CANADA GEESE IN THE FRASER VALLEY: A PROBLEM ANALYSIS

André M. Breault
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EXECUTIVE SUMMARY

This study was initiated in response to an increasing number of complaints about breeding and wintering Canada Geese (*Branta Canadensis*) in the Fraser Valley. The objectives of the study were to: 1) determine the location and type of problems caused by Canada Geese; 2) document concerns of land owners near the locations identified in 1); 3) document desired population levels in problem areas; and 4) suggest management practices to control problem flocks.

Information on goose flocks was obtained from different land users in urban and rural areas. For urban areas, we polled by phone: all regional governments in the Fraser Valley (21 municipalities and 4 Regional Districts); 59 public and private golf courses; 10 cemeteries; 6 airports; 5 stables; 3 race tracks; and 8 other land users. For rural areas, we phoned 28 farmers to which scare or kill permits were issued over the last 3 years by the Canadian Wildlife Service and the British Columbia Ministry of Environment and sent mail questionnaires to 55 farmers belonging to the Delta Farmers' Institute.

From those sources, we located both flocks considered to be a problem and flocks not considered to be a problem. Other problem flocks were located from discussions with provincial, federal and Ducks Unlimited Canada biologists. This report covers only problem flocks of geese. We located 34 problem flocks in urban areas, 11 on golf courses and 34 in rural areas. Problem flocks were distributed throughout the Fraser Valley.

In urban areas, complaints focused on droppings, grazing and health hazards. Most problems were caused by resident geese, with heavy damage reported throughout the year. Problem flocks ranged in size from 6 to 1500 birds, and 50% of the problem sites had problems for less than 5 years. Seventy percent of the problem sites reported increases in the goose population over the last 3 years.

Golf course superintendents complained mostly of the droppings and grazing, which increased maintenance time and potentially decreased use by golfers. Most problems were caused by resident geese, and heavy damage occurred throughout the year. Problem flocks ranged in size from 10 to 500 birds, and only 3 of the 11 courses with problems had suffered goose damage for less than 5 years. Most golf courses (63.5%) felt that their goose population had increased over the last 3 years.

In rural areas, problem flocks of geese were mostly observed on cash crops and pasture/hay fields. Farmers complained mostly of cash crop losses and grazing, although concerns for disease transmission and weed transport were also mentioned. All farmers with goose problems reported monetary losses related to the presence of geese. The majority of the damage incurred by farmers was caused by resident geese, with heavy damage in the spring/summer and much lighter damage in the fall/winter period. Problem flocks varied widely in size (50-3000 birds), and more than 80% of the farmers with problems had suffered damage for more than 5 years. Most farmers felt that the goose population had increased over the last 3 years.

Opinions on the acceptable number of geese varied greatly between rural and urban areas. In rural areas, a majority of farmers did not desire any geese at all on their farms, while a majority of people in golf courses and urban areas desired some geese on their property. There was also a clear difference in desired control methods for problem flocks between urban and rural areas. A majority of farmers agreed with increases in hunting pressure and destruction of problem flocks as best methods of population control, while in urban areas the majority agreed with adult sterilization and egg addling. Changes in landscaping practices and introduction of bylaws preventing goose feeding by the public were not supported in urban areas. In rural areas, goose control was thought to be almost solely a responsibility of the Canadian Wildlife Service and the provincial Ministry of Environment, but urban areas also wanted to see municipal authorities, Ducks Unlimited Canada and environmental groups involved.

The above suggests that problem flocks of Canada Geese should be managed differently in urban and rural areas. In rural areas, emphasis should be placed on: 1) changing either or both the bag limit and the hunting season length; and 2) using methods to reduce flock size at key locations. Those changes would likely also affect a portion of the goose population found in urban areas. As well, a stabilization in wintering goose numbers in the valley over the last 3 years suggests that some of the breeding control programs are having some effect on wintering abundance. Egg addling programs should be continued and expanded in areas not currently covered (e.g. Vancouver Game Farm and Serpentine Fen) and adult sterilization should be considered for key areas like Stanley Park and Burnaby Lake.

Because the number of problem flocks in the Lower Mainland is actually quite small, we recommend that management be conducted primarily at key breeding sites, with quick methods (e.g. scare/kill permits, flock culling). Because of the variety in the number of problems encountered with geese, we

recommend that management proceed along 6 points: 1) decrease recruitment; 2) increase mortality; 3) increase emigration; 4) modify breeding and wintering habitat; 5) continue monitoring the regional population to provide a better understanding of goose biology in the valley; and 6) provide information to the public on how to avoid some of those problems.

RESUME

Cette étude fut initiée afin de répondre à une augmentation du nombre de plaintes concernant les Bernaches du Canada (*Branta Canadensis*) nichant et hivernant dans la vallée du Fraser. Les objectifs de l'étude furent de: 1) déterminer l'emplacement et le type de problèmes causés par les Bernaches du Canada; 2) documenter les préoccupations des propriétaires terriens près des sites identifiés en 1); 3) documenter les niveaux de populations désirés pour les sites avec problèmes; et 4) proposer des méthodes d'aménagement pour contrôler les groupes de Bernaches causant des problèmes.

Nos données proviennent de propriétaires terriens en régions urbaines et rurales. En région urbaine, nous avons interviewé: tous les gouvernements régionaux de la vallée du Fraser (21 municipalités et 4 Districts Régionaux); 59 clubs de golf privés et publics; 10 cimetières; 6 aéroports; 5 écuries; 3 pistes de courses; et 8 autres propriétaires terriens. En région rurale, nous avons interviewé par téléphone 28 fermiers à qui le Service Canadien de la Faune ou le Ministère Provincial de l'Environnement ont émis des permis pour tuer ou éloigner les Bernaches au cours des 3 dernières années, et posté des questionnaires à 55 fermiers appartenant au "Delta Farmer's Institute".

Ces données ont permis d'identifier différents groupes de Bernaches du Canada perçus comme causant et ne causant pas de problèmes. D'autres groupes problèmes de Bernaches furent également localisés à partir de discussions avec des biologistes travaillant pour le gouvernement provincial, fédéral, et pour Canards Illimités (Canada). Ce rapport traite uniquement des groupes de Bernaches perçus comme causant des problèmes. Nous avons localisé 34 groupes problèmes en milieu urbain; 11 sur des clubs de golf et 34 en milieu rural. Ces groupes furent géographiquement répartis dans toute la vallée du Fraser.

En milieu urbain, les plaintes ont surtout porté sur les fécès, le broutage et les risques pour la santé. La plupart des problèmes furent causés par des oiseaux résidents, avec des dommages importants survenant à longueur d'année. La taille des groupes problèmes a varié entre 6 et 1500 individus, et 50% des sites ont des problèmes depuis moins de 5 ans. Soixante-dix pourcent des sites problèmes ont indiqué une augmentation du nombre de Bernaches au cours des 3 dernières années.

Les surintendants des clubs de golf se sont surtout plaints des fécès et du broutage par les bernaches, occasionnant une augmentation du temps nécessaire à l'entretien des clubs de golf. Ceci est perçu comme pouvant

éventuellement diminuer l'utilisation du club par les golfeurs. La plupart des problèmes furent causés par des oiseaux résidents, avec des dommages importants survenant à longueur d'année. La taille des groupes problèmes a varié entre 10 et 500 oiseaux, et seulement 3 des 11 clubs de golf avec problèmes sont affectés depuis moins de 5 ans. La plupart des clubs de golfs (65%) considèrent que la population de Bernaches a augmenté au cours des 3 dernières années.

En milieu rural, les groupes problèmes de Bernaches furent surtout observés sur des champs avec récoltes payant comptant, sur les pâturages, et dans les champs de foin. Les fermiers se sont surtout plaints de pertes monétaires sur les récoltes payant comptant et du broutage causé par les Bernaches, mais ils furent également préoccupés par la possibilité de transmission de maladies et le transport de mauvaises herbes. Tous les fermiers ayant des problèmes causés par les Bernaches ont mentionné des pertes économiques reliés à la présence des Bernaches. La majorité des dommages encourus par les fermiers furent causés par des Bernaches résidant dans la Vallée du Fraser. Les dommages les plus importants furent observés au printemps et en été, bien que des dommages moindre furent également observés en automne et en hiver. La taille des groupes problèmes a varié entre 50 et 3000 individus, et plus de 80% des fermiers sont affectés depuis plus de 5 ans. La plupart des fermiers ont mentionné une augmentation de la population locale au cours des 3 dernières années.

L'opinion des gens interviewés sur ce qui constitue un nombre acceptable de Bernaches a grandement varié entre régions rurales et urbaines. En région rurale, la majorité des fermiers ne désirent aucune Bernache sur leur ferme, tandis que la majorité des gens sur les clubs de golf et en région urbaine désirent un certain nombre de Bernaches sur leur propriété. Une nette différence fut également observée en ce qui concerne les méthodes favorites de contrôle entre régions rurales et urbaines. La majorité des fermiers favorisent une augmentation de la pression de chasse et la destruction de groupes problèmes, tandis qu'en région urbaine, la majorité des gens favorisent la stérilisation des adultes et le brassage des oeufs. Amener des changements dans les pratiques d'aménagement paysager et introduire des règlements municipaux interdisant l'alimentation des oies par le public ne furent pas des méthodes supportées en milieu urbain. En milieu rural, le contrôle des Bernaches fut perçu comme étant presqu'uniquement une responsabilité du Service Canadien de la Faune et du Ministère Provincial de l'Environnement. En milieu urbain, les gens interviewés ont également désiré que les gouvernements municipaux, Canards Illimités (Canada) et les groupes environnementaux soient également impliqués dans le contrôle des Bernaches.

Ces données suggèrent des méthodes de gestion différentes pour les groupes problèmes de Bernaches en milieu rural et urbain. En milieu rural, la gestion devrait être centrée sur: 1) changer la limite de chasse et/ou la saison de chasse; et 2) l'utilisation de méthodes visant à réduire la taille de groupes problèmes de Bernaches. Ces changements affecteraient probablement une portion importante de la population présente en milieu urbain. Une stabilisation de la population de Bernaches hivernant dans la vallée au cours des 3 dernières années suggère également que les programmes de contrôle des oiseaux nicheurs présentement en place ont un certain effet sur le nombre d'oiseaux hivernant dans la vallée. Les programmes de brassage des oeufs présentement en place devraient être poursuivis et étendus aux régions qui ne sont pas présentement couvertes par ces programmes (i.e. Vancouver Game Farm et Serpentine Fen). La stérilisation d'adultes devrait être considérée pour des sites tels que Stanley Park et Burnaby Lake.

Etant donné le nombre réduit de groupes problèmes de Bernaches dans la Vallée du Fraser, nous recommendons que la gestion des Bernaches soit principalement faite aux sites clés de nidification, en utilisant des méthodes rapides (i.e. émission de permis pour tuer ou effrayer les oiseaux, destruction de groupes problèmes d'oiseaux). Nous recommendons que la gestion des Bernaches soit centrée sur 6 points: 1) diminuer le recrutement; 2) augmenter la mortalité; 3) augmenter l'émigration; 4) modifier l'habitat de nidification et d'hivernage; 5) continuer le monitoring de la population régionale afin de mieux comprendre leur biologie dans la vallée; et 6) informer le public sur comment éviter certains de ces problèmes.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

This project was funded under Contract Number KA601-0-2165 to the senior author. Background information on Canada Geese in the Fraser Valley was obtained from Canadian Wildlife Service (CWS) and British Columbia Ministry of Environment (MOE) files. Federal and provincial enforcement officers provided access to records of scare and kill permits issued in the Fraser Valley. Special thanks go to D. Wilson, T. Burgess, G. Dick, G. Grigg, C. Copland and K. Fry for helping to locate goose flocks in the valley. We also thank all other provincial and federal biologists who provided suggestions on how Canada Geese should be managed in the valley.

We thank the Greenfields Project and Theresa Duynstee for mailing out questionnaires to selected farmers from the Delta Farmers' Institute. We also wish to thank park and golf course superintendents, farmers, and everyone else who contributed data to this study. We would like to thank CWS, MOE, Agriculture Canada, Provincial Ministry of Agriculture and Ducks Unlimited (Canada) biologists for reviewing and providing suggestions on the questionnaire regarding attitudes and solutions to Canada Goose problems. We thank all the naturalists who participated to Fraser Valley Christmas Bird Counts from 1977 to 1989. Wayne Weber provided unpublished data on the 1986 to 1989 Christmas Bird Counts for Vancouver and Ladner.

INTRODUCTION:

This project was initiated in response to increases in the number of complaints received by the Canadian Wildlife Service (CWS) and other regional agencies about Canada Geese (*Branta canadensis*) in rural and urban areas in the Fraser Valley. Local farmers have reported monetary losses due to goose grazing; golf courses report increased maintenance caused by droppings accumulation; airports are concerned about the danger of collisions with aircrafts; parks boards are concerned with health hazards ("swimmer's itch" and increased faecal coliform counts) in swimming areas, lower public use and increased maintenance problems due to accumulation of droppings; and the general public is concerned about the safety of geese nesting in urban environments.

In the past, complaints have been handled on a case-specific basis by CWS and the British Columbia Ministry of Environment (MOE). Interventions have ranged from relocation of problem flocks, removal of geese nesting on balconies in downtown Vancouver, egg addling programs to reduce recruitment, and issuing scare and kill permits to farmers and other land owners. Increases in the amount of resources devoted to handling goose problems and an apparent increase in the number and location of problem flocks in the Fraser Valley prompted CWS to review its Canada Goose management strategy.

As part of that review, the current project was aimed at updating information on problem flocks in the Fraser Valley and at reviewing different management techniques used to control problem geese. Specifically, the objectives were to: 1) locate and determine the size of problem flocks of Canada Geese in the Fraser Valley; 2) document concerns of land owners affected by problem flocks; 3) determine desirable goose population levels; 4) review management practices used to control problem geese; and 5) recommend local procedures to control goose populations.

To accomplish this, we looked into the overall distribution of Canada Geese flocks in the Fraser Valley, although this report focuses solely on problem flocks. Discussions with land owners affected by Canada Geese were used to address objectives 1 to 3. Recommendations on local management of problem flocks were derived from a literature review and from discussions with land owners, and provincial and federal biologists and enforcement officers.

The report is organized as follows. Section 1 presents the results of a questionnaire on problem flocks of Canada Geese in the Fraser Valley. We discuss: 1) location and size of problem flocks; 2) problems caused by geese; 3) desired solutions to goose problems; 4) acceptability of different

control methods; and 5) a list of areas where goose problems might arise in the future. Section 2 reviews management practices used to control problem flocks of geese and makes recommendations on future management of problem flocks in the Fraser Valley.

This report is based on information obtained from people and organizations affected by problem flocks of Canada Geese in the Fraser Valley. We understand that the attitudes described in this report might differ from attitudes of the general public. The goal of the project was to describe the goose problem in the way it is perceived by people and organizations affected. Our study was not an attempt at characterizing overall distribution of goose flocks in the Fraser Valley or public reaction to different goose management practices.

SECTION 1: SURVEY OF PROBLEM FLOCKS OF CANADA GEESE IN THE FRASER VALLEY

Introduction

Canada Geese were introduced into the Fraser Valley in the late 1960's and early 1970's to provide a harvestable surplus in areas open to hunting and to provide wildlife viewing opportunities throughout the valley. Urbanization, high fecundity and survival, diminution of hunting, and exploitation of vacant habitat in urban areas have led to a rapid increase in the goose population. Wintering populations (as estimated by Christmas Bird Counts) have doubled from 1977 to 1988 (McKelvey and Sullivan 1989). In November 1990, the Canada Goose population (after harvest) of the Fraser Valley was estimated at 9000 birds (McKelvey and Wilson 1990). Major breeding concentrations include the Serpentine Fen, Burnaby Lake, Mill Lake, Rees Gravel Pit and the Vancouver Game Farm.

Different problems have been associated with Canada Geese. The general public is concerned about the welfare of geese nesting on highrise buildings, while nearby residents have complained of disturbance caused by those geese. At high densities, geese are thought to cause or contribute to crop damage, declines in the use of grassy public areas, transmission of parasites to livestock, disease transmission to humans (swimmer's itch) and faecal contamination of water bodies. In spite of these problems, they enjoy an almost unanimous affection from the general public (Addison and Amernic 1983).

This section summarizes the results of a questionnaire on problem flocks of Canada Geese in the Fraser Valley and on attitudes of people and organizations affected towards different management practices. Specifically, we describe: 1) the location of problem flocks of Canada Geese in the Fraser Valley; 2) problem flock size and problems caused; 3) desired solutions to current goose problems; 4) acceptability of different control methods; 5) perceived responsibilities of agencies in controlling problem flocks of geese; and 6) a list of areas where goose problems might arise in the future.

Methods

Location of problem flocks.

Phone interviews were conducted between 1 October and 30 November 1990 to locate problem flocks of Canada Geese in the Fraser Valley. We approached:

- Municipal park superintendents for Abbotsford, Burnaby, Chilliwack, Coquitlam, Delta, Harrison Hot Springs, Kent District, Langley, Maple Ridge, Matsqui, Mission, New Westminster, North Vancouver, Pitt Meadows, Port Coquitlam, Port Moody, Richmond, Surrey, Vancouver, West Vancouver and White Rock.

- Regional district park superintendents for Central Fraser Valley Regional District, Dewdney-Alouette Regional District, Fraser-Cheam Regional District and Greater Vancouver Regional District.

- Race tracks, airports and cemeteries listed in the Metro Vancouver, Central Fraser Valley and Upper Valley 1990 phone directories.

- Golf courses listed in the Metro Vancouver, Central Fraser Valley and Upper Valley 1990 phone directories or listed in the 1990 edition of "Golf Guide, B.C., Alberta and Saskatchewan" [Vol. 7(1)]. Private Pitch and Putt courses and mini-golfs were contacted only if they belonged to municipalities.

- Farmers who either 1) had been issued kill and scare permits by CWS and MOE from 1988 to 1990; 2) were identified by Don Bates, Forage crop specialist, B.C. Ministry of Agriculture and Fisheries, as having goose problems; or 3) participated in the "Greenfields Project" organized jointly by the Canadian Wildlife Service and the Department of Soil Science, U.B.C.

- Local CWS and MOE conservation officers and biologists, Ducks Unlimited biologists, B.C. Ministry of Agriculture and Fisheries and Agriculture Canada wildlife damage specialists.

- Industrial and commercial properties identified from any of the above sources.

The complete list of people and organizations approached is on file at the Canadian Wildlife Service office, Delta, B.C.

We identified from the above sources problem and non-problem flocks of Canada Geese in the Fraser Valley. This report covers only flocks of geese considered to be a problem. We recorded the exact location of each problem flock of Canada Geese in the Fraser Valley. For compilation and analysis purposes, we recognized 3 types of problem flocks: urban flocks, flocks on golf courses and rural flocks. Each type of flock will be discussed separately throughout the rest of this chapter.

Flock size and problems associated with goose flocks.

For each problem flock, we asked interviewees to characterize goose use at their property and describe the problems caused by geese. We collected information on 1) maximum flock size in the spring-summer and fall-winter periods; 2) the type of problem(s) caused by geese; 3) when problems occurred; 4) how long (years) since the problem(s) first appeared; and 5) whether the problem(s) had worsened over the last 3 years. For compilation purposes, we will refer to the geese seen during the spring-summer period as resident geese and the ones seen during the fall-winter period as wintering geese, which may also include migrants.

When questioning farmers, we also collected information on crop type, drainage and acreage of fields used by geese, and on whether monetary losses were incurred. Due to the return of incomplete survey forms, the number of answers varied from question to question.

Desired solutions to Canada Goose problems.

For each problem flock identified above, respondents were asked to indicate an acceptable number of geese at the problem site and suggest solutions they would like to see implemented to solve their goose problem. We used the maximum number of geese the respondents would tolerate to derive acceptable goose numbers. Responses were grouped into 5 different categories: 0, 1-50, 51-100, 101-300, 300-500 and 500+ geese tolerated on the property. In the latter case (500+ birds), the actual acceptable number is presented. We compiled a list of all solutions put forward by respondents and present the frequency of occurrence of each response. Respondents from urban areas were also asked whether they were willing to actively collaborate to solve the problem on their property.

Acceptability of different control methods.

We asked people affected by problem flocks to comment on the effectiveness and appropriateness of 6 possible control methods identified from the literature survey described in the next section: 1) relocation of problem birds; 2) egg addling; 3) destruction of problem birds; 4) changes in hunting regulations to increase hunter-caused mortality; 5) changes in municipal bylaws to forbid feeding of geese by the public; and 6) changes in landscape management practices to avoid the creation of ideal goose habitat.

Respondents were asked whether each method was an excellent, acceptable or bad way to control problem flocks in the Fraser Valley. Support for each method was determined from the total number of "excellent" and "acceptable" answers divided by the total number of answers. Because of incomplete questionnaires, sample size varied from question to question.

Responsibilities of agencies in controlling problem flocks of geese

We presented the following list of agencies to each respondent with goose problems: CWS, MOE, municipal governments, Ducks Unlimited, and environmental groups. For CWS, we separated the control of hunting regulations role from the conservation role of the agency. Respondents were asked whether each of the above should be involved or not in solving goose problems in the Fraser Valley. We used the ratio of "yes" and "no" answers to determine the perceived level of involvement desired from each agency. We also present a list of other agencies or organizations respondents thought should be involved.

Areas susceptible to future Canada Goose problems

All respondents except farmers and golf course superintendents were asked to identify areas where Canada Goose problems might arise in the future. We present a list of those sites and their current use by Canada Geese.

Results

Location of problem flocks

We located a total of 79 problem flocks of Canada Geese in the Fraser Valley, distributed as follows: 34 in urban areas; 11 on golf courses; and 34 in rural areas (Table 1). The approximate location of problem flocks in the Fraser Valley is presented in Figure 1 and 2. The exact location of problem flocks is kept on file at The Canadian Wildlife Service, Delta, B.C. Problem flocks were distributed throughout the Fraser Valley. Vancouver and Burnaby accounted for the majority of the urban problems, while Surrey and Delta had most rural problems.

Table 1. Survey effort and number of problem flocks of Canada Geese in urban areas, on golf courses and in rural areas.

Location of problem flocks	Contacted	With problem flocks	Total number of problem flocks
Urban areas:			
- Municipal and regional parks	26	19	
- Race tracks	3	1	
- Airports	6	2	
- Cemeteries	10	4	
- Other	8	8	= 34
Golf courses	59	11	= 11
Rural areas:			
- Farmers with kill/scare permits	23	21	
- Farmers from the Delta Farmers Institute	54/15*	11	
- other farmers	2	2	= 34

* A questionnaire was mailed to a total of 54 farmers. Only 15 farmers returned the questionnaire.

Problems caused by Canada Goose flocks.

Urban areas. Problem flocks ranged in size from 6 to 500 birds in the spring/summer and from 10 to 1500 in the fall/winter. Problems occurred as frequently in the spring/summer period (28 of 31 cases) as in the fall/winter period (24 of 29 cases). Resident (as opposed to wintering)

1 - 34 = Urban area
A - V = Rural area
G-1 - G-11 = Golf course

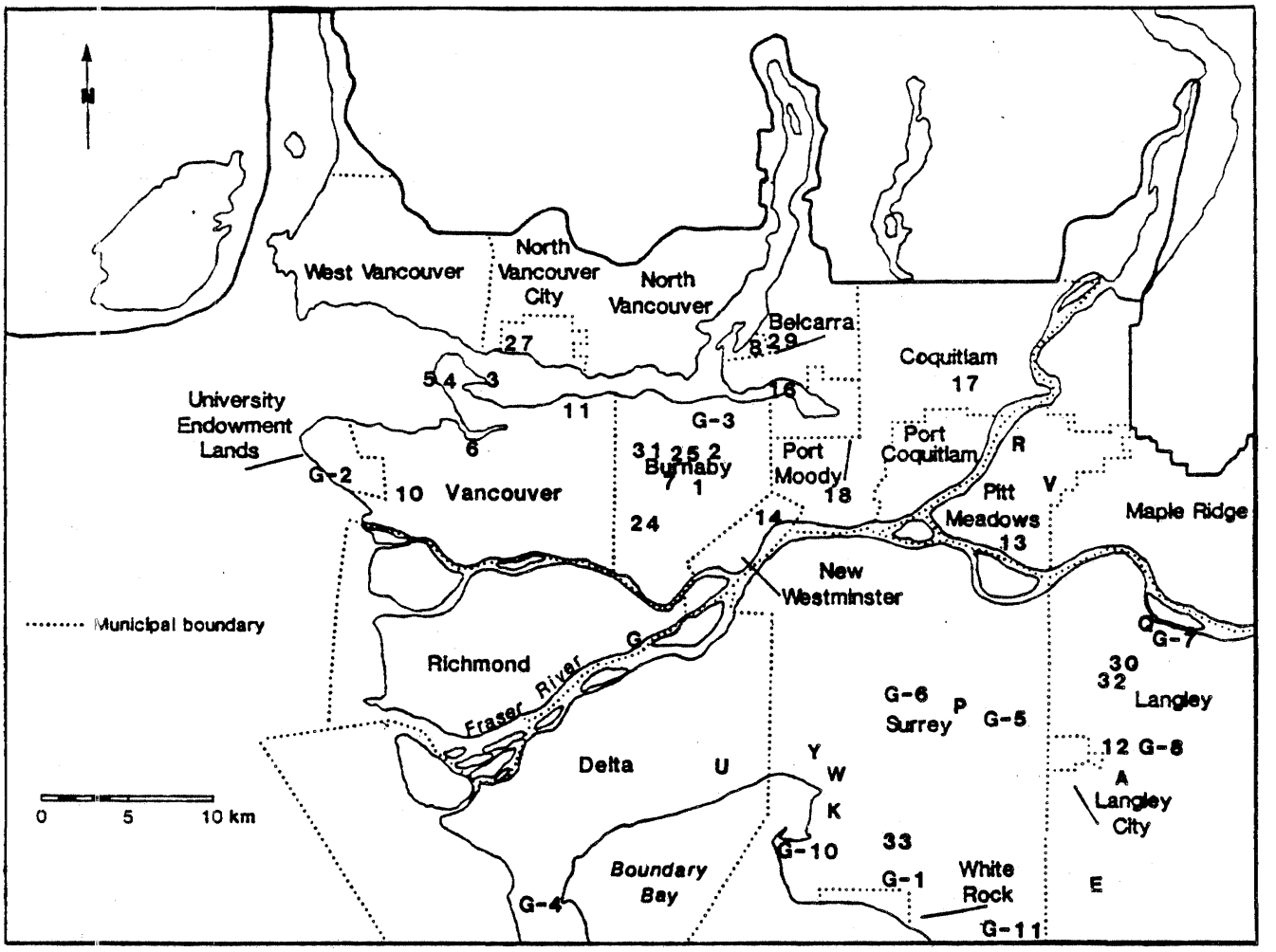

Figure 1. Approximate location of problem flocks by jurisdiction in the Lower Fraser Valley.

1 - 34 = Urban area
A - V = Rural area
G-1 - G-11 = Golf course

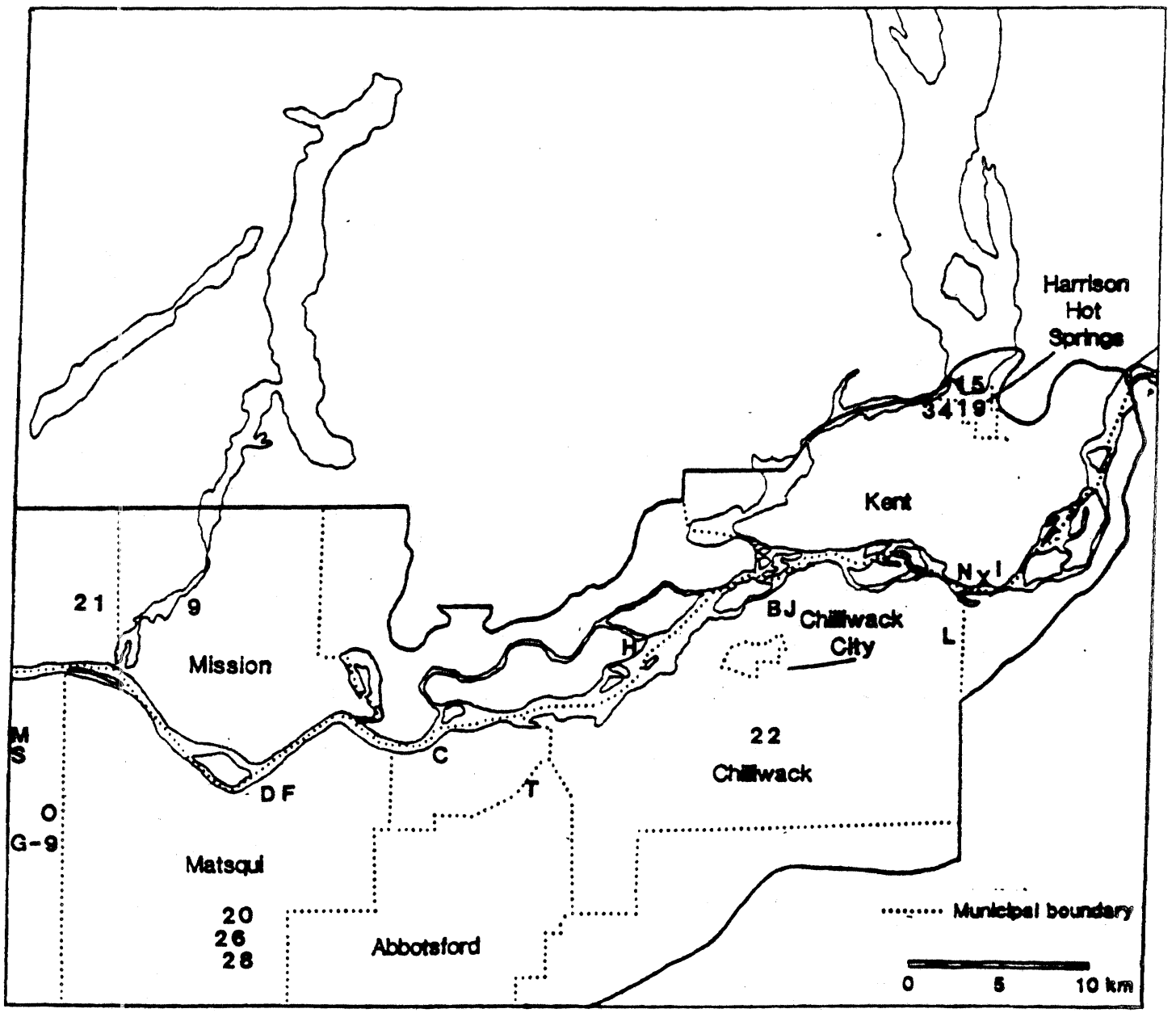

Figure 2. Approximate location of problem flocks by jurisdiction in the Central and Upper Fraser Valley.

geese caused 76% or more of the damage at 15 sites, 51-75% damage at 11 sites, 26-50% damage at 2 sites and less than 26% damage at 4 sites.

Complaints regarding those sites included droppings (n=29), grazing (n=14), health hazards (n=10), sporting hazards (n=3), aircraft hazard (n=2), nutrient loading in creek (n=1) and noise (n=1). When asked which of those complaints was the most serious, interviewees indicated droppings (n=19), health (n=7), grazing (n=3), sporting hazard (n=2), aircraft hazard (n=2) and nutrient loading in creek (n=1). Urban respondents were all (n=31) willing to collaborate actively to solve goose problems on their property.

Problem flocks appeared within the last 5 years at 15 of 30 sites for which data are available. Most sites surveyed (22 of 31) reported increases in the number of geese seen over the last 3 years.

Golf courses. Problem flocks ranged in size from 20 to 500 birds in spring/summer and from 50 to 300 in the fall/winter. Golf courses had problems with Canada Geese both in the spring/summer (7 of 11) and during the fall/winter (8 of 11). Seven of 11 superintendents indicated that 76% or more of the problem was caused by resident (as opposed to wintering) geese, 1 indicated 51-75% damage by resident geese and 3 indicated 26-50% damage by resident geese.

Greens superintendents were concerned about grazing (n=7) and droppings (n=8) and one superintendent expressed concern about disease transmission. When asked which of the above was their most serious concern, grazing ranked first (n=7) and presence of droppings on the turf ranked second (n=4). Superintendents perceived grazing and presence of droppings as increasing turf maintenance time and diminishing use of the course by golfers.

Problem flocks appeared within the last 5 years at only 3 of the 11 golf courses, suggesting high site fidelity for problem flocks of geese. Seven of the superintendents reported an increase in the number of geese frequenting their golf course over the last 3 years.

Rural areas. In rural areas, problem flocks (n=34) ranged in size from 50 to 3000 birds in spring/summer and from 200 to 2400 birds in fall/winter. When asked to indicate the proportion of incurred damage caused by resident, as opposed to wintering, geese, 33 farmers responded. Most farmers (n=29) had goose problems in the spring and summer but only 13 had problems in late fall or winter. Twenty-four farmers reported more than 76% of the damage was caused by resident

geese, 4 reported from 51-75% damage from resident geese, 3 reported from 26-50% damage from resident geese and 2 reported 0-25% damage from resident geese.

Problem flocks were found on the following fields: cash crops fields (n=17); grassland, pasture or hay fields (n=15); and cover crop fields (n=4). Most farms affected had well-drained fields (n=22), but some had intermediate (n=9) or poorly drained (n=2) fields.

Farmers were concerned about grazing on pastures (n=24), cash crop losses (n=22) and soil compaction (n=7). There were also concerns about disease transfer to cattle (n=1), weed seedlings originating from goose droppings (n=1) and reduced cow foraging in pastures with abundant goose droppings (n=1). When asked which of the above was their most serious concern, farmers indicated the following in decreasing order: cash crop loss (n=19), grazing (n=16), soil compaction (n=2) and disease transmission (n=1). All farmers surveyed (n=34) indicated monetary losses resulting from the presence of geese.

Twenty-seven of 33 problem flocks located in rural areas had been around for 6 or more years, indicating high goose fidelity at problem sites. Twenty-four of 32 farmers reported an increase in the number of geese frequenting their farms over the last 3 years.

Desired solutions to Canada Goose problems

Urban areas. Of the 34 urban areas with goose problems, 12 desired no geese at all; 14 desired between 1 and 50 geese; 2 desired between 51 and 100 birds; 2 desired between 101 and 300 birds; 1 desired up to 2000 birds and 3 did not answer the question. Ten solutions to goose problems in urban areas were mentioned a total of 39 times. By decreasing order of preference, desired solutions were:

- relocate problem birds (n=13)
- donate as food to welfare recipients/food banks (n=8)
- destroy problem flocks (n=6)
- decrease flock size through humane solution (n=4)
- increase hunting (n=2)
- provide scare/kill permits (n=2)
- egg addling/adult sterilization (n=1)
- stop relocation programs (n=1)
- encourage disturbance in problem areas (n=1)
- clean up habitat affected by problem flocks (n=1)

Golf courses. Of the 11 golf courses with goose problems, 7 desired between 1 and 50 geese; 3 desired no geese at all; and 1 desired between 51 and 100 geese. Six different solutions to problem flocks of geese on golf courses were mentioned a total of 14 times. By decreasing order of preference, desired solutions were:

- destroy problem flocks (n=4)
- provide equipment to scare birds (n=3)
- donate birds to welfare recipients or food banks (n=2)
- do nothing (n=2)
- move the birds out (n=2)
- issue kill permits (n=1)

Rural areas. Of the 34 farmers with goose problems, 17 desired no geese at all on their farms; 12 would tolerate between 1 and 50 geese; 3 would tolerate between 51 and 100 geese; and 2 did not answer the question. When asked how they would like goose problems to be solved, 31 farmers mentioned 13 solutions a total of 45 times. By decreasing preference, desired solutions were:

- destroy problem birds (n=12)
- provide scare/kill permits (n=8)
- increase hunting season and/or hunting bag (n=8)
- give the birds to welfare recipients or to food banks (n=5)
- keep the birds in sanctuaries (n=2)
- change hunting boundaries to include farmland (n=2)
- stop relocation programs (n=2)
- provide scare equipment (n=1)
- let Ducks Unlimited buy and manage farmland (n=1)
- stop providing nesting areas for geese (n=1)
- stop hatching young (n=1)
- relocate birds somewhere else (n=1)
- provide financial compensation for crop losses (n=1)

Acceptability of different control methods

Urban areas. Table 2 summarizes the opinion of people affected by problem flocks of Canada Geese regarding different control methods. By order of preference, preferred methods were 1) adult sterilization (81% excellent or acceptable), egg addling (81% excellent or acceptable), goose relocation (59% excellent or acceptable) and changes in hunting season/bag limit (59% excellent or acceptable). Changing landscape management practices, introduction of bylaws limiting goose feeding by the public and destruction of problem flocks were disapproved of by a majority of respondents (by respectively 84%, 60% and 53% of the respondents).

Table 2. Opinion of respondents from urban areas on possible methods for controlling problem flocks of Canada Geese.

CONTROL METHOD	EXCELLENT	ACCEPTABLE	BAD	SAMPLE SIZE (n)
Relocating geese	37.5%	21.9%	40.6%	32
Sterilize adults	46.9%	34.4%	18.7%	32
Flock destruction	31.2%	15.6%	53.1%	32
Egg addling	31.2%	50%	18.7%	32
Change hunting season/bag limit	28.1%	31.2%	40.6%	32
Bylaws preventing goose feeding by the public	30%	20%	60%	30
Change landscape management practices	4%	12%	84%	25

Golf courses. The opinion of grounds superintendents or golf course owners on possible control methods is summarized in Table 3. They clearly favored changes in hunting season and/or hunting bag limit (91% excellent or acceptable) and adult sterilization (90% found it excellent or acceptable). They also clearly supported (but less enthusiastically) egg addling (73% excellent or acceptable). Destroying problem flocks was opposed by 45% of the respondents. Relocation of problem flocks, introduction of bylaws preventing goose feeding by the public and changing landscape management practices were disapproved of by a majority of respondents (respectively 54%, 60% and 55%).

Rural areas. The opinion of farmers on established control methods is summarized in Table 4. Farmers clearly favored changes in hunting season and/or hunting bag limit (98% excellent or acceptable); egg addling programs (85% excellent or acceptable); adult sterilization programs (78% excellent or acceptable); and destruction of problem flocks (76% excellent or acceptable). The introduction of bylaws to prevent goose feeding by the public was marginally supported by a majority of respondents (57% excellent or acceptable). Relocation of problem flocks was not supported by a majority of respondents (72%).

Table 3. Opinion of golf course superintendents on possible methods for controlling problem flocks of Canada Geese.

CONTROL METHOD	EXCELLENT	ACCEPTABLE	BAD	SAMPLE SIZE (n)
Relocating geese	18.2%	27.3%	54.5%	11
Sterilize adults	45.5%	45.5%	9.1%	11
Flock destruction	18.2%	36.4%	45.5%	11
Egg addling	36.4%	36.4%	27.3%	11
Change hunting season/bag limit	72.6%	18.2%	9.1%	11
Bylaws preventing goose feeding by the public	20%	20%	60%	10
Change landscape management practices	33.3%	11.1%	55.5%	9

Table 4. Opinion of farmers on possible methods for controlling problem flocks of Canada Geese.

CONTROL METHOD	EXCELLENT	ACCEPTABLE	BAD	SAMPLE SIZE (n)
Relocating geese	18.7%	9.5%	71.9%	32
Sterilize adults	33.3%	43.3%	23.3%	30
Flock destruction	55.2%	20.7%	24.1%	29
Egg addling	33.3%	51.9%	14.8%	27
Change hunting season/bag limit	65.6%	32.2%	3.1%	32
Bylaws preventing goose feeding by the public	14.3%	42.9%	42.9%	14
Other: - change landscape management practices - reduce valley flock to 300-500 birds - allow farms to market hunt and sell birds	 0% 100% 100%	 75%	 25%	 4 1 1

Involvement of public agencies

Urban areas. More than 90% of the respondents thought that municipalities, CWS and MOE should be involved in solving urban goose problems (Table 5). Slightly more than half the respondents from urban areas (64%) also wanted to see Ducks Unlimited involved, while a weak majority of respondents (53%) did not want to see environmental groups involved with the issue.

Table 5. Opinion of respondents from urban areas on who should solve the Canada Goose problem in the Fraser Valley.

ORGANIZATION	SHOULD BE INVOLVED	SHOULD NOT BE INVOLVED	SAMPLE SIZE (n)
Municipalities	96.8%	3.2%	31
Canadian Wildlife Service			
- biologists	96.8%	3.2%	31
- hunting regulations	78.6%	21.4%	28
Ministry of Environment	93.6%	6.4%	31
Ducks Unlimited	64.5%	32.3%	31
Environmentalist Groups	46.7%	53.3%	30
Other:			
- Sporting groups	100%		2
- Community organiz.	100%		2
- Cemeteries	100%		2
- People affected	100%		1
- Airports	100%		1
- Fisheries Depts.	100%		1
- Naturalist groups	100%		1

Golf courses. At least 90% of the respondents thought that CWS, MOE and Ducks Unlimited should be involved in solving goose problems in the valley (Table 6). Involvement of municipalities and environmental groups was also supported by at least 70% of the respondents.

Rural areas. The Canadian Wildlife Service and the provincial Ministry of Environment were the only 2 agencies that more than 90% of the respondents thought should be involved in solving goose problems in the valley (Table 7). Slightly less than half the farmers surveyed wanted to see Ducks Unlimited

and municipalities involved. An overall majority of farmers (85%) did not want environmental groups involved with solving goose problems.

Table 6. Opinion of golf course superintendents on who should solve the Canada Goose problem in the Fraser Valley.

ORGANIZATION	SHOULD BE INVOLVED	SHOULD NOT BE INVOLVED	SAMPLE SIZE (n)
Municipalities	81.8%	18.2%	11
Canadian Wildlife Service			
- biologists	90.9%	9.1%	11
- hunting regulations	90%	10%	10
Ministry of Environment	100%	0%	11
Ducks Unlimited	90%	10%	10
Environmentalist Groups	70%	30%	10
Other:			
- Parks superintendents	100%		3
- Farmers' Associations	100%		2
- Agriculture Depts.	100%		1
- Business Community			

Table 7. Opinion of farmers on who should solve the Canada Goose problem in the Fraser Valley.

ORGANIZATION	SHOULD BE INVOLVED	SHOULD NOT BE INVOLVED	SAMPLE SIZE (n)
Municipalities	45.8%	54.2%	24
Canadian Wildlife Service			
- biologists	100%	0%	30
- hunting regulations	92.3%	7.7%	26
Ministry of Environment	96.7%	3.3%	30
Ducks Unlimited	47.8%	52.2%	23
Environmentalist Groups	15.4%	84.6%	26
Other:			
- Farmers' Associations	100%		3
- Agriculture Depts.	100%		2
- Business Community	100%		1

Areas where Canada Goose problems may be expected in the future.

Concern was expressed for 15 Fraser Valley sites currently used by Canada Geese. The location and evidence for this concern is shown in Table 8.

Table 8. Areas where Canada Goose problems are expected in the future.

MUNICIPALITY	SITE	CURRENT USE
Abbotsford	Hogan Park	100 birds in summer
Abbotsford	McDonald Park	100 birds in summer
Burnaby	Barnett Beach	100 birds for 2-3 day periods
Burnaby	Central Park Lake	20-25 wintering birds
Chilliwack	Bridal Falls area	D.U. Project on local wetlands
Chilliwack	Sardis Lake	Unknown
Coquitlam	all sport fields	Currently used at low densities
GVRD Park	White Pine Beach	3 birds in 1987; 12 in 1990
Haney	Alouette Lake	Unknown
Matsqui	Correctional Center	600-1200 wintering birds
New Westminster	Fraserview area (old penitentiary)	Low use
New Westminster	Ravine Park	Low use
New Westminster	T. Hughes Park	100 wintering birds
Richmond	Minoru Park	1-2 birds fed by public
Richmond	Vancouver Int'l Airport (N end)	40 birds - would conflict with 3rd runway

Discussion

The Canada Goose population in the Fraser Valley is now estimated at roughly 10,000 individuals. No population increases have been observed over the last 3 fall surveys (1988, 1989 and 1990) conducted by CWS and MOE. This likely indicates a stabilization of the local wintering population.

The information collected on problem flocks on golf courses, urban areas and rural areas present interesting patterns. Goose damage occurs throughout the year in all areas, but is overall associated with resident geese. Urban areas (including golf courses) reported important damage by both resident and wintering geese, while most damage in rural areas was caused by resident geese. Causes for these differences (e.g. hunting) will be discussed in Section 2.

It also appeared that most problem areas have been problems areas for a long time (minimum of 6 years). This, combined with the fact that most sites reported increases in goose numbers over the last 3 years, suggests: 1) high site fidelity of problem flocks; 2) high flocking behavior, i.e. few new flocks are created; and 3) increases in size of existing flocks. If this is the case, problems should continue to worsen at those locations until either 1) flocks subdivide into smaller flocks (no information is currently available on how this process takes place) or 2) until flock size is controlled. By itself, a possibility of further increases in problem flock size justifies a close monitoring of the populations found on sites currently used by low numbers of Canada Geese (more so if the sites involve breeding pairs).

The number of problem flocks that appeared within the last 5 years was greater in urban areas than on golf courses and rural areas. This suggests more movements or population expansion in urban areas than in the other 2 types of areas.

What constituted an acceptable number of geese and acceptable control methods varied between rural and urban areas. In urban areas and on golf courses, a minimum number of geese was considered desirable, while farmers generally did not desire any geese at all. Urban areas and golf courses supported adult sterilization and egg addling programs, while farmers favored increased hunting pressure and flock destruction as methods of population control. Changes in landscaping practices and introduction of bylaws preventing goose feeding by the public were not supported in urban areas. Urban areas and golf courses wanted to see CWS, MOE, Ducks Unlimited, municipal authorities and environmental groups involved in solving goose problems. Urban respondents were unanimously in favor of active collaboration with the above agencies to solve their goose problem. In rural areas, goose control was thought to be almost solely a responsibility of CWS and MOE.

SECTION 2: MANAGEMENT OF CANADA GEESE IN THE FRASER VALLEY

Introduction

Canada Geese are generally managed to maintain viable populations that provide viewing and other non-consumptive uses and that are able to support an annual harvest. Geese can however create certain problems in urban and semirural areas like the Fraser Valley. Problems result from their adaptable and somewhat aggressive nature and from the relative absence of normal population regulators such as food shortages and predation.

Over the last 5 years, 3 different types of problems have been addressed by CWS and MOE. These are: 1) excessive concentrations of geese during the molt in areas such as Stanley Park, Deer Lake, Burnaby Lake, Buntzen Lake and Hayward Lake); 2) complaints about geese nesting in inappropriate locations such as flower boxes, balconies and roof tops; and 3) crop damage caused by geese (Anon. 1988).

The strategies used to deal with those problems have centered primarily on attempts to increase mortality or decrease fecundity. Primary techniques have consisted of: 1) relocation of molting birds to rural areas, where they likely would be subject to higher hunting mortality; 2) removal of birds or eggs from nests for which complaints have been received; 3) egg addling at key nesting sites such as HMCS Discovery and Burnaby Lake to lower recruitment; and 4) issuance of scare or kill permits to farmers subject to crop losses (McKelvey and Wilson 1988).

The objectives of this section are to review published and unpublished management practices for problem flocks of Canada Geese and to make recommendations on the future management of problem flocks in the Fraser Valley. Specifically, this chapter 1) lists possible techniques identified from a literature review on management of problem flocks of geese; 2) summarizes current management of Canada Geese in the Fraser Valley; and 3) makes recommendations on the management of local flocks.

Methods

Literature review of goose management techniques

We conducted a literature review using the keywords "swans and geese", "birds, economics, damage, predation and control" and "*Branta*" in the Wildlife Review (U.S. Fish & Wildlife Service) issues from 1985 to 1990 (vol. 196 to vol. 219 incl.). We compiled all references related to management programs, damage caused by geese and solutions to goose problems. We also searched the literature cited section of selected papers for other references covering those same headings.

Because a large number of relevant papers were not available through local libraries, we cannot present an exhaustive list of goose management practices. Further information on management programs in other parts of North America and in Europe should be obtained from those source papers. We used the titles and sometimes abstracts and contents of papers identified from the literature review to derive a list of possible management techniques used to control problem flocks of Canada Geese. We present a brief summary of each technique identified in the literature review.

Current management of Canada Geese in the Fraser Valley

Information on current management of Canada Geese in the Fraser Valley was obtained from 2 sources: 1) published and unpublished CWS and MOE reports, and 2) discussions with CWS and MOE biologists. We present a summary of the current management practices.

Recommendations on future management of problem flocks

The list of management techniques identified in section 1 was used as a framework for recommendations. Discussions with the agencies listed in Section 1 and with provincial and federal biologists were used to derive recommendations on the suitability and applicability of each of those methods to problem flocks in the Fraser Valley.

Results

Literature review of goose management techniques

We identified 118 studies covering Canada Goose management. There appeared to be 4 major groups of methods used to manage Canada Geese: 1) methods to reduce recruitment; 2) methods to increase mortality; 3) methods to force emigration; and 4) methods to reduce habitat availability. Details on each method are presented below.

Methods to reduce recruitment:

We identified 3 different methods that would achieve this purpose:

- change hunting regulations and/or increase hunting bag limit. This would increase harvest of birds and would disrupt breeding activity (mated adults would lose their mates and pair-bonding in 2 and 3 year-olds would be disrupted and delayed).
- reduce egg production through either egg collection, egg addling or chemical or surgical adult sterilization.
- relocate flightless birds away from problem areas.

Methods to increase mortality:

Three methods were identified from the literature review:

- promote hunting by either directing hunters to areas where hunting opportunity is maintained and where geese densities are high or by creating new hunting areas.
- cull flocks to a size where the flock is not considered a problem any more.
- issue kill permits to individuals affected by problem flocks.

Methods to increase emigration:

Three different methods could be used to make certain areas less attractive to flocks of geese:

- increase harassment on problem flocks to incite them to move away. Scare permits and dogs have been successfully used to that effect.
- discourage feeding of geese by the public, in the hope that birds will move away from areas where they are not fed.

- use miscellaneous scare techniques like flags, scarecrows, cracker shells, whistles, and swans to keep geese from using an area (see Peatt 1987 for more details on those techniques).

Habitat management methods:

Three methods could be used to alter goose habitat quality and habitat selection:

- change landscaping practices so that "perfect" goose foraging habitat is not created.
- provide alternative more attractive habitats of greater forage quality (i.e. wildlife refuges) far from problem areas.
- reduce artificial and natural breeding habitat in and around problem areas.

Management of Canada Geese in the Fraser Valley

Three management practices have been used to address the problems encountered at selected sites: relocation of juveniles; egg addling; and the issuance of scare and/or kill permits. Adult sterilization was also considered, but was rejected on the basis of the high manpower and financial costs involved.

Young have been rounded up in Stanley Park, Deer Lake and Burnaby Lake in 1987, 1988, 1989 and 1990 and relocated to areas with relatively high hunting mortality (McKelvey, unpubl. data). Although relocated birds remove a significant number of birds from the problem area, they do not really solve the problem caused by breeding birds. Because adult survival in geese is high (78% per year for relocated adults in England; Palmer 1976), relocated young may not significantly affect the breeding population in subsequent years. Also, fewer and fewer locations are willing to accept relocated geese, from fear of having a similar problem develop in their area. Finally, concerns about the genetic quality of the stock of geese found in the Fraser Valley currently keeps management agencies from relocating the geese to areas outside the valley. Should the genetic argument be overcome, problems may however arise on new breeding sites or on the wintering areas, especially if relocated birds return to the Fraser Valley to winter.

Egg addling has taken place at HMCS Discovery in Stanley Park and in Burnaby Lake since 1988. In Burnaby Lake, egg addling reduced gosling production by approximately 85% in 1988 (Guthrie 1988). Although highly successful, egg addling does not produce a short term decrease in population size. Because of the high reproductive success of geese, the program must be continued over long periods of time to insure a reduction of the population, and areas that are currently subject to problems will continue to be problem areas until adult birds begin to die from old age. If done continuously, egg addling can however help stabilize the size local goose population.

Scare/kill permits are currently issued by both MOE (area east of and including Surrey) and CWS (area west of Surrey). Certain permits issued by MOE required that all Canada Geese killed be returned to the Fish and Wildlife branch.

Suitability of various methods to control local problem flocks

In section 1, we identified 4 groups of methods that could be used to manage problem flocks of Canada Geese: 1) methods to reduce recruitment; 2) methods to increase mortality; 3) methods favoring emigration; and 4) methods that reduce the amount of suitable habitat. This section will cover each of those methods and discuss their local applicability. Our recommendations are based on discussions with all agencies, organizations and farmers contacted during this study.

Because management policies depend on accurate estimates of local populations and on good understanding of the ecology of the species, we also present recommendations on the research needed to better understand the biology of local populations of Canada Geese.

<u>Methods to reduce recruitment into the breeding population:</u>

- reduce egg production through either egg collection, egg addling or adult sterilization.

Egg addling and sterilization are time-consuming and appear most appropriate to urban areas with limited amounts of nesting habitat and high nesting densities (e.g. Stanley Park area, Burnaby Lake). Farmers residing near sanctuaries (e.g. Serpentine Fen and the G. C. Reifel Migratory Bird Sanctuary) would approve and benefit from a program reducing young produced at such sites.

- relocate goslings.

This method is costly and does not appear to have a significant impact on local populations, while it raises the possibility of creating problems at the release site. Municipal authorities contacted in this study did not generally want geese relocated to their areas. Farmers are also concerned by the significant numbers of geese that could be brought to farming communities.

Methods to increase mortality:

- change hunting regulations either through an extension of the hunting season and/or an increase in bag limit.

Liberalizing hunting regulations would increase harvest of resident birds and would disrupt breeding activity. This would be perceived as immediate relief to a large number of farmers, and might somewhat contribute to a reduction in the number of geese in urban areas.

Early openings, or multiple openings, would result in spreading the local population over a much greater area. Damage to individual farmers could be reduced, and some geese might migrate out of the Fraser Valley. Opening selected areas in refuges to goose hunting, prior to the duck season, might also be considered.

The main drawback to this method of control is the limitation imposed by municipal firearms restrictions. As more areas are closed to the discharge of firearms, hunting becomes less and less a practicable solution to goose population control.

- promote hunting by directing hunters to areas where hunting opportunities are maintained and where goose densities are high.

Such a move is favored by the farming community. New hunting areas could be created in areas with important goose problems, and municipalities should be encouraged to review their firearm restrictions in rural areas. Rural areas would likely benefit most from this type of intervention.

- cull flocks to a pre-determined level at site-specific locations.

This method was often proposed in our questionnaire from respondents in rural areas and to a lesser extent in urban areas, and was often perceived as the most efficient solution

in terms of resource investment and effectiveness. Use of the meat (given to either food banks or welfare recipients) was strongly supported by the people contacted in this study.

The migratory Birds Convention Act does not preclude solving the problem in this fashion. However, it would have to be done in a manner that is acceptable to the public. The meat would have to be inspected, and the origin of the birds involved would have to be ascertained in order not to jeopardize local stocks. Further study of this option should be undertaken prior to its implementation.

- provide kill permits to residents of rural areas suffering economic losses from problem flocks of geese.

Many farmers complained that scare permits did not work, and that they had only limited time to chase the birds, especially in the spring. Kill permits should not have clauses requiring killed birds to be returned to the issuing agency. Farmers suffering economic losses from Canada Geese appeared sceptical about current management of problem flocks of Canada Geese, and many stated that they would not transport goose carcasses to government offices (because of either lack of time or as a protest against what they perceive as a ridiculous request). Alternative solutions would be to either ask farmers with kill permits to phone in the number of birds killed or to get a government employee to visit those farms to pick up the birds.

Methods to increase emigration:

- increase harassment, through either scare/kill permits or other sources of activity.

Parks people found that dogs often successfully chased flocks of geese from public areas. This method would be most suitable in urban areas.

- discourage goose feeding by the public.

This might reduce goose attraction to certain sites, but municipal bylaws of this type are said to be unenforceable, and are usually ignored by the general public. People contacted in this study did not support the introduction of such municipal regulations. However, without such attempts on the part of the affected land owners, it may be difficult for other agencies to deal with the problem on their own.

- use other scare techniques such as flags, scarecrows, cracker shells and whistles.

These techniques appear to be quite time-consuming and got mixed reviews from people who tried them. In many instances, geese quickly habituated to the scare techniques. However, if used consistently and/or in combinations, these techniques can be useful.

Habitat management methods:

- change landscaping practices so that "perfect" goose habitat is not created.

This method is not currently used in the Fraser Valley. Changing landscaping practices is unrealistic in practice, as humans and geese appear to use the same criteria to determine how "attractive" a site is. The method received almost no support from the people contacted in this study. Golf courses would likely benefit from information on the type of habitat acceptable and unacceptable to geese and they would be the most likely land users to change land management practices in order to avoid problems with goose flocks. For example, refraining from building grassy islands in the middle of ponds or planting denser shrub vegetation along ponds would likely limit access or availability to goose nesting and resting habitat on the golf course.

- provide alternative habitat such as wildlife refuges away from problem areas.

In the case of urban areas, this would not work as parks boards desire some geese within their parks, and other geese using the site have no reasons to relocate to refuge-type habitats. The creation of more refuges would not be supported by the farming community. Farmers perceive that the refuges currently in place (e.g. Reifel and Serpentine Fen) are incapable of supporting the geese and waterfowl populations found in them and that it would be up to the nearby farmers to provide food for those birds.

- reduce current breeding habitat in areas where breeding is currently encouraged.

One farmer adjacent to a subdivision complained that his neighbours were setting up geese nesting platforms on tires in a creek adjacent to his farm. Installation of new nesting platforms should be discouraged and existing platforms should be removed where possible.

Other recommendations:

Substantial information is available on the abundance of Canada Geese in the Fraser Valley. However, to effectively manage local populations, we require a good understanding of their biology and a good monitoring program. We currently know little about overall habitat use in the Fraser Valley and the extent to which migratory geese contribute to local problems.

The following recommendations address 1) research needs to improve our understanding of the local goose population; 2) monitoring needs to assess the effectiveness of current and proposed management practices; and 3) how to best distribute the information currently available to decrease current goose problems and prevent future ones from happening.

Our recommendations are to:

- expand on the current banding program, to include a wider sample of birds breeding and wintering throughout the valley. Such a program would reveal local patterns of movements and aid in determining the distribution of non-resident geese wintering in the Fraser Valley.

- increase the distribution of information currently available on goose use of urban and semi-urban areas (e.g. "There's a goose in my flower box.", a CWS and MOE unpublished handout).

Such information would be of help to golf courses and municipalities that have not yet developed an expertise in handling goose problems. For example, one golf course reported that placing a thick string 30cm from the ground around each of their ponds successfully reduced to zero the number of geese using the ponds. Time and effort should be invested to improve current land management practices.

- design and distribute to all municipalities information pamphlets illustrating current problems caused by geese and discouraging installation of nesting platforms or the creation of nesting habitat.

- keep complete records on the number, location and causes of complaints by different land-users. These records could be used as an index of problem frequency in the valley and could be used to monitor effectiveness of management practices.

In order to monitor the effectiveness of control measures, insure that all requests for permits are filled out properly (including exact address and phone number) and that the permit specifies the number of birds causing damage. Such statistics can be used for long-term monitoring of problem flocks in different areas.

- implement a long-term management plan to solve goose problems in the Fraser Valley including regional target populations and management priorities.

- monitor population levels to determine the effectiveness of different control methods. This should involve goose banding in breeding and wintering areas, and close monitoring of reproductive success and wintering numbers in the Valley.

Monitoring of breeding and wintering populations is necessary to assess the impact of changes to hunting regulations. Continued banding of juvenile and molting geese is necessary to increase understanding of habitat use by geese and to assess the success of various management programs.

- involve to a greater extent municipalities, regional authorities and people affected by geese (golf course superintendents and farmer's representatives) in prevention programs and management of problem flocks. Relocations should not take place without the consent of local governments and farmers at the release site.

Conclusion

In the Fraser Valley, the problems caused by Canada Geese have chiefly consisted of crop losses by farmers; increased maintenance cost and turf damage in golf courses and public areas; and geese nesting in inappropriate locations. The literature review we conducted identified 4 groups of methods used to control and manage Canada Goose problem flocks: 1) methods that decrease goose recruitment; 2) methods that increase goose mortality; 3) methods that favor emigration; and 4) methods to alter habitat to make it unsuitable for geese. All methods identified in the literature review have been considered to manage the local population, but different methods were rejected due to their prohibitive cost or their inapplicability to local conditions.

Current management of problem flocks focuses on 3 objectives: 1) decreasing goose damage in agricultural areas; 2) decreasing population size at specific nesting and molting sites and 3) reducing the number of geese nesting in

inappropriate locations. These objectives are accomplished through a combination of methods: egg addling at key breeding sites; round-up of molting birds and subsequent relocation in areas with high hunting pressure; issuance of scare and kill permits to farmers in rural areas; removal or relocation of birds nesting in unsuitable urban environments; and the distribution of a pamphlet explaining how to handle geese in the urban environment.

The survey we conducted identified desired goose population levels and how people affected by problem flocks of geese wished to see their goose problems solved. Substantial numbers of geese were generally desired in urban areas and on golf courses, but not in rural areas. In urban areas, land users favored methods reducing recruitment (e.g. sterilization of adults and egg addling) while people in rural areas desired increased hunting bag limit, changes in the hunting season and culling of problem flocks.

Differences in problems and desired solutions between rural and urban areas indicate that problem flocks should be managed differently in each area. The current management practices described above address the concerns identified in our survey of people/organizations affected by problem flocks of Canada Geese, although goose population levels are higher than desired in each area.

We propose that problem flocks of Canada Geese in urban areas be primarily managed through egg addling programs. Sterilization of adult geese was considered as a control method, but was rejected due to high cost of implementation. Problems with birds nesting in urban environments should be addressed through both an educational program aimed at municipalities on how to prevent goose problems from arising, and by removing/relocating birds nesting in unsuitable environments.

Egg addling programs were initiated at key breeding sites in 1988 (Anon. 1988), and have since been expanded to new locations. Fall surveys conducted over the last 10 years in the Fraser Valley suggest that the fall population stabilized at roughly 10,000 birds in 1989 and 1990 (McKelvey and Wilson 1990; McKelvey, unpubl. data). Considering 1) an annual harvest of approximately 2,000 geese (McKelvey 1990) and 2) the success of egg addling programs currently undertaken at all major breeding concentrations in the Fraser Valley (e.g. Stanley Park, Burnaby Lake, Deer Lake, and Vancouver Game Farm), wintering geese populations should likely decrease over the next few years, alleviating current problems in both urban and rural areas.

We also propose that problem flocks in rural areas be managed primarily through: 1) the issuance of scare or kill permits; 2) changes in hunting regulations; and 3) by possibly culling year-round resident flocks. Although mentioned repeatedly by different respondents, culling of problem flocks would be difficult from a public relations point of view. Control of hunting regulations is one of the easiest ways by which wildlife agencies can control goose populations. However, current variations in firearm discharge regulations across the valley and presence of large concentrations of geese in areas not open to hunting limit the effectiveness of that control method.

The survey also highlighted the need for further information and public education on geese in rural and urban environments. This information could take the form of brochures, workshops, and/or videos, to be distributed to municipalities, golf courses and other land users in the Fraser Valley.

This report identified specific problems with goose flocks in the Fraser Valley. Current management practices can only be effective if done in collaboration with land-users supporting those goose populations. People and organizations polled in our survey indicated a strong desire to be involved in the management of local goose populations, and their participation is critical to the implementation of an effective goose management program in the Valley.

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