longer take them). In-state trap and transport activities were terminated by the Division of Fish and Wildlife in 1997.

The current resident Canada goose population in Delaware is estimated to be approximately 7,000 birds including approximately 2,000 breeding pairs. About 65% of these are located in New Castle County, 17% are in Kent County and 18% are in Sussex County. Due to the small size of the state (1,995 mi²), resident goose numbers can be monitored by counting flocks as well as through the breeding pairs survey.

Resident Canada goose problems are primarily due to birds being in non huntable areas. These include golf courses, water treatment facilities, residential areas, industrial complexes, hospitals, shopping malls and other areas where feces, feathers, noise, water pollution and aggression conflict with human activities. At this point agricultural damage is a smaller problem than the above listed items. Current control measures include egg shaking, lawn treatment with taste aversion agents, fencing, hazing and in some cases euthanasia with the meat donated to food for the hungry programs. The Division of Fish and Wildlife serves in an advisory capacity, but does not actively participate in these activities. Approximately 20 to 30 complaints are received each year. Capture and euthanasia is done by private contractors hired by the landowner under a landowner held Federal permit.

The Delaware Division of Fish and Wildlife endorses a statewide resident Canada goose population cap of 1,000 birds including not more than 200 breeding pairs. This is consistent with populations in the mid to late 1980s when problems with these birds were minimal in Delaware. Additionally, the Division endorses a population cap of 25 geese per site as compatible with human activities except in cases where health or human safety is concerned. In those cases, all birds should be removed. These population caps should provide ample opportunity for the public to observe and enjoy Canada geese without placing an unacceptable financial burden on landowners.

Florida

Approximately 1,600 Canada geese were released in Florida in the late 1960s and early 1970s in an effort to establish a resident flock. Florida historically did not support a breeding population of resident Canada geese. The attempts to establish breeding geese in Florida had only limited success, likely due to poor nest success and gosling survival. No reliable empirical estimates of statewide abundance exist. Anecdotal information and casual observations suggest that the current population ranges between 2,000 and 5,000, concentrated in urban and suburban areas (B. Constantin and D. Eggeman, pers. commun.). Nuisance problems are relatively minor. Florida's population goal is to maintain the current population size.

Georgia

Historically, migratory Canada geese passed through Georgia on their way to an important wintering area, St. Marks National Wildlife Refuge in Florida. Over time, the Atlantic Population of migratory Canada geese declined in number, and fewer and fewer geese passed through Georgia. Today there are virtually no migratory geese present in Georgia.

In 1975, the Georgia Department of Natural Resources began a program to re-establish Canada geese in Georgia. During the restocking period of 1975 through 1987, over 8,000 wild Canada geese were relocated from several northeastern states and were released on reservoirs and farm ponds across the state. Canada geese quickly adapted to the available habitats in Georgia, and our resident goose population began to grow and expand into new areas.

Currently, Georgia's goose population is estimated at approximately 45,000 birds. Georgia has no formal goose population monitoring program in place at this time, but various types of surveys are being considered for future use. Current population estimates are based on a "Lincoln-Index" using direct recoveries of birds that are banded during the summer molting period.

Geese often use habitats where they cannot be hunted, such as golf courses, beaches, lawns, housing developments around major impoundments, and man-made ponds in subdivisions and apartment complexes. Goose-human interactions occur often in these settings. Goose complaints usually fall into one of four categories: 1) crop damage, 2) property damage, 3) being in areas where they are unwanted, and 4) potential health and safety issues.

The Canada goose hunting season in Georgia provides recreational opportunity for sport hunters and acts as a management tool to slow the growth rate of the resident goose population. Since the first resident goose season in January of 1990, Georgia has gradually increased goose hunting opportunity to the current statewide, 70-day season with a bag limit of two geese per day. Using a calculated direct band recovery rate of 8%, and a published reporting rate of 32%, Georgia hunters harvest about 25% of the population each year.

The population objective for resident Canada geese in Georgia is 30,000. This population will allow adequate recreational opportunity, reduce nuisance problems, and retain the aesthetic value of the birds to the general public.

Maine

Resident Canada goose populations have been increasing in Maine at a moderate rate since the Department of Inland Fisheries and Wildlife first began transporting geese in the mid 1960s from numerous out-of-state sources. Our banding files reveal that Maine has received geese from New Jersey, New Hampshire, New York and Connecticut. We last transported geese from Connecticut to northern Maine wetlands in 1985. At that time, our Waterfowl Management Plan Abundance Objective #2 was "To increase the distribution of Canada Geese in Wildlife Management Units 1,2, and 3 (essentially northern Maine) by 50 percent by 1990." While Maine's waterfowl goals and objectives have not been updated, the Department has made no efforts in this direction. The geese seem very capable themselves of meeting this objective and populations continue to grow at some unknown rate.

Maine's resident goose population is currently estimated at 2500 pairs, distributed over the entire length and breadth of Maine. Geese are monitored by brood counts on index areas and during the Midwinter Inventory. We do get 3-5 nuisance situations per year that generally are associated with town or state parks and one dairy farm in central Maine. Our Regional Wildlife Biologists routinely move 50-75 geese (adults and goslings) per year into northern Maine lakes. The resident goose hunt in September has been deemed a big success and may be enough to keep these bird numbers and nuisance situations in check, although in spring 1999, there seemed to be more nesting pairs around than ever before (B. Allen, MDIFW, pers. commun.).

Within the next year or two, it is anticipated that considerable effort will be targeted towards updating Maine's Waterfowl Management Plan and new goals and objectives for resident Canada Geese will be established.

Maryland

Resident or non-migratory Canada geese in Maryland originated from the release of decoy flocks during the 1930s and government and private stocking programs. Many flocks in Maryland were started with giant Canada geese brought from the Midwest. Famed decoy maker, Madison Mitchell, told of how giant Canada geese were purchased from sources in the Midwest and used as decoy flocks to attract wild geese to the gun. These birds were released each spring and other birds were purchased next fall.

The earliest recording of Canada goose stocking in Maryland dates back to 1935, when a group of 41 geese was moved to Backwater NWR (National Wildlife Refuge) in Dorchester County. In the 1930s, migrant geese were not common on the Eastern Shore, but were observed stopping to feed on pastures before moving further south to Carolina wintering areas. The most successful flock of resident geese in Maryland was started at Patuxent Wildlife Research Center near Laurel. This flock began in 1946 when eight wintering geese were trapped at Blackwater NWR and released at the Center. More wild birds were added in 1951. Flocks on the Patuxent River near Croom, Maryland were started in the late 1940s. Edgar Merkel began to release Canada geese obtained on the Eastern Shore on ponds. The flock established near Davidsonville, Maryland can be credited to Lou Wayson. In 1953, he placed several pinioned pairs of adult Canada geese purchased on the Eastern Shore on a pond located on his farm. Other geese, principally crippled migrants given to him by hunters, were added at irregular intervals. Offspring from these releases remained in the area to breed, establishing new flocks that spread to farm ponds and tidal marshes in nearby counties.

Other flocks were started by the MD DNR (Department of Natural Resources) when >2,000 nuisance Canada geese were captured on western shore golf courses and were relocated to Dorchester, Caroline, and Somerset Counties. In 1991, the Maryland DNR stopped relocating nuisance geese.

In Maryland, most resident Canada geese are found west of Chesapeake Bay, mainly in the Piedmont region. Since 1989, estimates of breeding resident geese have been obtained from the AF Waterfowl Breeding Survey conducted annually each April. Estimates of resident geese in Maryland have increased from 25,000 in 1989 to more than 90,000 in 1998. Problems caused by nuisance geese are frequent and increasing. Problems include over-grazed lawns, turf farms,

and golf courses; accumulation of droppings and feathers on walkways, beaches, play areas, and golf courses; nutrient loading of water areas; public health concerns at beaches; aggressive behavior by nesting birds; and safety hazards near roads and airports. Complaints of geese damaging agriculture crops (sprouting corn and soybeans) are becoming more severe, especially on the Eastern Shore.

The Maryland DNR has used special resident goose hunting seasons as the primary means of trying to slow the growth of this goose population. However, resident geese typically inhabit urban and suburban areas where they are safe from hunting. Federal depredation permits are frequently issued to limit reproduction and to allow landowners to take a limited number of geese when goose problems become severe and where hunting is not practical. In 1999, capture and euthanasia will be used for the first time in the state to solve severe nuisance goose problems.

The Maryland DNR has established a target objective of 30,000 resident geese as a desirable population objective. At this level the DNR believes that nuisance and depredation problems caused by geese could be managed by sport hunting and socially acceptable methods of control.

Massachusetts

Resident Canada goose populations in Massachusetts are the descendants of birds once kept as live decoys. In 1930, state records indicate that 8,500 geese were registered as live decoys. In 1935, the use of live decoys was prohibited and an unknown number of these birds were released, joining flocks of geese previously established via escapes or earlier releases. Most of these flocks were located in the eastern third of Massachusetts.

Complaints about geese in the 1960s led to a transplant program which involved moving goslings from eastern areas to central and western Massachusetts. This program continued until the mid 1970s. At that time, Massachusetts' resident goose population was estimated at 6 to 8 thousand birds.

Special resident goose hunting seasons were initiated in Massachusetts in 1988 with a post migration season in the coastal waterfowl hunting zone. In 1990, a short, September season was held in the western waterfowl hunting zone. Both seasons allowed a 5-bird daily bag. In 1992, the late season was expanded into the central waterfowl hunting zone and in 1995, the September season was expanded statewide when the regular 70-day season was closed.

Population estimates based on mark-resight techniques using neck-collared birds resulted in an August population estimate of 25,000 geese in 1991 which increased to 38,000 by 1997. Increases in population size appeared related to restrictions on Canada goose hunting during the regular waterfowl season. Current monitoring is based on breeding pair estimates at a state level, with broad confidence limits.

Goose populations in western Massachusetts appear to have stabilized, with broad distribution of geese with few major buildups of flocks in urban areas. This is a desired goal. In central Massachusetts, nuisance problems are minor and localized. Only eastern Massachusetts continues to experience major problems with geese at a number of sites.

Hunting is restricted in urbanized eastern areas, but more sites are being open to goose hunters. The combined special seasons harvest up to 25% of the state's resident population. The reinstatement of a traditional Canada goose season in 1998 via implementation of the North Atlantic Population Canada Goose Management Plan, should increase the harvest of resident geese.

Massachusetts' population goal for resident geese is to reduce the size of large flocks in urban-suburban settings and create greater dispersal of geese throughout existing habitat, reducing complaints about geese. Resident geese will be the focus of Massachusetts' Canada goose harvest. A socially acceptable resident goose population size is likely a summer population of less than 20,000 birds.

New Jersey

In New Jersey, the resident goose population is believed to have originated from the release or escape of captive birds from private waterfowl breeders and hunters as well as through purposeful introductions and immigration of resident geese from adjacent states. Small numbers of local breeding geese have probably been present in the state since the 1930s or 1940s. The first purposeful introductions are believed to have occurred at Great Swamp and Brigantine (now Forsythe) National Wildlife Refuges during the 1950s. During the 1960s and early 1970s resident geese were transferred from CT, NY and Brigantine to several state wildlife management areas in New Jersey.

Resident geese utilized a variety of habitats, but they were especially common in suburban parks and ponds. The geese provide aesthetic and recreational values, but they are also associated with many nuisance and damage problems. As the number of resident geese increased in the late 1970s and 1980s, federal wildlife control officials, with state assistance, rounded up nuisance geese and transferred them to several southern states. Following a prohibition in 1984 on transferring geese, due to an avian influenza outbreak, few round-ups were conducted.

From 1984-89, New Jersey conducted a statewide study of resident goose population ecology. Nesting studies indicated that resident goose nest success was high and generation time was shorter for resident geese than for migrant geese. On average, 67% of all goose nests hatched at least one gosling and gosling survival was good. Survival rates based on legband recoveries averaged 83% for all cohorts. Population modeling indicated that the population could be expected to double in 11 years. As fall Canada goose hunting seasons were reduced and then suspended in 1995, the rate of population growth continued to increase. Population estimates derived from the Northeastern Breeding Plot Index (BPI) indicate that the New Jersey resident goose population doubled between 1989 and 1997. For the past 3 years (1997-99), the NJ BPI for the resident goose population has been somewhat stable, averaging 84,530. New Jersey currently has the highest density of resident geese in the Atlantic Flyway and possibly in the United States.

In addition to the BPI, Canada geese are also counted in New Jersey each January during the Mid-winter Waterfowl Survey (MWS). At this time resident and migrant geese are mixed, but 2/3 of these wintering geese are believed to be resident population geese. Many of these "resident" geese breed in states north of New Jersey, making a short migration south to New

Jersey for the winter. During January 1999 over 280,000 geese were counted in New Jersey, the second highest state count in the Atlantic Flyway. Significant nuisance and damage complaints occur during the winter period.

A special September goose hunting season (Sept 1-15) was initiated in part of New Jersey during 1993 to help increase the harvest of resident birds. The September season was expanded statewide in 1994, expanded to Sept 1-30 in 1996, and has been conducted each September since. The September harvest has averaged 12,500 geese in recent years. A special winter resident Canada goose season was established in 1994. During 1996, the hunt area was expanded slightly and the season was increased in length (Jan 15-Feb 15). The winter harvest has averaged 5,000 geese. While these seasons have been helpful in targeting harvest at resident geese, additional strategies are needed to effectively manage the resident goose population.

The New Jersey resident goose population objective is a population of 41,000 statewide. Populations should be reduced in both agricultural and urban areas to address concerns expressed by these constituents. In reaching this population objective, consideration was given to maintaining the significant aesthetic and recreational benefits these birds provide, while reducing nuisance and damage problems as well as concerns about human health and safety.

New Hampshire

The New Hampshire Resident Canada goose population has substantially increased over the last decade both in number and distribution. The population increase is occurring in a south to north direction and based upon the Northeast Breeding Waterfowl Plot Survey data the Canada goose has surpassed the black duck as the third most commonly breeding waterfowl species in the state.

It's theorized that New Hampshire's Resident Canada goose population has increased primarily as a result of an expanding Massachusetts population. The highest density of Resident Canada geese in the state occurs in the southern three counties which border Massachusetts. In the late 1970s. New Hampshire obtained a small number of Canada geese from southern New England and relocated them in the northern part of the state. This may have also contributed to the resident Canada goose population.

Monitoring of NH's Resident Canada goose Population was initiated in 1991 as part of the AF Resident/Migrant Canada goose study. In 1995, data from work conducted as part of the study and data generated from the Northeast Breeding Waterfowl Plot Survey was used to derive a breeding population estimate of some 7,700 Canada geese in the six southern counties (46% of the state's land area) that translated into a density of 2.0 Canada geese/mi². No statewide estimate was determined at that time. Recent statewide estimates based on 1997 and 1998 Northeast Breeding Waterfowl Plot Surveys, indicate a state breeding population of some 20,000 (2.3/mi²) Canada geese. However, densities in southern sections remain substantially higher than those in northern sections of the state.

Brood size data has been collected statewide since 1991. Data indicates that resident geese are quite productive and during late June and early July have annual brood sizes of between 4.3 and 4.9 goslings.

In winter, New Hampshire's resident Canada geese move primarily to southern New England. In mid-winters, up to 1,000 geese remain in the state at inland locations and in winters with little snow, birds will return as early as mid-February. Canada geese that winter in coastal habitats are primarily birds from eastern Canada.

Canada goose nuisance complaints and requests for assistance are reported to USDA Wildlife Services. Since 1993, the number of complaints pertaining to resident Canada geese has tripled. The majority of complaints pertain to property damage and human health and safety issues. Most complaints are from southern sections of the state where both resident goose and human populations are the highest. However, complaints are increasing from central sections of the state where resident goose populations continue to expand.

A statewide population objective of 1.5-2.0 geese/mi² would allow for continued population growth in northern sections of the state and provide for population reductions in areas of the state where nuisance complaints are highest.

New York

New York's resident goose population was among the first established in the Atlantic Flyway. In the early 1900s, Canada goose flocks were held in captivity on private estates on Long Island and in the Lower Hudson Valley, with stock from wild-trapped birds, and possibly from western game breeders. These early flocks probably included *B. c. canadensis*, *B. c. interior* and *B. c. maxima*. It is not known when some of these birds became feral and self-sustaining, but by 1930, flocks had become established in local parks, cemeteries and golf courses. In upstate New York, resident Canada goose flocks are nearly all related to stock obtained from a Wisconsin game bird breeder in 1910. These birds and their progeny were held in captivity until 1919, when some were allowed to fly free around a State game farm at Sherburne. In 1934 some of the birds were moved to other game farms where free-flying flocks were also established. Liberation of private decoy flocks in 1935 (when their use for hunting was banned), with geese from various sources, may have contributed to these local flocks, resulting in a mixture of subspecies throughout the population. During the 1950s and 1960s, game farm stocks were used to establish goose flocks at various upstate wildlife management areas. Pioneering and translocations of geese from these areas eventually resulted in geese nesting statewide in a wide variety of habitats from industrial properties to remote beaver ponds.

In 1981, it was estimated that there were about 19,000 resident Canada geese in New York (12,000 in the Lower Hudson Valley and Long Island, and 7,000 upstate). During 1997-1999, spring population estimates averaged 137,000 birds (not counting young-of-the-year), with about 39,000 breeding pairs statewide, indicating a 7-fold increase in less than 20 years. In the Lower Hudson Valley and Long Island, the more recent population estimate was approximately 18,000 total geese (2.0 geese/km²), suggesting a more modest increase. Population growth was most dramatic upstate (excluding the Adirondack region), as the average was 118,000 birds (1.3 geese/km²), a 17-fold increase. In the Adirondack region, the population remains relatively low, with an average estimated population of about 1,400 total geese (<0.1 geese/km²).

Across New York State, resident Canada geese provide tremendous aesthetic benefits and

recreational opportunities. In addition to viewing, resident geese provide a substantial sport hunting activity and harvest in New York. In 1997 and 1998, approximately 10,000 people who hunted geese harvested approximately 50,000 birds per year. This is close to the total goose harvest (primarily migrant geese) that occurred during 90-day regular seasons in the late 1980s (67,000 birds/year). If each hunter spends an average of \$200 per year on this activity, goose hunting generates close to \$2 million in economic activity in the state.

Although most people enjoy seeing some geese, conflicts and damage occur when the birds become over abundant, creating demand for management relief. Human/goose conflicts have been common in the Lower Hudson Valley and Long Island since the 1960s, resulting in wildlife agency programs to capture and relocate geese to more rural areas and other states. Between 1960 and 1990, an estimated 25,000 geese were taken from nuisance locations in the Lower Hudson Valley, for release in Maine, West Virginia, North Carolina and South Carolina. Complaints about resident geese became widespread in upstate New York during the 1990s, and conflicts with geese seem to have intensified in all areas of the state in recent years.

We believe that the growing frequency and severity of complaints about geese is directly related to overall growth of the resident population, which is made possible by the birds' adaptability to a wide variety of habitats, including urban and suburban areas. Population growth seems to have accelerated after suspension of the regular hunting season in 1995. Based on these observations, DEC biologists believe that a more acceptable number of resident geese in New York is at or below 85,000 birds, assuming a fairly uniform distribution of geese (e.g., 0.8 geese/km²), except in the Adirondacks, where a much lower density (e.g., 0.2 geese/km²) is more appropriate due to habitat limitations. A lower and more evenly distributed population would reduce severity of problems in many areas and help prevent new problems from occurring.

North Carolina

In that portion of the state approximately west of I-95, the resident goose population was most likely due to the movement of birds from adjacent states, particularly South Carolina, Georgia, and Virginia. Only one flock in the Piedmont, Cowan's Ford (Mecklenburg Co.), is known to be the result of stocking by the Wildlife Commission. Private individuals, who maintained flocks for use as live-decoys or practiced aviculture, released some additional birds. In the lower coastal plain, east of I-95, resident goose populations largely descend from birds stocked by the Wildlife Commission during the 1980s. Several thousand nuisance geese were transported to North Carolina from Ontario, Pennsylvania, New York, New Jersey, Connecticut, and Delaware, and released.

The number of resident Canada geese in North Carolina in 1986 was estimated by local Wildlife Commission biologists at 5,148. At least 1,000 of the 22,000 Canada geese counted during that year's Midwinter Waterfowl Survey are thought to have been resident birds. In 1999, a similar estimate of resident geese in North Carolina totaled 96,505. The change in estimate between 1986 and 1999 assumes an annual rate of growth in the population of about 25 %. About 5,000 resident birds are thought to be represented in the 1999 Midwinter Waterfowl Survey of approximately 15,000. Resident Canada geese in the state, under current hunting regulations, are thought to be increasing.

A September aerial survey is conducted every 3 years, in that portion of the state covered by the Midwinter Waterfowl Survey. Purpose of the survey is to develop a minimum estimate of resident geese in the survey area and thus improve the estimate of migrant geese. A periodic estimate of resident Canada geese is also made by local biologists for their area of responsibility.

In the portion of the state east of I-95, the landscape is predominantly rural and nuisance goose problems involve more conflicts with agriculture, relative to the remainder of the state. Canada geese are most often reported doing damage to seedlings of corn, soybeans and peanuts. Some damage to produce, specifically bell-peppers, has occurred. Most agricultural damage seems to occur in the spring immediately after planting and germination. Significant problems also occur in urbanized areas of eastern North Carolina. These have been the result of droppings on waterfront lawns and golf courses and damage to turf grass.

In the more urban portions of the state west of I-95, damage from resident geese is more serious and widespread, particularly in the I-85 corridor between Durham and Charlotte, and west to Winston-Salem. Most damage is reported by managers of parks, golf courses, corporate parks, and municipal water supplies and by homeowners. Typical problems involve droppings on lawns, damage to turf, degradation of water quality, and noise.

The population objective for resident Canada geese in North Carolina should be no more than 30,000 resident Canada geese.

Pennsylvania

Pennsylvania's resident goose population is believed to have originated from the introduction of *Branta canadensis maxima* by the Pennsylvania Game Commission (PGC) and various sportsmen's organizations. In 1936, 30 pinioned birds were obtained that started the nucleus of the Pymatuning flock in Crawford County. Over the ensuing years more birds were obtained from game breeders and through natural reproduction that enabled introduction efforts to occur throughout the state. During the 1970s the first nuisance complaints were received from landowners in southeastern Pennsylvania. Subsequent trap and transfer programs relocated over 40,000 problem geese to new areas both within and outside the state. In 1995 the PGC terminated the trap and transfer program.

Most nuisance complaints are associated with suburban areas where geese congregate on public or private ponds and forage on lawns and mowed areas associated with parks, beaches, golf courses and residences. The major problems are associated with goose droppings both aesthetically and from direct damage to lawns or golf greens. Agricultural losses occur primarily in the late winter and spring. The major crops damaged are corn, soybeans, winter wheat and improved pastures. In recent years crop damage complaints have increased in number and severity, particularly in the southeastern part of the state.

Breeding resident Canada geese occur in every county. The breeding population is monitored annually through the Northeastern Breeding Waterfowl Plot Survey. The highest densities are in the Southeast (4.3 geese/km²) and the Northwest (5.0 geese/km²) parts of the state. The statewide total population was estimated at 262,000 in 1999, which included 104,000

breeding pairs. Numbers of resident geese have been increasing in all survey strata.

Since 1992, Pennsylvania has annually leg-banded about 2,000 Canada geese throughout the state. These band recovery data are used to help evaluate special hunting seasons and estimated recovery rates of resident Canada geese. The PGC has used special resident hunting seasons as the primary tool to control population growth. Currently about 80% of the total Canada goose harvest occurs during special resident hunting seasons.

The population objective for Pennsylvania should be about 100,000 geese or about 2.2 mi². This population level is similar to our statewide estimates during the early 1990s before regular Canada goose hunting seasons were suspended and population levels began to increase dramatically. This level should provide optimal recreational opportunities while reducing nuisance and damage complaints.

Rhode Island

Dr. Harold Hanson identified Rhode Island's resident Canada goose population as the giant subspecies (*B. c. maxima*) in the mid 1970s. First reported nesting of Canada geese was in 1958 in Briggs Marsh, Little Compton. Population build-up was reported on during the 1970s (Allin 1980), and estimated at 500 birds.

During the initial study, Canada geese had an 89% hatching success and 90% brood survival rate. Since then, the resident population has grown to an estimated 4,500 geese distributed statewide. A greater proportion of the population is located in Providence, Kent, and Washington Counties, with molt flocks of 500± birds.

Monitoring of the population has occurred sporadically with leg and neckbands in the AF cooperative study. A brief study is planned for 1999 and 2000 to recheck nesting and brood survival success and compare with our earlier study. Much of the resident population remains in RI year round, however, a small segment has been reported wintering in central NJ. Recent years have found the state's wintering population grow to over 12,000 birds, causing complaints from farmers, golf courses, commercial properties, and state airports. Nuisance complaints generated by resident birds come from golf courses, public drinking water supplies, waterfront property owners, state airports, state parks, private pond associations, cemeteries, and town recreation departments. The basic complaints are of goose droppings and feathers, pollution, and aggressive behavior.

Rhode Island has conducted special resident seasons in September (1995-98) and late experimental seasons (1997-99). Goose hunters find the September season framework dates do not correspond with local farming corn harvest, resulting in declining requests for required season permits. Harvest during this season is averaging 473 birds and the late experimental season average harvest is 579 geese.

A desired goose population of 3,000 birds would be a satisfactory level for a state objective for resident Canada geese.

South Carolina

Resident geese now occur in all 46 counties of the state and appear to be becoming more abundant and more widely distributed.

Problems include depredation on commercial row crops, gardens, golf courses, and ornamentals in residential and suburban areas. Public health and sanitation problems in public swimming areas and campgrounds are also a problem. Additional problems exist around Air Force Bases, particularly Shaw Air Force Base, and around commercial airports.

We do not conduct formal surveys, but the latest population estimate was 22,000. We would like for our population objective to be established at a maximum of 20,000 birds.

Vermont

Prior to the 1960s, Canada geese were not known to nest in Vermont. In 1956, 44 birds, wild trapped on the Bombay Hook National Wildlife Refuge in Delaware, were released on the Dead Creek Wildlife Management Area in Addison, Vermont. The first nest was observed in 1960. A survey conducted by the Vermont Department of Fish and Wildlife during the late 1970s showed that resident Canada geese were nesting in the Champlain Valley in Addison, Chittenden, and Grand Isle Counties, and in Bennington and Windham Counties in southern Vermont. A breeding bird survey conducted by the Vermont Institute of Natural Sciences during 1976-1981 showed similar findings. The source of the southern Vermont birds is unknown, but suspected to have originated from Massachusetts or New York. The total population of resident geese was estimated at that time to have numbered less than 500.

A resident Canada goose nesting survey was conducted again in 1997. This survey revealed an estimated 513 breeding pairs located in 96 (38%) Vermont towns. The late summer population of resident Canada geese was conservatively estimated to be 3,000 birds. The largest concentrations were located in the Champlain Valley from southern Chittenden County south through Rutland County, and in Bennington and Windham Counties. This survey will be conducted again in 2002.

Damage or nuisance complaints were reported from 23 Vermont towns between 1995 and 1997 and have increased dramatically during the last two years. Most of the complaints have come from lake shore property owners, state and municipal parks, golf courses and agriculture fields. Personnel from the Vermont Department of Fish and Wildlife and the USDA Wildlife Services treated goose eggs in two locations in 1998 and are expected to add several lakes to the list in 1999. Vermont held its first resident Canada goose season in 1998.

It is felt that a reasonable population objective for resident Canada geese in Vermont would be 5,000 birds. At this time, Canada geese are felt to be at objective numbers in the Champlain Valley (Grand Isle, Franklin, Addison Counties), overpopulated on several lakes in southern Vermont (Rutland, Bennington and Windham Counties), and below objective level in the remaining counties located in the central and northeastern part of the state (Lamoille, Orleans, Essex, Caledonia, Washington, Orange, and Windsor

Counties).

Virginia

As in other areas of the Atlantic Flyway, Virginia's resident goose population is derived from a number of sources, including the release or escape of captive birds from private waterfowl breeders and hunters, and introduction or immigration of birds from other areas. Small numbers of local breeding geese have probably been present in the state since the 1930s or 1940s.

As the number of resident geese increased in the 1970s and 1980s, so did the number of contacts and interactions with human populations. The geese adapted well to living around people, taking advantage of the well-manicured lawns and quiet ponds in urban environments. The geese provide aesthetic and recreational values to many citizens of the state but they also cause many nuisance and damage problems, and have raised concerns for human health and safety. A population growth rate of >10% during the 1990s has led to increasing concern about interactions with people and with other wildlife populations, and is creating new management challenges. Population estimates derived from the Northeastern Breeding Plot Survey over the past 3 years (1997-99) indicate that there are between 250,000-300,000 resident geese in the state.

Management activities have evolved over time from simply monitoring the birds as they became established, and promoting their growth in some instances, to attempting to control their growth rate as their numbers have continued to increase. In the 1970s and 1980s many private landowners erected nesting platforms and created habitats to promote resident goose production. When complaints about "nuisance" geese occurred, initial management actions were to capture problem birds and move them to areas where there were no geese. Such actions, though well intentioned, probably accelerated the spread of geese across the state. These translocations were stopped in the early 1990s and population control measures were initiated.

A special September goose hunting seasons was initiated in 1993 to help increase the harvest of resident birds. However, the closure of the regular Canada goose hunting season in 1995 made it difficult to keep resident goose number in check. Harassment and exclusion techniques such as noisemakers, scarecrows, fencing, and chemical taste deterrents have been used in attempts to move geese off problem areas. In addition, a special late hunting season was initiated in 1997 to control resident goose numbers in the western part of the state where fewer migrants winter. Each of these management techniques have been useful, but additional strategies are needed to effectively manage the resident goose population.

The resident goose management objective for Virginia is to reduce the size of the resident goose population to a 3-year average of 180,000 statewide. Populations should be reduced in both agricultural and urban areas to address concerns expressed by these constituents. This population level should provide significant aesthetic and recreational benefits while reducing damage problems and concerns about human health and safety.

West Virginia

West Virginia's resident Canada goose population originated primarily from birds

transplanted from northeastern states. Most of the transplanted geese came from New York, but Connecticut, New Jersey, Maryland, and Delaware also supplied birds. A total of 5,442 Canada geese were relocated to West Virginia between 1976 and 1983.

Canada geese are well established in suitable habitat statewide. The Ohio Valley and the Eastern Panhandle have the most uniform distribution and highest concentrations of geese. Central and northern West Virginia also has a relatively uniform distribution and a moderate goose density. Canada goose distribution in southern West Virginia is spotty with good numbers of birds in areas of suitable habitat. The statewide population is estimated to be 25,000-30,000 birds.

West Virginia does not conduct a standardized survey to monitor the Canada goose population. Calculations based on USFWS harvest estimates and survival rates from banding/neck collar studies, subjective estimates from each district game biologist, and the mid-winter inventory are used to derive a subjective estimate.

Most Canada goose complaints in West Virginia come from urban/suburban areas and are of the nuisance (droppings, feathers, aggressive behavior) or property damage (lawns, golf courses) variety. Agricultural damage and health/safety type complaints are relatively rare.

The Canada goose population objective for West Virginia is 1/mi² or 24,119 birds. The current Canada goose population is above the objective.

CANADA

New Brunswick - TBA

Nova Scotia - TBA

Ontario - TBA

Prince Edward Island - TBA

Quebec

Before 1970, Canada geese were rarely observed during summer between 45° N and 48°50' N, except on Anticosti Island. After 1980, small flocks of 30-50 non-reproductive Canada geese were regularly seen between June and October along the St. Lawrence, the Ottawa and the Saguenay Rivers. In the Lake St. John area (48° N), molting birds were captured in 1996 and 1997 and none had a brood-patch. According to the data of Moser and Rolley (1990), 80% of those birds were resident geese.

By mid-1980, some nests were found south of 46° N, mainly in the St. Lawrence valley and since then, the nesting population is in expansion. The actual nesting population of the Giant Canada goose is estimated at 1000 pairs according to the 1998 waterfowl breeding ground survey carried out in agricultural sectors of the St. Lawrence lowlands. A total of 4,994 Canada geese were observed during this survey. Most Giant Canada geese migrate south of the province after

mid-November and come back by early April.

An early hunting season for the Giant Canada Goose was introduced in the agricultural fields of some hunting districts in 1996 and a late season in a part of one district. The estimated number of Giant Geese killed in pre and late seasons established for geese in Quebec during 1996 and 1997 was respectively around 2,700 and 1,800 birds.

Any expansion of a summer population in the St. Lawrence valley will result in depredations problems in agricultural fields and in urban parks. So, the population objective for the Giant Canada Goose in Quebec has been fixed to zero. We will continue to collect information on the Giant Canada Goose population status to adjust our bag limits and seasons and to avoid harvest of Canada Geese migrating from areas north of 48° N.