



In the CRD, there was plenty of news coverage regarding a cull, e.g., <http://www.cheknews.ca/c-r-d-to-go-ahead-with-canada-geese-cull-what-do-you-think-104900/>

series of mitigation techniques suitable for the region, including habitat modification, water management (with habitat modification), hazing, relocation, egg addling, hunting, kill permits, and ‘regional implemented, managed goose kills’. Kill-to-support-scaring permits were differentiated from kill-to-remove permits, and managed goose kills were deemed illegal within the current regulatory framework. A review of local government policies (e.g., feeding wildlife) and the development of a guide of sorts to ease permit processes for landowners and managers were recommended. A thousand geese was determined to be the population target and the threshold above which serious impacts occurred; this was the estimated number of geese in 1985. Surveys over the breeding and rearing periods, as well as leg-banding during the moult were suggested. The strategy also included a communications plan for engaging stakeholders and the general public (CRD 2012).

Funding was secured from the Agricultural and Environmental

Initiative to support 2013-14 initiatives (CRD 2015). The Steering Committee and Working Group created a website (see <https://www.crd.bc.ca/project/goose-management>) and an educational brochure that asserted migratory geese are not present in the summer and are rarely present in urban locations (which is not the case here) (CRD 2015). The group hosted an egg addling workshop in January, 2014 for ~40 people, mainly from the Saanich Peninsula agricultural community (K. St. Claire, pers. comm. January 9, 2015). A similar workshop in 2015 was postponed due to low registration (CRD 2015). The group worked with the Province and Environment Canada on an application to conduct a cull in the summer of 2015 (K. St. Claire, pers. comm. January 9, 2015).

Armed with a permit to cull 250 geese on agricultural lands, project partners killed 50 birds in Central Saanich in 2015, providing the carcasses to a nearby raptor centre (T. Clermont, pers. comm. 2015).

Canada Geese below Hatley Castle, Royal Roads University, Colwood, B.C.





Canada Goose roundup and banding at the Campbell River estuary, July 3, 2015. Photo by Tim Clermont.

11.32 North Island

The Campbell River Environmental Committee (CREC) began monitoring Canada Goose populations in May, 2013, in response to losses of habitat following extensive and expensive restoration efforts on the Campbell River estuary. The local population in the vicinity of the estuary was estimated to be less than 200. More than 1,000 birds were present during the moulting period in 2013 and 2014. Three exclosures were installed on the estuary in spring 2014 (CREC, pers. comm. to T. Clermont, January 15, 2014).

The group banded 199 birds during the 2015 moult. The Campbell River Indian Band may take moulting birds on reserve lands to help reduce the goose population (CREC, pers. comm. to T. Clermont, January 15, 2014; T. Clermont, pers. comm. September 2015).

11.33 Lower Mainland

In 1991, CWS published *Canada Geese in the Fraser Valley: A Problem Analysis*. Relocations to areas where geese could be hunted had taken place in 1987, '88, '89 and '90. New areas had closed to hunting as a result of municipal firearms restrictions. The analysis documented complaints from a wide variety of stakeholders, including farmers who stated that scare permits did not work and they were too busy to chase birds. Egg addling programs were initiated at key breeding sites, such as Stanley Park and Burnaby Lake in 1988. Populations were expected to stabilize, based on fall counts and

the success of addling programs (Breault and McKelvey 1991). Over the last 10-20 years, some areas experienced marked increases in wintering Canada Geese, while others show no trend or were variable (Lower Mainland Canada Goose Working Group email 2014).

The Vancouver Airport Authority led a Canada Goose workshop in October, 2013, and another in June, 2014. A preliminary map was created showing areas of conflict and places where geese were known to congregate. A Google Earth-based Conflict Mapping Project was launched in August, 2014, to engage communities and document where people were experiencing conflicts with geese. Members of a newly formed group, including CWS and Ducks Unlimited staff, began mapping population abundance and distribution using a variety of existing data (i.e., Christmas Bird Counts; ~3,000 re-sight records of Canada Geese banded on the Lower Mainland dating back to the 1960s; banding records for birds banded elsewhere and sighted on the Lower Mainland; Coastal Waterbird Surveys, Breeding Bird Surveys, CWS Goose Blitz Data (i.e., annual fall counts coordinated with ground and aerial surveys, ca. 1985 – 1995) (Lower Mainland Canada Goose Working Group email 2014).

Also in 2014, the Lower Mainland Canada Goose Working Group developed a Terms of Reference (ToR) to formalize its existence, and began working on the precursors to a collaborative management strategy: a problem statement, goals and objectives (e.g., a socially determined

population size, aimed at reducing conflict; 50% reduction in crop damage by 2020; zero annual air traffic safety incidents related to Canada Geese) and research questions. The group created a list of potential stakeholders, and a draft communications strategy that aimed to facilitate internal discussions within member organizations; develop communications materials (e.g., fact sheets, press releases, how-to videos) and processes (e.g., outreach person or coordinator, social media); and enable accurate and consistent messaging from group members to the media and public. The group asserted, “Environment Canada is responsible for the management and conservation of goose populations, but is not responsible for dealing directly with the birds or their actions, or mitigating damage that birds may cause”, a fundamental statement with which we disagree.

The second Lower Mainland Canada Goose workshop was held January 26, 2015. The group expected to finalize its ToR and communication strategy. It was looking for commitment from stakeholders, particularly cities and municipalities (D. Bradbeer, pers. comm. January 9, 2015).

11.34 Okanagan Valley

The Okanagan Valley Goose Management Committee was struck in 1995. An action plan with strategies to manage Canada Geese was endorsed in 2006 (Okanagan Valley Goose Management Program 2015).

Plan development included public meetings in Vernon, Kelowna, Penticton, and Osoyoos. Population data was compiled from Christmas Bird Counts, aerial surveys, and band recoveries from the 1980s. However, overall goose numbers were of less concern than the concentration of geese on area beaches and the results of water quality samples, which indicated contamination was reaching threshold levels (Robertson Environmental Services & Ophiuchus Consulting 2006).

The action plan included educating the public and increasing awareness (e.g., signage, encouraging participation through nest reporting); examining and changing bylaws; habitat modification; relocating geese away from sensitive areas (e.g., popular recreational areas); promoting fall hunting; hazing geese from public areas; expanding addling programs; using other lethal controls as a last resort; monitoring goose numbers by way of brood counts and annual surveys; and monitoring water quality at beaches (Robertson Environmental Services & Ophiuchus Consulting 2006; Osoyoos Lake Water Quality Society 2014).

The Okanagan Valley Goose Management Program was established in 2007. It is a partnership between the City of Kelowna, Central Okanagan Regional District, Regional District of Okanagan Similkameen, District of West Kelowna, City of Vernon, City of Penticton, Town of Lake Country, Town of Osoyoos, Town of Oliver, District of Peachland,

District of Summerland and Glenmore Ellison Irrigation District (Okanagan Valley Goose Management Program 2015). Its focus is to reduce populations, and large concentrations of geese in heavily used public areas in particular (City of Kelowna 2009).

The flagship of the Program is annual egg addling. The first year of the program realized more than 1,170 addled eggs in 216 nests between Osoyoos and Vernon (City of Kelowna 2009). Trained contractors begin the addling season by identifying mating pairs and nesting sites. The public is asked to assist by reporting lone geese, pairs of geese, or nest locations on private or public land. They are advised to keep away from goose nests and avoid touching eggs (Okanagan Valley Goose Management Program 2015). In 2013, the Union of B.C. Municipalities (UBCM) endorsed a resolution from the Town of Osoyoos requesting CWS be more permissive in the issuance of kill permits, as addling has had limited effect (Fletcher 2013; UBCM 2013). Failing an agreement to do so by CWS, the Province was asked to take the initiative to provide kill permits to affected local governments for goose population reduction.

There had been a series of UBCM resolutions related to problem Canada Geese: in 2002, sponsored by Osoyoos; 2003, sponsored by Kent; 2010, sponsored by North Saanich; 2010, sponsored by Osoyoos; and 2011, sponsored by Metchosin (UBCM 2012).



Local media help the Okanagan Valley Goose Management Program reach out to the public. See <http://infotel.ca/newsitem/goose-management-activities-beginning-in-west-kelowna/it18931>

Reliable information regarding culls (e.g., if and when they occurred, how many geese were killed) was difficult to obtain online. The Vancouver Sun (2008) reported that Kelowna and Osoyoos had applied for special permits to cull geese. Walkinshaw (2009, October), reporting for the Penticton Western News, said that the Penticton Council had voted unanimously for a permit to cull Canada Geese, concerned about the slow progress of the goose management program. Earlier in the year, Kelowna had received a permit to cull 50 geese. In Summerland, a child had fallen ill after landing in water contaminated with goose feces, requiring hospitalization (Walkinshaw 2009). In 2013, CWS endorsed the Town of Osoyoos goose management plan and provided a permit to kill up to 10 adult birds per week at its Desert Park horse racing facility and the Osoyoos Golf course, without blinds or decoys, and the geese could not be kept by the hunter. A local hunter agreed to do the work for \$30 per goose, to cover his license, shells, and fuel. The South Okanagan Rehabilitation Centre for Owls in Oliver agreed to take some of the birds (Osoyoos Times 2013).

In 2012, geese were leg-banded (red bands for Penticton, green for Kelowna, and white for Vernon geese). In 2013, all birds were fitted with yellow leg bands (Okanagan

Valley Goose Management Program 2015).

In June, 2014, post-nesting ground surveys were conducted to estimate the gosling proportion of the population (9.5%) and identify areas that were missed during the adding season. In June and July, aerial surveys found that populations had not increased since the last surveys in 2011 (Okanagan Valley Goose Management Program 2015).

At the time the Okanagan Valley action plan was written, municipalities in the Okanagan Valley were collectively spending more than \$100,000 each year to manage Canada Geese (Robertson Environmental Services & Ophiuchus Consulting 2006). In 2007, the program was expected to cost \$136,000; Kelowna contributed \$75,000 and committed to spending an additional \$90,000 to control (haze, relocate, and modify habitats) and clean up after geese on City-owned lands (City of Kelowna 2009). Banding was paid by a grant from the Western Canada Turfgrass Association with staff time donated by LaHawk Ltd. and Wise Wildlife Control (Okanagan Valley Goose Management Program 2015).

Chapter 12 - Management Options Highlights

This chapter introduces management options, contributing to Goal 4.

An egg addling program began in our region in 2002 at the Englishman River estuary. Later, the program included Nanoose Bay and Marshall-Stevenson units of Qualicum National Wildlife Area, other parts of the Little Qualicum River estuary, parts of Errington, Canadian Forces Maritime Experimental and Test Ranges base in Nanoose Bay, Winchelsea and Yeo Islands, and some private properties. The addling program prevented at least 5,345 eggs from hatching, or at least 2,088 new breeding birds in the population.

Without an addling program or other coordinated intervention to curtail Canada Goose populations, there are typically more independent and often undesirable efforts to control geese, such as draining of wetlands, inhumane methods of killing, and harassment of non-target species.

A successful addling program is dependent on a very high proportion of nests being found and treated for many consecutive years. The success of the regional addling program has been constrained by several interrelated factors: manpower and funding; a long season, with early and late nesters; limited access to private properties; and the conspicuousness of Canada Goose nests.

Even the most successful addling program will have negative consequences. It may prompt birds to leave known nesting grounds to re-nest or nest in successive years in areas that are remote or inaccessible to addling crews. Failed nesters that stay in the area probably feed more often than they would while incubating eggs, increasing grazing pressure on vulnerable estuarine resources. Addling may also exacerbate problems elsewhere, by encouraging failed nesters to moult-migrate.

Senior governments tend to promote hunting as the best way to reduce populations of nuisance geese, yet many studies examined in the preparation of this strategy have concluded that hunting is insufficient on its own. Twenty-one percent of our marked Canada Geese were known to be shot by hunters, from 2008 to 2014.

Sixty-eight percent of all birds shot were killed within the study area. The remainder were shot elsewhere on Vancouver Island, on the Lower Mainland, in Alberta, and in the western United States.

Early fall hunting seasons are intended to harvest local geese, while later seasons target both residents and migrants. Three (18%) of 17 marked birds shot in the region in September were confirmed local resident (LR+) migrant types.

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Chapter 12 - Management Options

More Highlights

More than half of the marked geese shot by hunters were banded at the Little Qualicum River estuary. Seventy-two percent of marked geese that were shot outside of the region had never been observed on huntable sites here. Of local resident (LR) migrant types, all birds banded at the Little Qualicum River estuary were 'huntable', i.e., they were observed on huntable sites in the region. By contrast, one third of local residents banded at the Englishman River estuary and two thirds of those banded at the Craig Creek estuary were huntable in our region.

Hunting often moved Canada Geese into areas that were more protected, however geese may also be able to anticipate hunting seasons. A Quebec study found that many Canada Geese moved away from areas where hunting was allowed to places where firearm discharge was prohibited or hunter numbers were low, several weeks prior to the start of hunting season. Adults accompanied by goslings were more likely to move to safe sites, than geese without young.

CWS has asserted that further liberalization of hunting, enabled with an overabundant designation, would do little because the number of hunters and areas where people are allowed to hunt are declining.

Since 2000, the number of hunters and goose harvest estimates in our region have fluctuated. In the 1-5 management unit (Maple Bay north to the Little Qualicum River estuary), numbers were up (e.g., 170 hunters in 2012 when the bag limit changed, with nearly 1,600 geese harvested in 2011 and 2012), while in unit 1-6 (from the Little Qualicum River estuary north to Campbell River), numbers were mostly down (e.g., less than 40 hunters, and fewer than 100 geese harvested in 2012). Federal hunter surveys covering a large area of B.C. showed a dramatic decrease in hunter numbers from 1971 to 2013, yet harvest estimates were very similar in those two years (i.e., ~5000 birds harvested in both 1971 and 2013), with wild fluctuations in between.

Land grants in the late 1800s and early 1900s, together with increasing human populations and associated development have led to a preponderance of privately held lands that are closed to hunting. However, all farmers surveyed in the preparation of this strategy had hunted geese or allowed and encouraged others to hunt. One had been harassed for allowing hunting.

Some residents feed geese, even when they are aware of the adverse effects of Canada Geese and efforts to mitigate them. There are currently no bylaws to discourage people from feeding geese, despite the deleterious effects it may precipitate (e.g., aggressive birds and related injuries, poor nutrition and associated diseases).

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Chapter 12 - Management Options

More Highlights

There are many ways to foster 'goose unfriendly' habitats, keeping in mind that Canada Geese are highly adaptable and resilient. The Guardians installed exclosures and snow fencing on the estuaries, a temporary and experimental solution. The City of Parksville inadvertently reduced goose use of its community park by erecting fencing along the beach. A farmer altered the timing of seeding and harvesting of his forage crops. Other techniques, untested in our region, include using bamboo stakes, dense or tall plantings, suspended grids or parallel lines (of wire, for example), and steepened banks to reduce access, visibility, and opportunities to take flight. Planting coarse grass species, mowing less frequently, or applying approved chemical deterrents may reduce palatability.

Scare techniques achieved limited success and survey respondents understood they were simply moving the problem elsewhere. They used trained and untrained dogs, trained raptors, scare shells, laser light, and utility and all-terrain vehicles, mainly to protect properties from damage and fouling. The City of Parksville's Canine Goose Control Program, which operated from 2009 to 2011, included an awareness campaign to prevent the use of untrained dogs and to distinguish Canada Geese from Brant, a provincially blue-listed species present in large numbers during the spring migration.

There are many hazing techniques that have been used elsewhere with varying degrees of success. Some may be unlawful under local bylaws or require permits. Prior to use, all should be assessed for their impacts to other people, pets, and non-target species.

Hunting pressure may be increased by opening new areas to hunting, even for a day or weekend; creating incentives for hunters; encouraging landowners with geese to allow access to hunters; and further reducing hunting restrictions. A one-year exception prohibiting the discharge of firearms within city limits was granted by the City of Port Alberni, to allow designated, licensed hunters to shoot Canada Geese on the Somass River estuary. Currently, all of the estuaries in the region are closed to hunting; however parts of the LQRE, NBE, and even the ERE may be sufficiently far from residences to enable safe and legal hunting. Or, it may be necessary to move urban and otherwise protected Canada Geese into areas where hunting can occur (by hazing or roundup and transport).

From survey responses and interviews, it is apparent that scare, damage and danger permits have been used by most sectors. However, they are probably underutilized due to lack of awareness (i.e., some people do not know they exist) and onerous permitting processes (i.e., complicated applications, barrier-laden requirements, lengthy waiting times). Some respondents that had attempted addling found it to be neither feasible or successful.

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Chapter 12 - Management Options

More Highlights

Culling is a sensitive topic, particularly when people who believe that animals have rights similar to humans meet those who have lost all tolerance for nuisance geese. Most people hold positions somewhere in between, or none at all. Hunters may wish populations to remain high or to grow. Most people do not wish geese to suffer, and many reject wasteful or debasing treatment of carcasses. A standard operating procedure for preventing animal suffering while performing 'depopulations' was created by MFLNRO in 2014, but the use of carcasses remains largely unresolved. The logistical challenges of coordinated capture, transport, killing, and disposal have been led in the U.S. by government agencies but are only monitored by senior governments here. These concerns have relegated culling to a 'last resort' control measure.

In the U.S., the large-scale capture and euthanasia of resident Canada Geese began in 1996. It has since expanded into many jurisdictions, and is described as the most efficient and cost-effective way to reduce the size of an urban flock, second only to hunting. Still, some communities have been unable to afford to cull or have avoided culling to prevent polarizing their communities in conflict. Culled birds captured during the summer months can be processed for human consumption and donated to charitable organizations (i.e., food banks). Culling of Canada Geese has also occurred in New Zealand since 1993.

There is precedence for culling of birds in Canada. For example, in B.C., Barred Owls were culled to protect at-risk Spotted Owls. In Ontario's Point Pelee National Park, 'hyperabundant' cormorants were culled to protect ecosystems and species at risk. Canada Geese were culled on Vancouver Island's Saanich Peninsula in July, 2015.

Only one mid-island farmer had registered for the B.C. Ministry of Agriculture Wildlife Program, a free compensation program available to qualifying livestock and forage producers.

USDA economists found that for every dollar spent on wildlife damage management programs to control Canada Geese, \$1.31 to \$5.56 could be saved in damage and maintenance costs.

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12.1 Status Quo



A gosling among addled eggs. Eggs that are close to hatching are not addled.

12.11 Egg Addling Program

To control rising Canada Goose populations and reduce grazing pressure on the ERE, an egg sterilization program was initiated in 2002. The Nanoose Bay unit of the Qualicum National Wildlife Area, encompassing the estuaries of the Nanoose and Bonnell Creeks (NBE), was added in 2003. The program was expanded to the LQRE and parts of Errington in 2004. City of Parksville staff joined the addling crew in 2004, but thereafter opted to pay Guardians members and hires to do the work. Hamilton Marsh was searched for nests in 2007. In 2012 and 2013, Guardians personnel also addled eggs at the Canadian Forces Maritime Experimental and Test Ranges (CFMETR) base in Nanoose Bay, Winchelsea Island, Yeo Island, and on some private properties (This timeline was derived from Manning, Cooper and Associates 2003, 2005, 2006; Lynch 2007; Morrison 2013; Guardians of Mid-Island Estuaries Society 2014 and email sources).

Addling was conducted by trained volunteers or paid personnel under permit from CWS (cf. Manning, Cooper and Associates 2003, 2005). The program typically operated through the incubating period of the nesting season, with most nest searches occurring during April and May. Addling crews observed geese on the nesting grounds as early as February and as late as June, to look for early nests and re-nesting pairs.

Addling was usually performed in the first two weeks of incubation,

to prevent the embryo from developing and hatching; eggs that are just laid cannot be addled, as the membranes will not detach from the shell, and eggs that are shaken too close to hatching may result in injured or deformed young. Each egg was vigorously shaken until the membranes detached, then marked and replaced in the nest; often a sloshing was felt and heard.

The justification for addling, rather than removing or destroying eggs, is to prevent the geese from re-nesting. When the eggs are addled and left in the nest, the goose will continue to incubate them. If the pair stays with this nest late into the nesting season, they are unlikely to re-nest. Canada Geese have been known to incubate infertile or dead eggs for up to 91 days, while others have deserted the nest at 28 days, the length of a typical incubation period (Brakhage 1965; Cooper 1978); Cooper found an average of 42 days, for what he termed 'overtime incubation'.

From 2010 to 2014, the estuaries were thoroughly searched over many visits. In earlier years, visits were more sporadic. Nests were examined each visit to sterilize any new eggs or eggs that could not be addled previously, and to document whether nests had been depredated and abandoned. From 2010 through 2014, the eggs were measured for length and width with calipers. Egg and clutch sizes were explored to determine whether changes in estuarine vegetation or in disturbance (e.g., harassment) affected reproductive

Chapter 12.2, No Action, describes the results of the egg addling program.



There are risks associated with egg addling. Crews must defend themselves against aggressive birds and navigate difficult topography.

output and subsequent juvenile survival (cf. Johnson et al. 1992). Locations were recorded with a Garmen handheld GPS unit.

Geese can be very aggressive when defending their nests. For safety, addling crews included at least two people. Any work on the estuaries, which frequently entails navigating uneven ground, a dendritic network of tidal channels, mudflats, and river crossings, were usually done in pairs or groups.

Although we did not have any serious health and safety issues, individuals working around geese and eggs should be aware of the risks, including risks of exposure to pathogens; the Public Health Agency of Canada's *Fact Sheet: Guidance on Precautions for the Handling of Wild Birds* is available at <http://www.phac-aspc.gc.ca/influenza/fs-hwb-fr-mos-eng.php>.

Several survey respondents expressed interest in participating in the addling program. However, program success has been constrained by several interrelated factors, including 1) manpower and funding; 2) a long season, with early and late nesters; 3) limited access to private properties with nesting Canada Geese, and 4) the difficulty in finding nests, which are often concealed.

A successful addling program is dependent on a very high proportion of nests being found and treated for many consecutive years (J. Cooper, pers. comm. 2003). CWS (2010) suggested that addling programs continue until birds die naturally or leave the area due to failed nests.

Effects of Addling

Egg addling contributes to regional population control primarily by reducing the annual recruitment of young. However, the program itself may contribute to its own ineffectiveness as successive failed nests may motivate pairs to leave their preferred nesting grounds and move into other areas, some of which may be more difficult to find. Failed nesters may migrate to moult, lessening local impacts but increasing them elsewhere. On the upside, moult migrants may be exposed to greater hunting pressures than they would face at home (Sheaffer et al. 2007; Heller 2010). See Chapter 12.2, No Action, for additional information.

Addling Versus Other Hatch Prevention Techniques

CWS (2010) suggests that destroying eggs is less complicated and may be just as effective. It recommends using egg sterilization techniques, including addling and oiling, only where there is reason to believe that geese will re-nest if eggs are destroyed. *Best Practices for Sterilizing Goose Eggs* is available to addling permit applicants (CWS 2010).

Of three re-nests of marked pairs recorded prior to 2015, only one had incubated addled eggs; the other two nests were predated before any eggs could be addled. When eggs are destroyed, geese that do not re-nest are likely to do one of two things: 1) feed more often on vulnerable estuarine resources, or 2) leave the area. If geese remain on the estuary, sterilizing eggs is preferential to destroying them.

12.12 Hunting

Hunting is considered the most important source of mortality for adult geese (CWS 2010), and government agencies everywhere promote it as the best way to address nuisance problems involving migratory game birds. Many studies that have examined whether hunting is effective in reducing populations of temperate-nesting geese have concluded that, while an important control measure, it is generally insufficient as a standalone option (cf. Huang 2010; Beaumont 2014). Twenty-two percent of our marked birds were reported to have been shot by hunters, to September 13, 2014.

Early fall hunting seasons (i.e., September seasons), are intended to harvest local Canada Geese,

whereas later fall seasons and spring hunting seasons target both residents and migrants (cf. Lindberg & Malecki 1994; Beaumont 2014).

Just over 30% of the 66 marked birds shot between October 10, 2009 and September 13, 2014 were killed in September. Of these 20 birds, 17 were shot within the study area. Three were local resident migrant types (i.e., LR+), 6 were emigrants, and the remainder were not assigned a migrant type due to insufficient information.

Huntability of Marked Geese

Goose populations that confine their movements to urban and other non-huntability areas cannot be controlled by hunting. Each marked Canada Goose was assessed to determine whether

they had been observed on any sites deemed huntable within existing hunting regulations and local government bylaws. Huntability was not examined in terms of access, i.e., whether permission to hunt would be granted or not, or age. (See Chapter 10.32, Mortality, for a brief discussion of age-related mortality.)

Of the 66 birds shot, 48 (73%) were killed within the study area. Eight were killed elsewhere on Vancouver Island, 3 on the Lower Mainland, 1 in Alberta, and 6 in western U.S. states. Of the 66 birds, more than half were banded at the LQRE (Figure 12-1). These findings concur with reports from CWS (2010) that most marked birds are shot near to where they are banded.

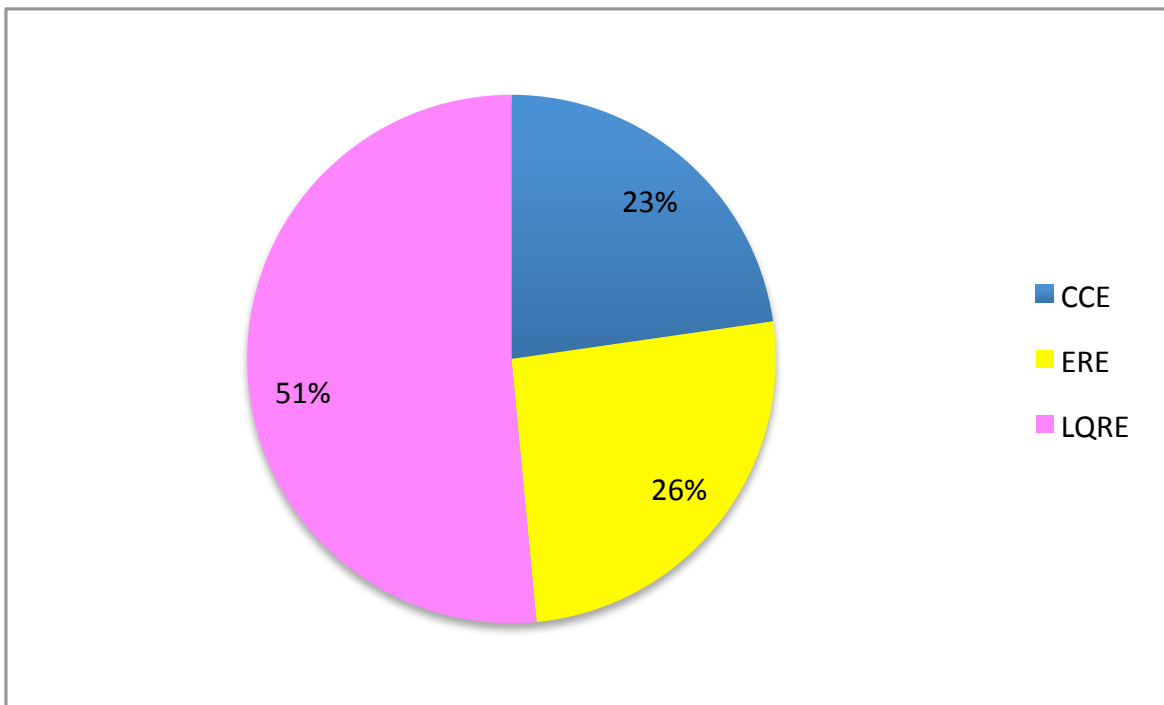


Figure 12-1. Marked Canada Geese killed by hunters, by banding location (n=66).

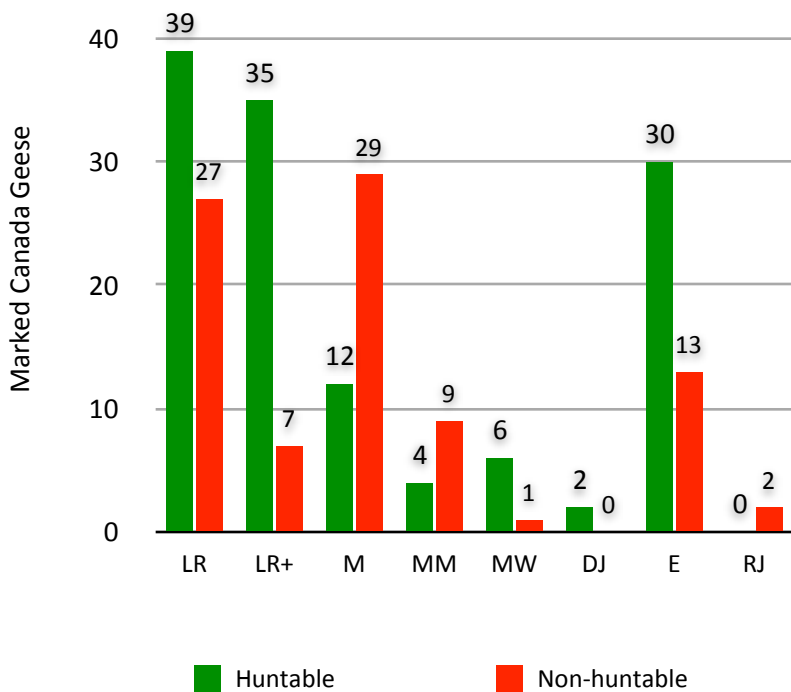


Figure 12-2 suggests that local residents are more huntable than migrants. However, migrant Canada Geese may frequent non-huntable areas here, but are huntable elsewhere. In fact, 72% of our marked geese that were shot elsewhere had not been observed on huntable sites here (Figures 12-3 and 12-4).

Approximately one third of ERE local residents were huntable, while two thirds of CCE local residents were huntable, and all of LQRE local residents were huntable.

Figure 12-2. Huntability of Canada Goose Migrant Types (n=216). (See Chapter 6.4 for descriptions of migrant types.)

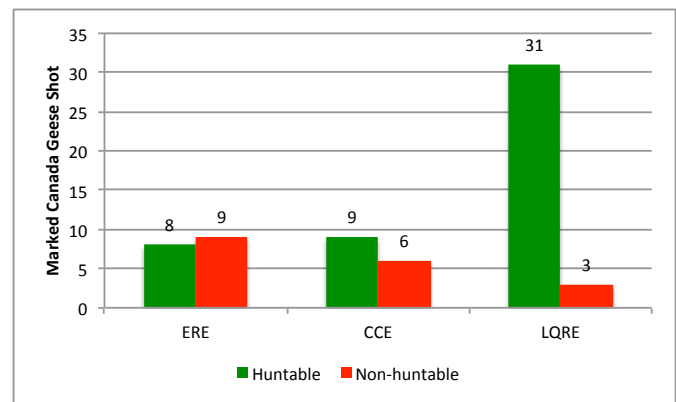
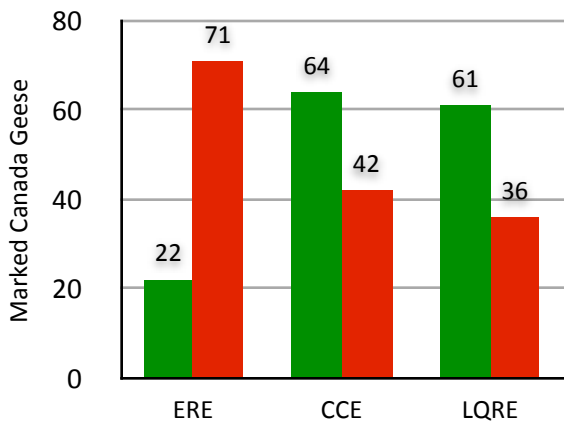
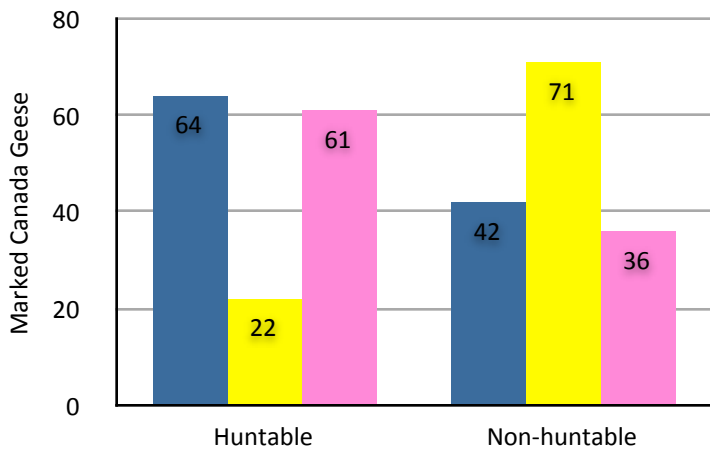


Figure 12-3. Regional huntability of marked Canada Geese (left) (n=296) and regional huntability of shot, marked Canada Geese (right) (n=66), by banding estuary.



As a cohort, ERE-banded birds were far less huntable than Canada Geese banded at the CCE and LQRE. Still, slightly more non-huntable ERE birds were killed than those deemed huntable.

Limitations
Our survey sites excluded several private properties where hunting was known to occur, and possibly other huntable sites that have not yet been identified.

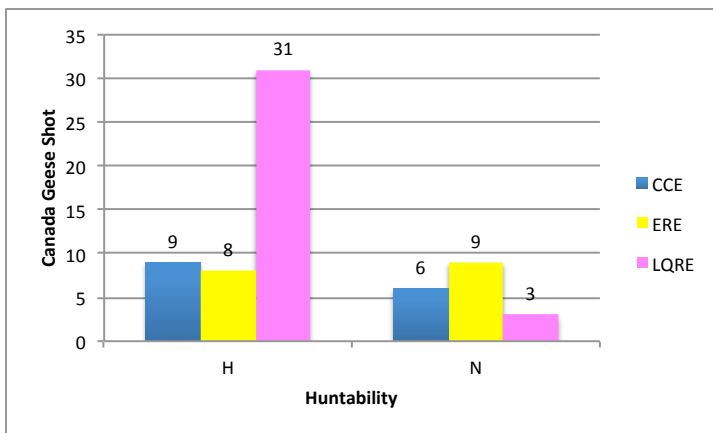


Figure 12-4. Regional huntability of Canada Geese banded at each estuary (upper) (n=296) and regional huntability of shot, marked Canada Geese (lower) (n=66).

In a study of radio-collared Canada Geese in Quebec, Beaumont et al. (2013) demonstrated that many geese moved from areas where hunting was allowed to places where firearm discharge was prohibited or hunter numbers were low, several weeks prior to the start of a special early hunting season intended to reduce populations of local geese. Furthermore, they were more likely to move to non-huntable areas if they were accompanied by juveniles, or had abandoned or lost their broods.

The birds stayed in non-huntable areas until late in the hunting season, when there were notably fewer hunters but still quality feeding opportunities in agricultural fields. The authors believed that Canada Geese have the ability to risk assess, based on prior knowledge and tradition.

In our area, geese moulting on the estuaries exhibited at least daily movements to both urban and rural habitats in late summer and early autumn, as soon as they could fly. Although hunting

precipitated the movement of Canada Geese from agricultural areas to more protected (e.g., urban) environments, this did not appear to be as prolonged as movements observed in Quebec. As a result of the addling program, most pairs were not accompanying juveniles so they may have been less likely to stay in non-huntable areas. Most Canada Geese spent the autumn in and near the City of Parksville, and used the estuaries, regardless of whether it was hunting season (Figure 12-5).

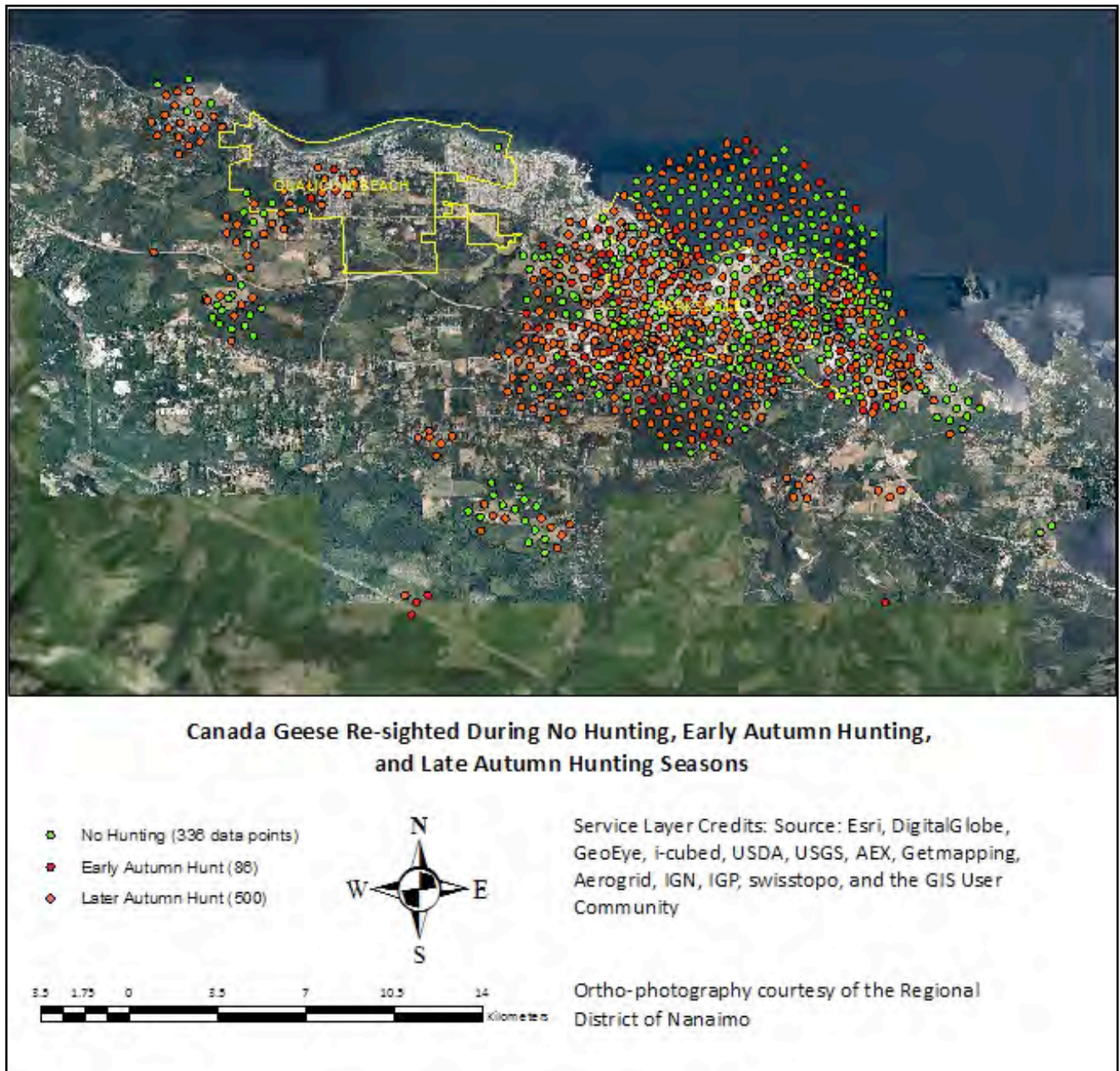


Figure 12-5. Canada Geese re-sighted in autumn, by hunting season, 2008-2013 (n=944). Stacked dots have been digitally dispersed.

Hunters have pointed to the success of opening day, the first day of each hunting season, as evidence that many geese do not anticipate the hunt. In our area, hunters reported that the opening

weekend in September was the best hunt of the year (survey respondent, 2014; hunter report to T. Clermont, pers. comm. 2014). In the eastern U.S., the effect of harvest on bird movement was

strongest during the early days of the hunting season (Hestbeck, Nichols, & Malecki 1991), and hunting success declined as the season progressed (cf. Lindberg & Malecki 1994).

Hunter Numbers

According to CWS' National Wildlife Research Centre, the number of active waterfowl hunters in federal management zone 1 has dramatically declined since the 1970s; this zone

encompasses most of the province, including our study area. Over the last decade, numbers stabilized at fewer than 2000 hunters (Figure 12-6) (Gendron & Smith 2014). Provincial data for management units 1-5 (Maple Bay north to the LQRE) and 1-6 (LQRE north to

Campbell River) (see map, Figure 12-7) showed no obvious trends between 2000 and 2013 (Figure 12-8). Increased bag and possession limits, beginning in 2012, may have motivated more individuals to hunt in unit 1-5 that year.

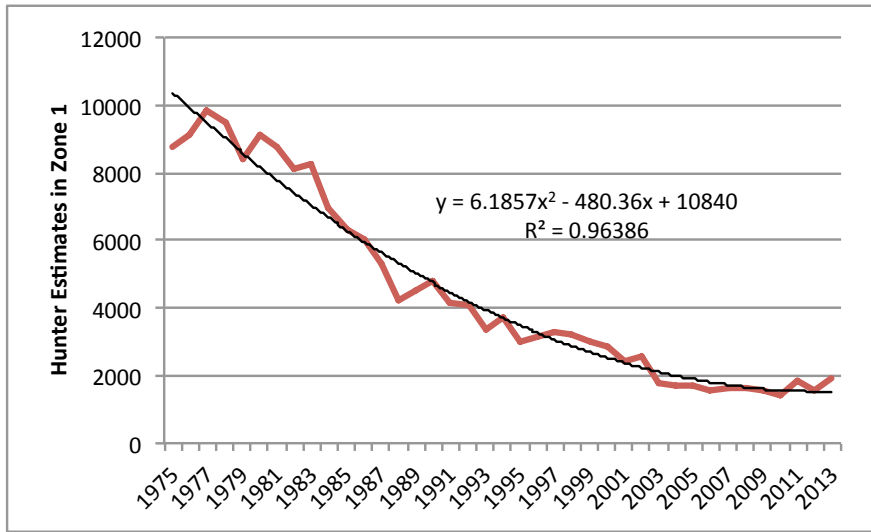


Figure 12-6. Active waterfowl hunters in B.C. Zone 1, 1975 to 2013 (Gendron & Smith 2014).

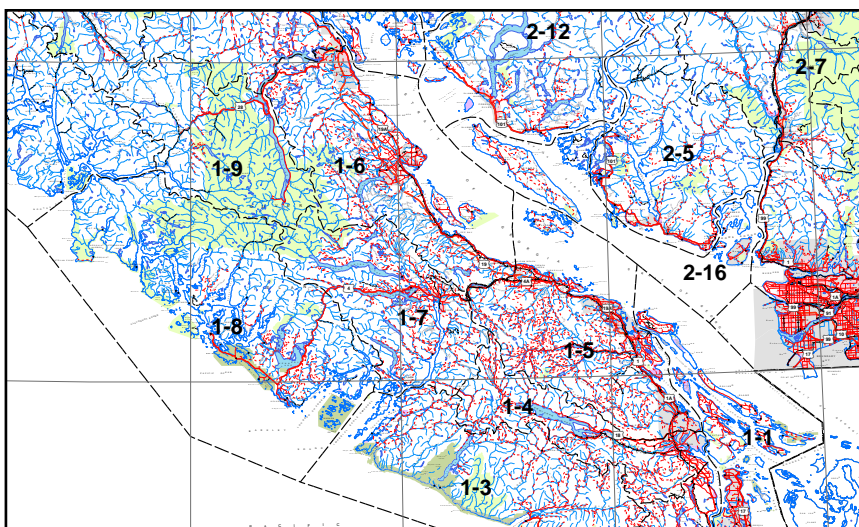
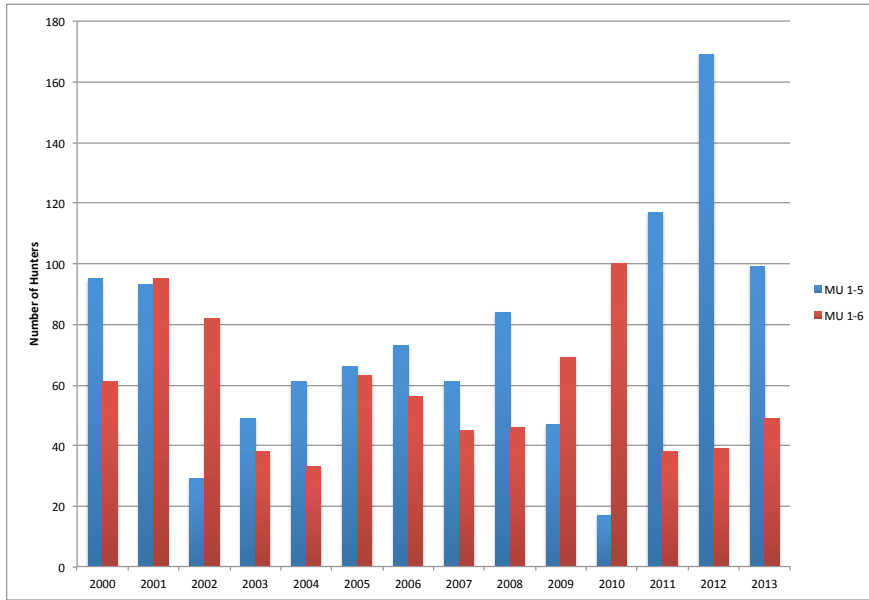


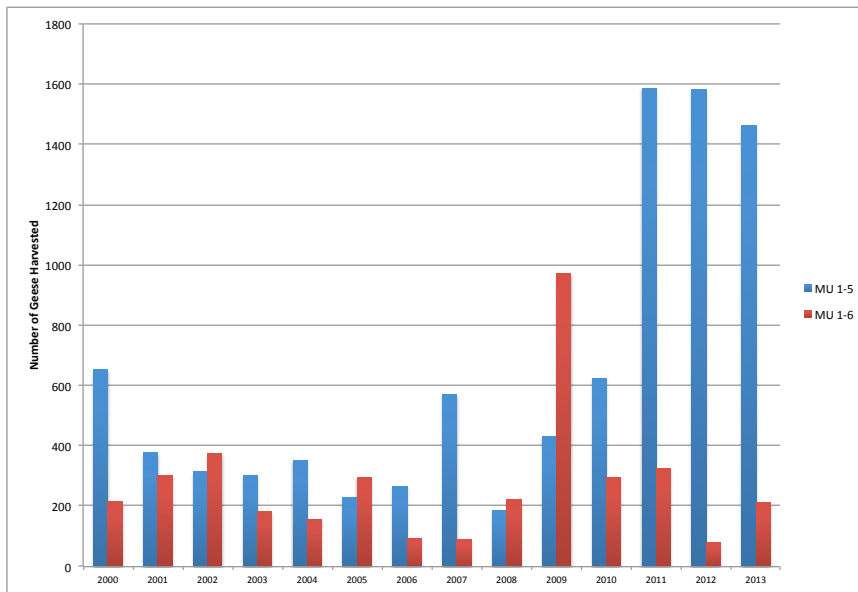
Figure 12-7. Provincial fish and wildlife management units, available at http://www.env.gov.bc.ca/fw/wildlife/docs/mu_maps/south%20western.pdf. Our study area lies within management zones 1-5 and 1-6.



By contrast, the number of goose hunters in B.C.'s Fraser Valley has increased by 50% over the last five years, from 2,000 to 3,000 (J. Evans, pers. comm. to T. Clermont, June, 2015).

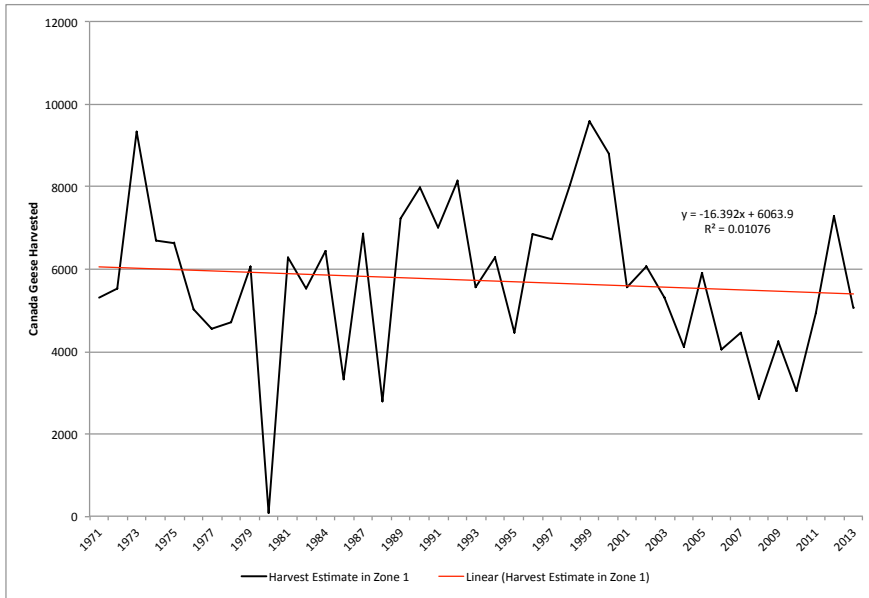
Figure 12-8. Goose hunters in Management Units 1-5 and 1-6, 2000-2013 (M. Chutter, pers. comm. to D. Janz, December 29, 2014). Provincial hunter sample based on annual hunter questionnaires.

Harvest Estimates



The number of geese harvested in management unit 1-5 peaked in recent years (2011 to 2013), whereas there was a new low in unit 1-6 in 2012 (Figure 12-9). Peaks in unit 1-5 reflect the hunter numbers there (Figure 12-8), and suggest a comparatively larger goose population.

Figure 12-9. Geese harvested in Management Units 1-5 and 1-6, 2000-2013 (M. Chutter, pers. comm. to D. Janz, December 29, 2014). Provincial hunter sample based on annual hunter questionnaires. Canada Geese were not differentiated from other geese.



Federal harvest estimates for B.C. zone 1 reveal Canada Goose harvests in 1971 and 2013 were similar, however estimates fluctuated by thousands of birds over the intervening 42 year period (Figure 12-10).
 Importantly, goose populations increased substantially over this period, whereas the federal hunter and harvest numbers did not.

Figure 12-10. Harvest estimates for Canada Geese in B.C. Zone 1, based on federal data, 2000-2013 (Gendron & Smith 2014).

Available Hunting Areas

A widely held belief is that hunters are limited by the number of available and accessible hunting areas (cf. E. Lok, pers. comm. December 1, 2004). East-central Vancouver Island is characterized by a preponderance of privately held lands, a consequence of land grants in the late 1800s and early 1900s. As the island has developed, more areas have been closed to hunting and the discharge of firearms (CWS 2010).

Our surveys found that most farmers hunt on their lands, or allow or encourage others to hunt. One Nanoose Bay farmer commented that more and more

hunters are asking for permission to hunt. A farmer in the French Creek area had permitted hunting in the past, but found the cattle and horses were “greatly disturbed with guns around”. An Errington couple would allow more hunting, if they could be assured they would not be harassed; they reported incidents where neighbours - not adjacent but distant neighbours, had disrupted their busy store, loudly complaining about hunting on the farm. Two farmers allowed goose hunting by hunting clubs. One set up a permanent blind and calls the Nanaimo Fish and Game Club when he sees geese during the hunting seasons. The other farmer

called the Hidden Valley Conservation Club “our most successful venture to date” [in controlling geese], while noting the hunting season is only 4 months of the year. (Note: The hunting season is limited to 3.5 months, or 107 days, by the *Migratory Birds Convention Act.*)

Local Hunter Report

In four years, a local hunter and his buddies shot 138 Canada Geese over 24 days in our region (Table 12-2). His hunting effort increased over time, partly due to increased bag and possession limits. His hunting areas were widespread, and included sites outside of the region.

Table 12-2. Local hunter report. Some hunters reported bands, and others did not. Geese shot include White-fronted Geese and Cackling Geese.

Date	Number of Hunters	Number of Geese Shot	Hunting Area
2011 September 10	5	25 (limit)	Qualicum
2012 October 16	unknown (min 3)	23	Qualicum
2012 October 20	unknown (min 2)	17	Errington
2012 November 7	unknown (min 3)	27 (total 67 in 2012)	Gabriola island*
2013 September 7 (opening day)	unknown	4	Gabriola island
2013 September 8	unknown	9	unknown
2013 October 26	unknown (min 2)	15	Nanoose Bay
2013 October 29	unknown	8	Nanoose Bay
2013 late December	2	14 (total 50 in 2013)	Nanoose Bay
2014 January 4	unknown (min 3)	22	Gabriola island
2014 February 22	5	47	Gabriola island
2014 September 7	unknown	2	Qualicum
2014 September 9	unknown	8	Nanoose Bay
2014 September 13	unknown	2	Nanoose Bay
2014 October 11 (opening day)	unknown	10	Nanoose Bay
2014 October 25	unknown	1	Gabriola island
2014 November 15	unknown	1	Nanoose Bay
2014 November 16	unknown	2	Nanoose Bay
2014 November 17	unknown	1	Nanoose Bay
2014 November 23	2	1 (total 97 in 2014)	Nanoose Bay
Total hunting days: 21 from September 2011 through November 2014, 15 in our region; 6 in the September season	Total hunter days: at least 37, 24 in our region	Total CAGO shot: 239, 138 in our region	*Gabriola Island sites outside of our region



Natural barriers, in the form of Large Woody Debris, have protected an isolated stand of sedges on the ERE. One resolute goose was observed infiltrating the perimeter.

12.13 Use of Permits by Landowners

According to our limited surveys, scare permits and damage and danger permits (i.e., egg sterilization and kill permits) have been extensively used. The City of Parkville and others have acquired permits for addling, hazing using raptors, and reportedly for dog programs. (Federal permits are not required to use dogs to haze geese.) Most farmers used permits to scare and/or kill geese outside of the hunting season; two had arrangements with hunting clubs to manage geese.

The Fairwinds community/golf club addled eggs for several years, mainly on the small islands offshore from Schooner Cove. One farmer reported addling eggs whenever nests were found. A Parkville residents’ association attempted egg addling once or twice, and found it to be neither “feasible” or “successful”.

A common complaint regarding permits was remembering to apply in time; considerable damage was done while waiting for permits to be processed.

12.14 Goose Unfriendly Habitats

Creating goose unfriendly habitats is one of two non-lethal ways of controlling Canada Geese; the other is hazing (see Chapter 12.15).

No Feeding

Feeding may attract and sustain more animals in an area than would otherwise be supported by natural food resources (USDA 1999). However, it is unclear how much of a difference it makes in areas where

overall food resources are abundant.

The City of Parkville does not have a bylaw preventing the feeding of Canada Geese or any other wildlife, and the City staff I spoke with had not observed or received reports of residents feeding Canada Geese (A. Metcalf, W. Payne, pers. comm. November 2014).

However, some residents of Parkville’s Craig Bay Estates feed geese, despite discouragement by their strata councils. To date, the councils have not instituted any penalty for feeding geese.

According to one survey respondent, many people enjoy watching the geese, but few feed them, and the vast majority of owners are thankful for Canada Goose control efforts.

Feeding wildlife may have many detrimental effects (e.g., children being injured by geese habituated to approaching humans for handouts, poor nutrition from unnatural diets). Eckberg (2010), who studied Canada Goose issues in Rochester, Minnesota, noted that a debilitating condition called Angel Wing, thought to be the result of a nutritional imbalance from being fed too much bread, afflicts many urban Canada Geese and renders them flightless.

Barriers

Barriers can be effective if they exclude areas from geese, prevent geese from landing or taking flight, restrict movement when they are moulting and flightless, and/or cause them to feel more vulnerable by blocking escape routes or lines of site (cf. Conover & Kania 1991; Ray 2011).

See also 12.31 Goose Unfriendly Habitats, in Additional Non-lethal Controls.



Planted sedges protected by orange snow fencing outside of a fenced enclosure, Little Qualicum River estuary, summer 2014



Red-winged Blackbirds (*Agelaius phoeniceus*) perching on enclosure, Little Qualicum River estuary, June 3, 2014

Conover and Kania (1991) found that Canada Geese could be excluded by increasing the flight clearance angle to greater than 13° by planting trees around lawns or small bodies of water. Also effective was placing shrubs to reduce a bird's ability to detect predators at distances beyond 9 m - particularly when combined with distress calls and other forms of harassment.

Estuary Exclosures and Fencing

Experimental Canada Goose exclosures installed on the LQRE and ERE (12 and 6 exclosures, respectively) in 2010 were constructed from green Bezin-coated fencing supported by 7 and 8-foot painted metal t-posts, and crisscrossed at the top with white polyshock cord or twine. The fencing and cord were flagged to prevent bird collisions and entanglement (Clermont 2010, June; September). One exclosure required limited maintenance, when goslings were observed slipping under them. Monitoring plots were established inside the exclosures, but also outside of them on the upstream side. This deliberate act was based on the premise that the geese might avoid these areas if their lines of sight were limited by the fencing. Monitoring could then compare areas protected by exclosures, areas screened by exclosures, and open areas. As expected, nesting and grazing Canada Geese appeared to avoid using areas immediately behind the exclosures, on their upstream side. On the ERE, due to the loss of substrate/marsh platform, exclosures were installed only along the perimeter or along

its farthest upstream reaches; they were too far away from congregating Canada Geese to show visible differences in grazing and grubbing.

In May, 2013, bright orange snow fences were erected to protect plantings along the main dendritic channel at the LQRE marsh, anchored to existing exclosures. Again, geese avoided the areas upstream of the fencing, allowing natural regeneration of vegetation to occur. Although the fencing did not obstruct the channel, it provided a visual 'pinch point' along the channel beyond which most geese would not venture. Thus, the combination of the exclosures and snow fencing effectively protected the entire mid-upper marsh area above the fencing normally accessible from the channel. Based on this success, a larger fence was installed across the entrance to the main channel of the marsh in May 2014, to prevent moulting birds from accessing the area. Photo-monitoring showed some vegetative recovery in areas behind the fence. The recovery was short-lived, as the fence collapsed within a month due to the weight of accumulated algae.

All non-lethal controls will have unintended consequences for non-target species, some positive, others negative. Exclosures on the LQRE were often used as perches by Red-winged Blackbirds (*Agelaius phoeniceus*), a positive effect. Other species may avoid the exclosures.

Fencing

The City of Parksville installed fencing along the beach, primarily to restore foreshore vegetation, but



Fencing along the beach, designed to restore foreshore ecosystems, also restricted Canada Goose access to upland habitats, particularly during the flightless moulting period.

also to discourage Canada Geese from walking from Parksville Bay onto the grass in the community park. Since the fencing was erected, there has been less fecal matter on the walkway along the beach (A. Metcalf, W. Payne, pers. comm. November 2014).

By contrast, owners at Craig Bay Estates have built short fences along the water to deter geese from leaving the ponds, but this has had little effect (survey respondent, November 2014).

Drainage

Two out of the five farmers surveyed had taken steps to prevent geese from depredating their crops and pasturelands by improving drainage to ensure there was no standing water to attract them. Despite reporting few Canada Goose problems at the Qualicum airport, the Town of Qualicum Beach intended to fill a depression to avoid ponding and attracting waterfowl near the airport (B. Weir, pers. comm. November, 2014). While it is important to reduce risks to aircraft from geese, drainage for most other purposes may be inappropriate. The USFWS (2002) considers draining waterbodies to be unreasonable and “aesthetically unacceptable” (p. II-2). A majority of the world’s wetlands have been lost to drainage (Biebighauser 2007;

2011; Davidson 2014), and even seasonal wetlands are considered important for their ecological values and ecosystem services.

Inaccessible or Unpalatable Food Sources

To discourage geese from foraging crops to bare ground, a Nanoose Bay farm now times the harvest of its rye/wheat forage crops to ensure plants grow taller before winter. This practice also provides more forage in spring, allowing the farmer to feed his cattle, rather than graze them on wet fields.

The sports field in Parksville’s community park had been a favoured grazing spot for Canada Geese. Yet, after the grass turf was replaced, few geese visited the field. What changed? The drainage was much better than before. The new substrate under the grass turf was sand, not organic matter, and the grass, a ryegrass and Kentucky Bluegrass mix, was kept green with fertilizer. Since these grasses are known to be highly palatable to geese (Conover 1991; Washburn & Seamans 2012), City staff speculated that the new grass may taste different due to the sandy substrate. As organic material built up over time, it would become more attractive to geese (A. Metcalf, W. Payne, pers. comm. November 2014).



Urban goose, City of Parksville



Roundups, such as this one at Craig Bay in July 2012, provide a good indication how much effort it takes to move geese. Many people, all along the shoreline and in boats, were necessary to herd the flightless geese. Photo by Charlene Lee.

12.15 Hazing

Some survey respondents reported using a wide range of techniques to scare geese (e.g., one had used dogs, raptors, scare shells, laser light, and utility vehicles), while others had used only one or two techniques. All reported limited success.

Hazing with Dogs

More than any other hazing method, dogs have been used to deter and chase geese on both public and private lands. The City of Parksville Canine Goose Control Program began early in 2009. The program was deemed 'pretty successful'. A dog trainer managed ~50 volunteers with pairs of dogs, to chase, but not harm geese. Owners were identified with an ID badge. The dogs, wearing bright yellow scarves to identify them as goose control dogs, were required to be on leash (consistent with local bylaws) except when working in the community park, Springwood Park playing field, City Hall and Parksville Community and Conference Centre. The \$8,700 program (\$2,400 annually, less in the final year) was initially funded in 2008, and ran until 2011 when the trainer became unavailable (City of Parksville 2009; A. Metcalf, W. Payne, November 2014). Importantly, an advertising campaign preceded the program, to generate interest and participation, to help ensure untrained canines would not be chasing geese as a result of the program, and to raise awareness of the differences between Canada Geese and Brant.

Brant are a provincially blue-listed species that rests and feeds on the foreshore of the PQBWMA and Rath Trevor Park during their

spring migration to Alaska. During the months of March and April, these beaches are closed to dogs, as the Brant are highly sensitive to the presence of dogs and take flight at the least provocation.

A similar control program was developed to chase Canada Geese off grassy areas and footpaths in a Parksville residential development, forcing them to take flight or find refuge in the strata's settling ponds. A dog trainer was paid for one weekend course each year, and dogs were trained to promptly and consistently return to their owners when called. They were allowed to be off leash only when chasing geese, and were required to wear a red bandana to identify them as goose patrollers. The program was in abeyance when the geese are moulting. Interest in the program has waned, as the dogs become dirty with feces and there was a growing feeling that they may be getting ill or diseased from participating. As an alternative, residents sometimes 'walked' the geese to the water from the grass (survey respondent, 2014).

Administrators at Parksville Elementary School explored the possibility of using trained dogs to chase the geese from school property, but could not proceed without the support of the School Division's Operations and Maintenance Department (survey respondent, 2014).

A Nanoose Bay golf course employs a falconer with a border collie, while a French Creek course has a dog that chases geese off of the course.

All farmers had dogs, and used them to chase geese, with varying

See also 12.32 Hazing, in Additional Non-lethal Controls.



Geese become accustomed to people, traffic, and other sights and sounds of urban environments.

levels of success. Every survey respondent that reported using dogs to scare geese also used human power (employees, farm kids) to harass them. One farmer acknowledged that he was merely moving the problem elsewhere.

Dog programs to control geese have been employed in many other jurisdictions. In New Jersey, Dow Jones & Co. eliminated Canada Goose problems on its property this way, after finding other harassment techniques were aesthetically unacceptable or too expensive. The company used border collies year-round, for 15-30 minute sessions, 1-3 times per day. The dogs received no special training, instinctively herding the geese into a pond, then swimming into the pond to encourage the geese to take flight. 'Invisible fencing' was used to enclose the dogs. The cost of implementation in 1990 was \$9,400 for dogs and fencing, with annual maintenance costs of \$2,000 paid for dog food and veterinary

care (Castelli & Sleggs 2000).

Hazing with Raptors

The City of Parksville employed a falconer with "Eddy the Eagle" to harass geese from 2010 to 2012, spending nearly \$26,600. City staff noted the dogs covered more space in a given time, when compared with the eagle (A. Metcalf, W. Payne, pers. comm., November 2014). A Nanoose Bay golf course spends more than \$3,000 per month employing a goose control person with an eagle and a border collie (survey respondent, 2014). Unlike hazing with dogs, hazing with raptors requires a federal permit.

Hazing with Equipment

Survey respondents reported using utility vehicles and All Terrain Vehicles to move geese, and laser light or cracker shells to scare them. Cracker shells are typically employed using a firearm, and so require a permit from Environment Canada.

12.2 No Action

With 'no action', any current programs to curtail Canada Goose population growth would be discontinued. Hunting would be the primary means of control, augmented by piecemeal damage and danger permits and hazing techniques used by private landowners.

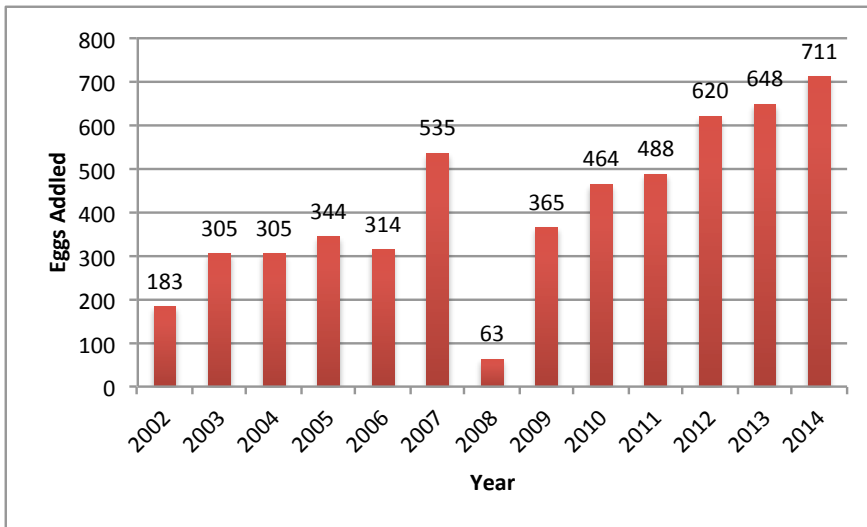
To measure the effectiveness of 'no action', we can simply examine how effective the egg addling program has been.

The estuary-focused addling program removed at least 5,345 eggs from local Canada Goose populations from 2002 through 2014 (Figure 12-11).

Approximately 80% of eggs produce viable young (cf. Cooper 1978; Dawe & Davies 1975), about 66% of goslings survive their first year (a conservative estimate, cf. Brakhage 1965; Bellrose 1976; Smith, Craven, & Curtis 1999; Heller 2010; Beston et al. 2014), and ~74% survive to their second

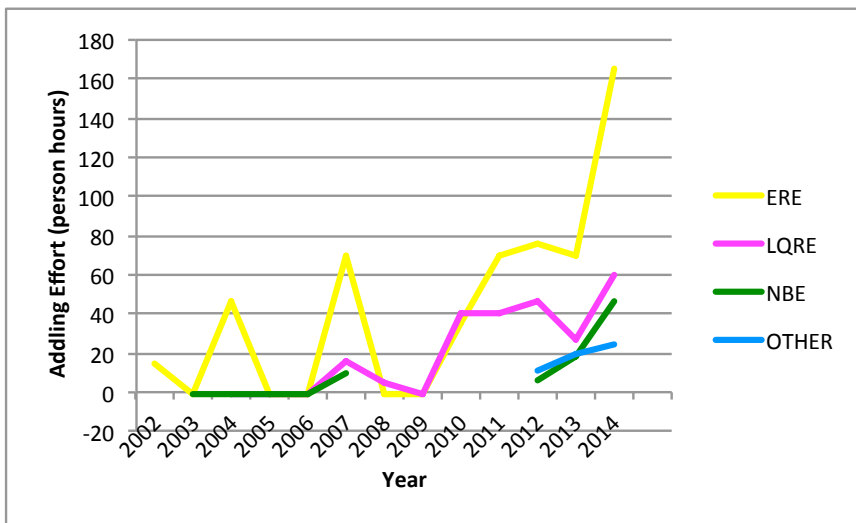
year (USFWS 2002; Heller 2010; Beton et al. 2014). Assuming Canada Geese have the potential to breed at age 2 (cf. Brakhage 1965), at least 2,088 breeding-aged Canada Geese were removed from the population over the twelve-year period. In other words, by addling 2.6 eggs, one adult was prevented from breeding.

An additional 585 eggs were addled in 2015, at the LQRE and ERE only (T. Clermont, pers. comm. 2015).



The number of eggs added has increased over recent years (Figure 12-11), however this is not entirely related to a growing number of breeding geese. Adding effort fluctuated over time, becoming more consistent from 2010-2014 (Figure 12-12). Data were missing for 2008 and 2009.

Figure 12-11. Canada Goose eggs added at all sites, 2002-2014 (n=5,345). Data were missing for 2008 and 2009.

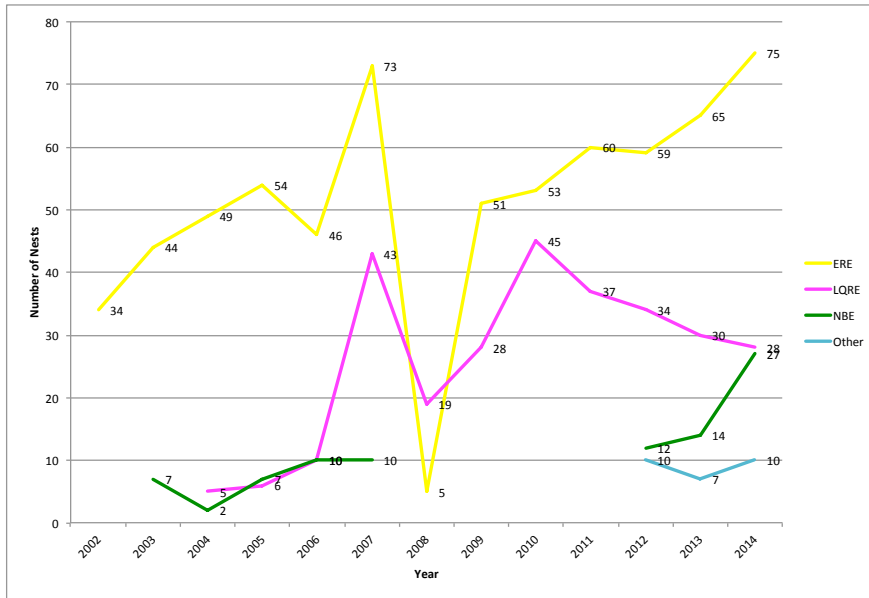


When funding for adding crews was not a limiting factor, the level of effort was directly related to the number of nests and eggs found. More nests and eggs require more person hours. Additional searching may also find more nests, with diminishing returns as the season progresses.

Figure 12-12. Adding effort at the ERE, LQRE, Nanoose Bonnell estuaries (NBE) and other sites, 2002-2014. Unknown effort = -1, no effort = 0.

In 2009, the adding dataset for the LQRE was largely unusable due to a well-intentioned person operating without an adding permit. Here, one marked egg was replaced in the nest, together with a rock, and other eggs were likely removed.

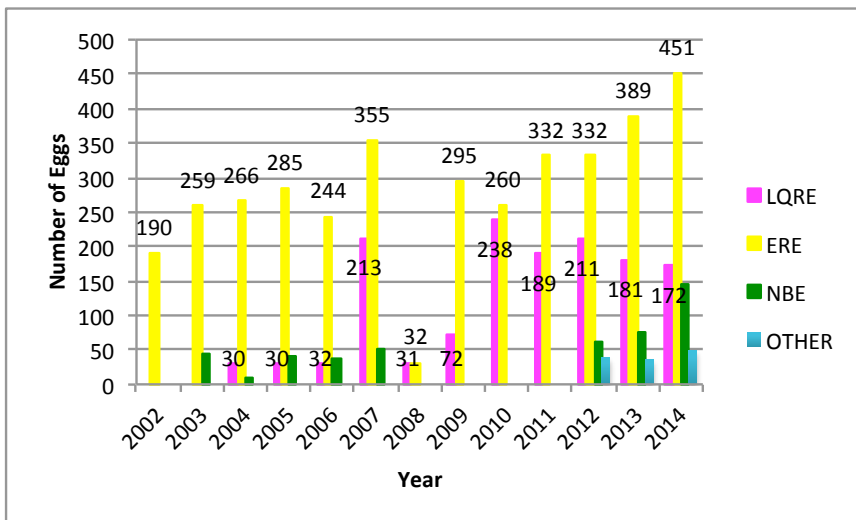




ERE: Goose productivity high and rising

The ERE, as the largest estuary (~115 ha), has consistently supported more nests and eggs than the LQRE or other sites (Figures 12-13 and 12-14). In 2015, there were 73 nests, 2 re-nests, and 461 eggs found, surpassing the fecundity record of the previous year. There were also five broods observed on the estuary during the nesting season, suggesting some nests were missed (T. Clermont, pers. comm. 2015).

Figure 12-13. Nests found at the ERE, LQRE, NBE, and other sites, 2002-2014 (n=1,069). Data are missing for 2008 and 2009.



LQRE: Goose productivity down

Since 2010, the number of nests discovered on the LQRE has decreased (Figures 12-13 and 12-14). In 2015, there were 25 nests, 1 re-nest, and 149 eggs (T. Clermont, pers. comm. 2015).

NBE: Goose productivity up

By 2014, the nest count at the NBE had nearly equaled numbers at the LQRE, with less search effort on the NBE (Figure 12-13). There were also 104 goslings observed at the NBE during the 2014 moult count, suggesting ~20 nests were undetected.

Figure 12-14. Canada Goose eggs at the LQRE, ERE, NBE, and other egg adding sites, 2002-2014 (n=5,681).

Without an addling program or other intervention to curtail Canada Goose populations, independent actions to control geese will inevitably increase. The USDA (1999) predicted an increase of undesirable, cumulative impacts (e.g., draining of wetlands, inhumane methods of killing, harassment of non-target species) with any decrease in government assistance (as governments had taken the lead in the U.S.), primarily because independent initiatives would be poorly monitored and those taking action would have low accountability.

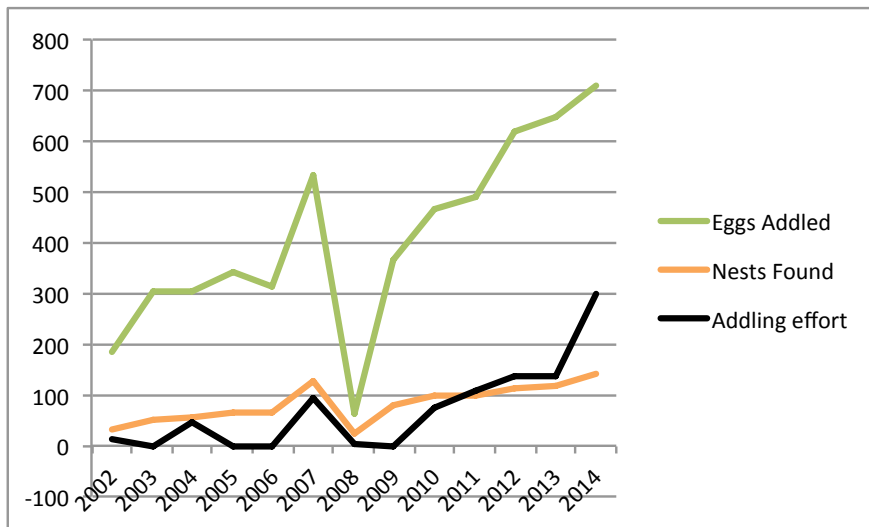


Figure 12-15 shows the level of effort, nests found, and eggs added for all adding program sites from 2002 through 2014.

Figure 12-15. Total numbers of nests and eggs added, with adding effort (person hours), 2002-2014 (n=1,069 nests and 5,345 eggs). Data were missing for 2008 and 2009.

12.3 Additional Non-lethal Controls

Those attempting to control Canada Geese typically use multiple methods applied with trial and error. However, there are numerous reviews describing non-lethal (and lethal) techniques, sometimes with conflicting opinions; see Ray (2011), CWS (2010), as well as many of the federal and state CAGO control reports or web pages (e.g., Maryland Department of Natural Resources, n.d.; USDA 1999; USDI 2005). The following provides a snapshot of common approaches.

12.31 Goose Unfriendly Habitats

Modifying habitats to be less inviting to geese can reduce the overall ability of the landscape to support geese, i.e., its carrying capacity for geese. However,

Canada Geese are highly adaptable. They have been known to nest in woodlands, in flower gardens, and on rooftops, for example.

Barriers

Bamboo stakes may have some promise as Canada Goose deterrents on the estuaries. The stakes guard preferred feeding areas, and birds are reluctant to navigate through them (K. Ashley, pers. comm. December 2014). Bamboo has been used in the restoration of eelgrass beds (Boyer & Wyllie-Echeverria 2010), albeit not to deter geese.

Dense plantings, tall enough to prevent adult geese from seeing over them, can deter Canada Geese from moving upland along shorelines or from ponds (CWS 2010). This is

particularly effective during flightless periods (USDA 1999). Although a frequently suggested management technique, vegetative barriers may not be supported everywhere. An online petition protesting a vegetative buffer along a Minnesota lake was signed by more than 600 people, who argued that crippled geese could not access food onshore (Eckberg 2010). And for some people, the aesthetics and enjoyment of lawn adjacent to water are more important than preventing Canada Geese from using these areas (USDA 1999).

Grids or parallel lines of wire, cable, twine, rope, or tape can be suspended above the surface of ponds or over new plantings. These and other visible deterrents (e.g., strung CDs that



This feeding area is weedy and has not been fertilized.

move in the wind) can be used to block flight paths and make areas less desirable (CWS 2010). It may be helpful to take prevailing wind directions into account, as geese prefer to take off into the wind (cf. Martin & Guignon 1983).

Making Feeding Areas Inaccessible or Unpalatable

There are several ways to make terrestrial habitats such as grassy areas less attractive to geese. Canada Geese like short, tender, young shoots, so planting coarse grass species, fertilizing less, and/or mowing less frequently to allow grass to become tall and coarse, *may* lead them to seek more palatable food elsewhere. Canada Geese prefer gentle slopes from aquatic to upland areas, so steepening these slopes and allowing vegetation to grow tall along the slope can discourage geese while protecting the bank from erosion. Breaking up vast grassy areas into smaller sites enclosed by shrubs or other tall structures can encourage geese to go elsewhere (cf. Maryland Department of Natural Resources n.d.). These techniques work best if there is a good alternative feeding source nearby (Conover 1991).

Chemical goose repellants have been used with varying degrees of success to prevent feeding on grass and other vegetation (USDA 1999; Ayer 2009; CWS 2010; Huang 2010). Ideally, the product will affect only the taste of vegetation, and not be harmful to wildlife or humans; it is important to check with the product supplier as a permit may be required for its use (CWS 2010). Frequent mowing may influence the longevity and efficacy of chemical

deterrents on grassy areas (Ayers 2009).

Methyl anthranilate, a registered repellent for Canada Geese in Canada and the U.S. (USDA 1999; Health Canada 2012), is marketed under the trade names Rejex-It™ Migrate for Agriculture and Turf Bird Repellent, and as ReleX-iT™ (Health Canada 2012). It repels Canada Geese when it comes into contact with eyes, nostrils and mouth. It has low toxicity to terrestrial organisms, including mammals and birds, but may adversely affect aquatic organisms (USDA 1999; Health Canada 2012). Methyl anthranilate is naturally occurring in grapes, and is used to produce the sugar-substitute saccharin (International Agency for Research on Cancer 1999). When assessing its effectiveness, the USDA (1999) reported mixed results.

Anthraquinone is a digestive irritant, and is sometimes combined with a plant growth suppressant to make it more cost-effective (USDA 1999; Ayers 2009). Accepted for use as a bird repellent at American airports since the late 1990s, anthraquinone is also used for textile dyes and as a pulp and paper additive. It was phased out of use by the European Union in 2008 and is “possibly carcinogenic to humans” (International Agency for Research on Cancer 2012, p. 66).

Ray (2011) suggested lime as a potential grazing repellent for Canada Geese. For a short time, it produces a caustic effect on the oral mucosal lining (Belant et al. 1997 in Ray 2011).

Hesse, Rea, & Booth (2009), in

their discussion of wildlife management around airports, documented the use of chemical deterrents on nesting and roosting sites. I was unable to find any examples where repellants were used on goose nesting and roosting sites.

Removing Domestic Waterfowl

Birds learn to locate food resources by watching other birds. Domesticated waterfowl act as decoys, luring Canada Geese into ponds and other areas. Domesticated waterfowl may be farmed, kept for aesthetic reasons, or congregate and stay in areas where they are fed, all with similar results. Importantly, concentrating domestic and wild birds in an area has been known to spread diseases (USFWS 2002).

There are discrepancies in the literature as to whether Mute Swans attract or repel Canada Geese; some say the territorial nature of the swans make them an effective deterrent, while the U.S.D.A. and others maintain they are only territorial while they are nesting. There are also other reasons to refrain from keeping swans, such as the potential proliferation of exotic species, damage to aquatic habitats, and aggression towards people (USFWS 2002). Such rationale can be overcome by using swan decoys; the sellers of these claim they are successful Canada Goose deterrents (e.g., <http://shop.tjb-inc.com/floating-white-swan-decoy-for-canada-geese-control-in-water-gardens--ponds-p1335.aspx>).

Bait and Lure Crops

Bait and lure crops may appear out of place in this section, as they are not 'goose unfriendly habitats'. However, they are 'carrot' habitat modification tools meant to discourage geese from using more vulnerable habitats, and so act in much the same way as 'stick' tools (e.g., barriers, goose repellants). It is important to note that bait in this context does not refer to baiting to lure birds for hunting (which may be permitted as a special provision should Canada Geese be designated as overabundant). Rather, lure crops may be planted, or bait (usually grains) deposited to attract wildlife away from more valuable resources. Baiting may also be used with capture nets to round up geese for banding, relocation, or extermination, within the conditions of a federal permit.

Lure crops are known to be largely ineffective where food resources are plentiful (USDA 1999), and are only available for short periods of time (USFWS 2002), so are considered inappropriate for most year-round urban goose problems. The effectiveness of baiting is also limited by the availability of alternative food resources (USDA 1999), and geese must be kept out of the vulnerable habitats (e.g., by hazing or with barriers) (USFWS 2002).

A key question remains, how available are alternative food sources in our region, and does this differ by season? CWS (e.g., CWS 2011) has stated that the rise in Canada Goose populations can be attributed, in part, to ever-

expanding food resources as humans modify the landscape, whereas the Guardians and others (e.g. MVIHES 2009; Dawe et al. 2011) have determined that once plentiful estuarine food sources have been dramatically diminished.

Bait and lure crops are sure to draw others species of waterfowl and their predators. Bait pads require frequent cleaning to prevent illness among its users. And such areas concentrate animals, making them more susceptible to pathogens and parasites.

12.32 Hazing

Most hazing programs have met with little success, as geese readily habituate to scaring techniques, move to other areas where they are not wanted (including areas where owners may suffer significant damages that they can ill afford), and then return once hazing is suspended (CWS 2010; Huang 2010; Ray 2011). Preusser et al. (2008) in Ray (2011) found that geese usually moved less than 2 km from hazing sites and often returned multiple times after hazing. Effective hazing requires that geese be chased every time they arrive, and employs multiple techniques to overcome habituation (CWS 2010); this is time-consuming and can be expensive. Certain types of hazing (e.g., chasing by dogs) may not be appropriate when geese are nesting or flightless during the moult, as the birds may be harmed if they cannot fly away or stay to defend their eggs. Migrants are

generally (but not always) more responsive to hazing than resident birds (cf. USDA 1999), therefore Cackling or Dusky Canada Geese may be targeted.

An experiment conducted in Scotland assessed hazing as a tool to manage Barnacle Geese (*Branta leucopsis*) depredating agricultural lands. Human 'goose scarers', supported by gas guns and plastic tapes, hazed geese from 'scare fields' to 'refuge fields' where farmers received payment to allow the geese to graze. Working in daylight hours over a 4 month period, 7-8 scarers were able to reduce the number of geese in scare areas by 50%; despite all efforts, a core group of geese remained faithful to the scare area. The scheme cost more than it saved in crop yields. Recommendations included using fewer people over a more focused time period, while monitoring birds for body condition and ensuring refuge areas were sufficient (Percival, Halpin, & Houston 1997).

Hazing on the Estuaries

Hazing on the estuaries is difficult at any time of year, and especially during high tides, because geese can access water at multiple points or across broad expanses. Once pairs establish territories and build nests on the estuarine marshes, the stage is set for ongoing damage. Hazing is less effective when geese are nesting or raising broods, as parents are less likely to leave eggs or young behind (CWS 2010). During the pre-moult period, the birds often swim along the shorelines to their favourite moulting sites. Geese

that are hazed during the moult will not be able to travel very far (CWS 2010). Therefore, mitigating damage from Canada Geese from March through August by hazing would require nearly constant vigilance, and possibly alternative measures such as baiting in less ecologically sensitive areas in proximity to present moulting sites (cf. CWS 2010). Hazing on the nesting grounds will move breeding geese onto other sites, some of which may be much more difficult for egg addlers to find.

To haze the geese from the estuaries to huntable areas during autumn, winter, and early spring hunting seasons will require simultaneous hazing efforts in other non-huntable areas, of which there are many. A well-coordinated, pilot effort would be necessary, ideally with several days of pre-observation to study birds movements, cooperation from landowners, and substantial manpower employing a variety of hazing techniques.

Hazing Techniques

Hazing techniques mentioned in the literature and not used by our survey respondents are described here. They have been applied with varying degrees of success, and what works for one site may not work for another. The effectiveness of a given technique will depend upon the nature of the problem, the character of the landscape, and the skill with which it is applied.

Hazing techniques may be visual, auditory, or both. Visual techniques include dead Canada Goose decoys (e.g. at <http://www.wildlifecontrolsupplies.com/animal/NWSDG01K.html>), swan

www.wildlifecontrolsupplies.com/animal/NWSDG01K.html), swan decoys (mentioned in 9.31 Removing Domestic Waterfowl), statues of owls or eagles, helium balloons and kites with graphics of large eyes or shaped like large birds of prey, scarecrows of predators or gun-toting humans, flashing or strobe lights, lasers (e.g., <http://www.wildlifecontrolsupplies.com/animal/NWSV000/BPL001.html>, <http://aviandissuader.com>), waving flags, shiny banners, streamers, flagging, and reflective tape (Smith, Craven, & Curtis 1999; USDA 1999; Blackwell, Bernardt, & Dolbeer 2002; CWS 2010; Eckberg 2010; Huang 2010; Ray 2011; K. Ashley, pers. comm. to C. Wightman, May 2014).

Auditory techniques include goose alarm and alert calls, predatory calls, propane cannons, air horns and sirens (CWS 2010; Eckberg 2010). Scare devices requiring a permit from Environment Canada include those discharged from a firearm, such as cracker shells, screamers, and bangers (Smith, Craven, & Curtis 1999; USFWS 2002; CWS 2010).

Audio-visual techniques include pyrotechnics and remote-controlled boats (USFWS 2002; Eckberg 2010). The City of Nanaimo uses a remote-controlled vehicle (K. Bridges, pers. comm. February 10, 2015). In some areas, motion-activated water sprinklers may be an effective hazing tool (CWS 2010).

Each technique must be considered for safety and legal implications, and public acceptance. It is important that

birds are not touched or handled. Hazing with firearms or with aircraft (e.g., drones) requires a permit. Some hazing techniques may contravene local government noise bylaws, or meet with public disapproval. Pyrotechnics, for example, may be prohibited in certain areas, and may cause injuries, start fires, and upset people and pets (USDA 1999). Hazing methods should also be assessed for their impacts to other species, particularly at-risk or sensitive species.

12.33 Adult Sterilization

In the U.S., Canada Geese have been baited with oral contraceptives during the breeding season. Nicarbazin, sold in the product OvoControl™, decreases egg production and hatching rates. Its use is limited to urban nesting sites where geese can be regularly fed. To be effective, geese must consume at least one ounce of bait per day for at least 21 days prior to nesting, and throughout the

nesting period. Its effects dissipate within a few weeks (USDA 2011).

Also in the U.S., ganders have been “vasectomized” to reduce recruitment. It is probably best suited for reducing small resident populations, as males must first be identified, then captured and surgically treated (Hundren et al. 2000 in Ray 2011). As this method typically affects only reproductive output from one female per gander, its effectiveness is limited (USDA 1999).

12.4 Additional Lethal Controls

Sometimes, non-lethal control methods are employed when lethal controls would have been more effective and biologically sound (USDA 1999). Lethal methods are sometimes necessary to reduce goose-human conflicts (CWS 2011). Lethal controls may enhance the efficacy of non-lethal controls; for example, when some members of the flock are killed, it scares remaining geese into other areas and may make them easier to scare in general (CWS 2011). (Often, though, surviving geese move to the estuaries or other areas where they are unwanted.)

12.41 Additional Hunting

There are two ways to increase hunting pressure on Canada Goose populations: 1) to expand hunting opportunities, and 2) to move Canada Geese into areas where hunting can occur.

Hunting opportunities can be expanded in several ways: 1) open

areas currently closed to hunting, even for a short time; 2) increase the number of hunters through encouragement programs or hunter incentives (including financial incentives); 3) encourage landowners with geese to allow access to hunters; and 4) further reduce hunting restrictions (extend seasons, increase bag and possession limits, allow equipment and techniques that are currently prohibited). Birds can be moved into huntable areas by hazing, or by roundup and transport.

The LQRE, ERE, CCE, and NBE are currently closed to hunting. However, parts of the ERE, LQRE, and NBE may be far enough from residences to enable safe and legal hunting. DUC secured an exception to a Port Alberni bylaw prohibiting the discharge of firearms within city limits. Designated, licensed hunters are allowed to shoot Canada Geese for one year, starting in September 2014, on

DUC conservation lands at the Somass River estuary. There is an option to extend following a report on conservation work in the estuary (Plummer 2014; D. Buffett, pers. comm. November 2014). Further afield, in Rochester, Minnesota, an early season Canada Goose hunt inside of the city’s game refuge earned the city national acclaim, including a title as one of the best cities for hunters to live in (Eckberg 2010).

Additional hunting opportunities may also be considered for golf courses, if there are areas where proximity of neighbours is not a concern. In Connecticut, 16 golf courses had active hunt programs; hunting occurred daily on 4, weekly on 4, and whenever geese were present on the remaining 8. Seventy-five other courses had requested state assistance to develop a hunting program (Huang 2010). Ray (2011) suggested archery and

entanglement (i.e., snares and nets) followed by removal as a way to take birds off of golf courses and other sites where discharge of firearms may be wholly inappropriate.

Also in Connecticut, a survey of farmers found that some were unaware that hunting was allowed on their lands, and subsequently initiated contact with hunters. Most farmers that were already hunting or allowing hunting wanted expanded seasons and bag limits (Huang 2010).

12.42 Additional or Expanded Kill Permits

There are at least two ways to ramp up the effectiveness of kill permits: 1) expand the egg addling program into new areas, and 2) encourage other landholders with Canada Geese to use kill permits. The Guardians have been asked on several occasions to addle eggs on properties currently outside of the program. A local hunter, on behalf of several farmers, contacted a Guardians member to determine how to secure kill permits to manage geese (pers. comm. October 2014). A campaign to raise awareness of these control options, and additional funding for addling will be needed if these methods are to make a marked reduction in the regional Canada Goose population.

12.43 Culling

Culling - the selective, lethal removal of wild animals, has collective benefits that most other control methods do not have. Like

hunting and permits to kill adult birds, it decreases the adult population, and so eliminates many costly and labour-intensive years spent addling eggs and chasing geese from one area to another. It typically targets a larger number of birds at one time, can be applied directly to a problem (sub)population, and its effects are obvious and immediate (cf. USFWS 2002, USDI 2005). There are also fewer risks that surviving members of the flock will return or cause problems elsewhere. Still, repopulation is anticipated, as nearby populations continue to grow and suitable habitats remain available. Females that escaped capture because they had moult-migrated (or for other reasons) will return to nest.

Ethics

Culling is a sensitive topic, sometimes motivating impassioned discussions and even organized conflict. Animal rights advocates have fiercely defended animals threatened with selective extermination, be they Canada Geese, deer, rabbits, wolves, or any other species, because they believe these animals have rights similar to humans. They may be opposed to any form of stressor or control, including hazing (USDA 1999), believing that humans should learn to tolerate and even appreciate these animals (USDA 2004). The U.S. organization, Love Canada Geese, supports a webpage entitled Canada Goose Hall of Shame, which lists the worst offending communities in Canada: Kelowna, Osoyoos, Penticton, and Vancouver, B.C.; Vancouver made the list because it

relocated juvenile geese, while Kelowna threatened, but did not undertake, a cull (LoveCanadaGeese.com 2014). Although most animal welfare organizations do not oppose wildlife damage controls (USDA 1999), the B.C. Society for the Prevention of Cruelty to Animals (BC SPCA n.d.) and others promote non-lethal methods and a respectful attitude towards urban geese.

On the other hand, there are people who have lost all tolerance for the nuisance animals, and are willing to reduce the problem by any means necessary (cf. Huang 2010). Most people hold positions somewhere in between, or no position at all. Hunters may wish populations to remain high or even grow.

These are ethical discussions about humaneness and justice, and individuals perceive them differently. Most people don't want the geese to suffer, and some are focused on determining the most humane extermination method. One survey respondent rejected the use of firearms for culling, but only as a public safety issue. A hunter viewed his participation in depopulation efforts as helping the City contain maintenance costs, assisting affected farmers struggling to make a living, and supporting local food initiatives. Disposal has come up repeatedly in meetings; many people reject any wasteful or debasing treatment of carcasses and will accept culling only as long as the birds are used for food. All of these factors, along with the logistical issues of coordinated

capture, transport, killing, and disposal, make culling a challenge. In the U.S., senior governments manage and oversee culls, whereas here they only participate as monitors. Not surprisingly, culling is generally seen as a control measure to pursue only when all others have been exhausted.

“Depopulations”

A number of stakeholder groups in the province have requested permits to cull, or conduct local ‘depopulations’, leading senior governments to address some of the aforementioned logistical issues (BC MFLNRO 2014; CWS 2011b).

In May 2014, in response to requests from the Capital Regional District, the B.C. MFLNRO produced the standard operating procedure (SOP) for performing depopulations of resident Canada Geese. The main intent of the SOP was to prevent animal suffering. The described procedures must be performed by veterinarians or individuals who have had training in wildlife handling and management specifically related to humane euthanasia techniques. Appropriate permits must be obtained from Environment Canada and the B.C. MFLNRO. The SOP recommends herding Canada Geese into an enclosed area during the moult period, described as mid-May to late July, then transporting them to a location away from public access to avoid ‘aesthetically displeasing’ the public. Another document, *Best practices for capturing, transporting and caring for relocated Canada Geese*, necessary

for capturing and moving the birds to a location that avoids distressing the public, is available at <http://www.ec.gc.ca/mbc-com/default.asp?lang=en&n=07368A95-1>. It is noteworthy that we have conducted four separate roundups for marking geese in early July, a busy tourism period, with little fanfare.

There have been several methods used for the euthanasia of geese, with no single option that stands out as the best choice. Recommended methods include cervical dislocation with mechanical assistance, and the use of a non-penetrating captive bolt device, the latter delivering a large concussive force, rendering the animal irreversibly unconscious. If not used for food, the carcasses must be buried at an approved site or incinerated at a facility with adequate capacity for the size of depopulation that is performed. All personnel should be comfortable with these tasks and trained to carry out their roles correctly and safely. Alternatively, a mobile poultry processing unit may be used; this method may be more cost-effective, safe and efficient than training new staff (BC MFLNRO 2014).

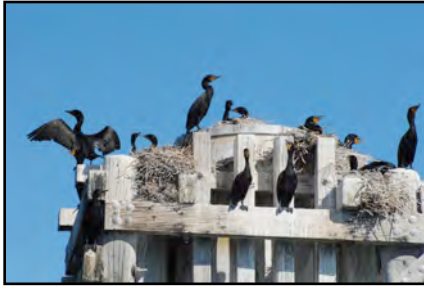
CWS developed *Best Practices for Killing Birds and Disposing of Carcasses* (CWS 2011b), available at [https://www.ec.gc.ca/Publications/95FAFB79-3856-4752-8309-1F95D0E4101D%5CCOM1425_BP-for-disposing-of-carcasses-\(EN\)march-2012.pdf](https://www.ec.gc.ca/Publications/95FAFB79-3856-4752-8309-1F95D0E4101D%5CCOM1425_BP-for-disposing-of-carcasses-(EN)march-2012.pdf). Gunshots, a carbon dioxide chamber (i.e., inhalant gases), stunning and

decapitation, and commercial poultry processing were preferred methods for killing Canada Geese. If pharmaceutical agents were used to dispatch geese, carcasses must be incinerated or limed and buried; they cannot enter the food chain (CWS 2011b).

Culling in Other Jurisdictions

Large-scale capture and euthanasia of Canada Geese in urban settings first began in the U.S. in 1996 (cf. Maryland Department of Natural Resources n.d.; T. Smith, pers. comm. February 17, 2015), and have since expanded into many jurisdictions. The U.S. Department of Interior’s Fish and Wildlife Service (2005) described culling and delivering the birds to food banks as an efficient and cost-effective way to reduce the size of an urban flock, second only to hunting. It requires a federal permit from the USFWS that documents other control techniques attempted, and their results. Landowners are encouraged to hire USDA Wildlife Services or a state-licensed control company to do the work (Maryland Department of Natural Resources n.d.; USDI 2005).

Roundups and culling have precipitated a generalized mild resistance, and spawned a few well-organized advocacy groups (such as Love Canada Geese, mentioned above) (Eckberg 2010). The provision of birds to food banks, and the airplane crash into the Hudson River in 2009 appear to have tempered opposition to Canada Goose culling in America (cf. Smith, Craven, & Curtis 1999). Huang (2010), who studied the societal acceptance of aggressive



Double-crested Cormorants (*Phalacrocorax auritus*). Photo from Trudy Chatwin.

population control techniques in Connecticut, found that all stakeholder groups surveyed agreed that population reduction was “not only acceptable, but needed” (p. 34); importantly, Huang’s groups did not include the general public. Nineteen towns wanted to reduce populations but found lethal control cost-prohibitive. Five other towns felt that the State should provide grants or conduct roundups and euthanize birds. Two towns rejected culling to avoid polarizing their communities. Huang concluded that there was a general lack of fortitude to implement controversial management techniques in the face of vocal minorities, yet asserted that population reduction through aggressive means was the only long-term solution.

Culling has occurred overseas as well. For example, in New Zealand, the Department of Conservation and Ministry of Agriculture and Forestry granted \$100,000 to set up a moult cull program throughout the country. Up to 18,000 birds were culled on public conservation lands by Federated Farmers, using a variety of site-specific methods (Cogle 2012). This was the latest in a series of culls dating back to 1993 (Spurr & Coleman 2005). At least one of the culls resulted in conflicts with organized groups, such as the Goose Guardians (Win 2001).

Cormorants

While cormorants are not protected by the *Migratory Birds Convention Act*, the culling of ‘hyperabundant’ Double-crested Cormorants (*Phalacrocorax auritus*) on Middle Island in Lake Erie and Ontario’s Point Pelee National Park

provides some valuable lessons. There are also some parallels between Carolinian Canada and east-central Vancouver Island; many ecosystems and species are at the northerly extent of their range. When survey data collected by CWS, Ontario Parks, and nearby universities showed the cormorants were damaging the ecosystems and associated species at risk, Parks Canada invested \$380,000 to implement the Middle Island Conservation Plan (Dobbie 2008). Culling was one of three management approaches, the other two being removal of nests and nest-building material to protect species at risk and discourage nesting around them, and installation of scarecrows to discourage nest building (Dobbie 2008; Parks Canada 2010).

Culling began in 2008 and is expected to carry on through 2015. Prior to hatching, small number of Parks Canada personnel shot cormorants associated with nests in trees using sound-suppressed, small calibre rifles. Carcasses were not removed, to avoid disturbing sensitive flora. Follow-up monitoring and carrying capacity modeling were important aspects of the plan (Dobbie 2008; Parks Canada 2010). According to Cormorant Defenders International (n.d.), less than 250 birds were killed in 2008, 1,600 in 2009, and 3,300 in 2010.

The plan was supported by the local Humane Society and SPCA (Parks Canada 2013). However, Cormorant Defenders International prepared a 93 page document refuting the rationale for the culls, including the term



Barred Owl (*Strix varia*)

‘hyperabundance’ (Kent MacKay & White 2008). The authors argued that there was no evidence that few cormorants existed on the island prior to the 20th century. Shooting was described as cruel, while cervical dislocation was “morally reprehensible” and possibly illegal under the Criminal Code of Canada (pp. 47-50).

Other Avian Species

In 2013, the Province initiated a control program for Barred Owls (*Strix varia*) deemed necessary to protect a handful of remaining pairs of Spotted Owls (*Strix occidentalis*). The Barred Owls had been outcompeting the Spotted Owls, which are federally endangered and provincially red-listed. By the time the program was announced, it had already relocated 73 and authorized the shooting of 39 Barred Owls within a 5 km radius of confirmed

Spotted Owl sightings (CBC 2013). While culls are never popular and this was no exception (cf. Wilderness Committee n.d.), the remainder of the initiative proceeded with little fanfare. (Note: It is beyond the scope of this paper to discuss the myriad examples of animal culls for conservation or other purposes.)

Social License

In this section, I have elaborated on the challenges of obtaining the social license to cull Canada Geese. This is not to suggest that culling is an inappropriate management tool, but to inform managers that, should they choose this option, awareness-building and education will be necessary, and there is always a possibility that no amount of justification will be enough to dissuade activism.

12.5 Renewable Resources

Pioneering farmers raised Canada Geese for food, although they were probably not a preferred species, and for down and as live decoys to lure migrating geese for hunting (cf. University of California 1977). Farmed flocks provided stock for introductions and relocations (see Chapter 1, Background), and it is likely that flocks of live decoys were released after the practice was outlawed in the U.S. in 1935 (USFWS 2002).

Today, domesticated Canada Geese are for sale in the U.S. (see, for example, <http://www.efowl.com/>

Canada_Goslings_p/1080.htm or <http://www.metzerfarms.com/CanadaGeese.cfm?Breed=Canada&BirdType=Goose&ID=CAN&CustID=17075>). Sellers provide non-transferable permits. (Federal legislation prohibits the sale, barter and purchase of wild geese (USFWS 2002)).

Here in B.C., raising Canada Geese without a permit will land you in trouble (CBC News 2012, January 17). Aviculture permits are available, but the birds must be bred in captivity. Conditions of the permit include requirements to control flight through pinioning

and wing clipping, as well as use of pens and facilities maintenance (E. Lok, pers. comm. January 9, 2015).

Yet, there is, or could be, a demand for Canada Goose products. Local farmers were interested in producing goose sausage and in marketing whole birds (survey respondent, 2014).

Down is considered a by-product for poultry farmers, albeit a lucrative one (Downmark n.d.). Hutterites raising geese on the Canadian prairies are renowned for their down, which is derived from mature, free-ranging small flocks (Robertson 2010).



Canada Goose™ apparel cashes in on the iconic bird, without using its down.

Interestingly, clothing manufacturer Canada Goose™, a company that has been in existence for nearly 60 years, uses goose and duck down from Hutterite birds - not Canada Geese, but white domestic varieties. Over the past decade, its sales grew 4000% to \$200 million (Financial Post 2014, October 16).

In the U.S. geese captured within the conterminous U.S. during the summer months can be processed for human consumption and donated to charitable organizations. Feathers cannot be sold (USFWS 2002). Keefe (1996) reported costs of \$18 to \$25 per goose, for capture and processing

for human consumption; these did not include holding captured geese for any length of time prior to processing.

Currently, wild-sourced Canada Geese cannot be raised or sold for human or pet consumption in Canada, nor can culled birds be offered to food banks. Canada Goose feathers are considered wildlife parts, and cannot be sold by anyone other than some First Nation members.

Regulations and policies regarding the use of non-hunted wild game for consumption are discussed in Chapter 4.9, Processing Non-hunted Wild Game for Consumption.

12.6 Compensation

There has only been one program registrant on the mid-island for the B.C. Ministry of Agriculture's Agriculture Wildlife Program, from the community of Hilliers (G. Fowler, pers. comm. January 12, 2015). This is a free compensation program available to qualifying livestock and forage producers for low value livestock forage crops, grown mainly for silage, hay, or pasture (BC Ministry of Agriculture and Lands (MAL) 2008); G. Fowler, pers. comm. January 12, 2015). Damage associated with Canada Geese, and any other waterfowl species, includes plant removal, plant yield reduction (grazing), weed introduction and infill, soil sealing (ponding, reduced drainage), minor excavations (root grubbing), and grit consumption. In the

Hilliers case, waterfowl and ungulate damage were both assessed (G. Fowler, pers. comm. January 12, 2015).

Most wildlife damage to forage grasses occurs over the winter months, and fields must be assessed prior to harvesting or other field activities (e.g., harrowing, manure spreading, aerating, fertilizing) that may mask the damage. Generally, assessments are conducted from February to April, prior to the first cuts in May or June. Later damage may be assessed, but there is generally less damage due to waterfowl migration and the availability of alternative foods (G. Fowler, pers. comm. January 12, 2015).

Silage corn assessments are conducted from June to October,

and are generally based on a single inspection per field. While geese are one of the first animals to damage corn crops, later damage by other animals such as bear, deer, and elk is typically greater (G. Fowler, pers. comm. January 12, 2015).

Damages to crops grown for human consumption are not covered by this program, as these fall under the Crop Insurance/ Production insurance program. Crop insurance programs have coverage premiums, production (yield) guarantees, and are delivered on a crop scale, versus an individual field scale. Human food crops are considered to be at greater risk from weather events, disease, and pests (G. Fowler, pers. comm. January 12, 2015).

By contrast, the South Dakota Department of Game, Fish, and Parks instituted a \$250,000 program in 1996 to reduce crop damage by geese. The program was funded by a \$5 surcharge on all hunting licenses. Landowners were given free access to State-led abatement techniques such as egg addling (Dieter & Anderson 2009).

National Wildlife Research Center economists (USDA 2011, November) showed that as resident Canada Goose populations increased, so did the costs associated with damages and control measures. They discovered that for every dollar spent on wildlife damage management programs to control Canada Geese, \$1.31 to \$5.56 could be saved in damage and maintenance costs.

Table 12-3 provides a SWOT (strengths, weaknesses, opportunities, threats) analysis of management techniques discussed in this chapter.

Table 12-3. SWOT analysis of management options

Technique	Strengths	Weaknesses	Opportunities	Threats
egg addling	reduces annual recruitment; lowers re-nesting rates; established program with significant experience and leadership	must continue for many consecutive years; failed nesters may moult-migrate; failed nesters may nest or re-nest in more remote or isolated areas; effectiveness is constrained by availability of manpower, funding over a prolonged period (may be expensive (\$)); limited access to private properties; addling crews difficult to populate due to time of year and physical demands; inexperienced crew members	failed nesters that moult-migrate and linger in more northerly areas may be exposed to greater hunting pressure; access to private properties and successful nest searches may be increased by building awareness, leadership, and training	crews may be exposed to safety and health risks; opponents prevent access to properties or harrass crew members
hunting	increases mortality rates; four seasons and increased bag and possession limits have precipitated greater harvests in management unit 1-5	some geese confine their movements to non-huntable sites; season designed to target local resident geese; exclusivity and costs of hunting clubs may prevent new and lower income hunters from hunting geese, reducing hunter numbers overall; farmers reluctant to open properties to hunting because of stress to farm animals	temporarily open areas to hunting or encourage landowners to allow hunting; promote goose hunting to encourage people to hunt, or hunt more often; encourage hunting in jurisdictions where our marked birds were shot; reduce hunting restrictions; move geese into huntable areas	hunting moves survivors into non-huntable areas, including vulnerable estuaries; hunting opponents and NIMBYism vilify hunters and discourage landowners from allowing access; perceived safety issues prevent hunting in estuaries and peri-urban settings

Technique	Strengths	Weaknesses	Opportunities	Threats
use of permits by landowners	addling reduces reproductive outputs, use of kill permits increases mortality rates	scare permits move birds to other areas; some are unable to addle or dislike doing it; some cannot implement a kill permit without help	assist people who don't know how to access or use permits; reduce or eliminate processing times; connect potential permit-holders with addling crews and hunters to implement them	processing times are prohibitive
no feeding policies or bylaws	feeding may sustain more geese than would be supported by natural food resources, injure people, or cause debilitating conditions in geese (e.g., Angel Wing)	require enforcement, which may be time-consuming and \$	introducing feeding bylaws and/or policies may help raise awareness of the problem of local overabundance	
barriers	prevent geese from landing or taking flight, restrict movement when flightless, cause them to feel vulnerable by blocking escape routes and lines of sight	no effect on population size; may be expensive (\$), may block waterfront views or be unsightly	natural barriers may have multiple benefits (e.g., as habitat for other species, flood protection)	goose unfriendly habitats may be detrimental or hazardous to other species (e.g., bamboo stakes may prevent access by other waterfowl, grid lines may entangle)
drainage	reduces features that attract geese	no effect on population size; reduces seasonal or permanent wetlands, which are rare and have many important values; \$		goose unfriendly habitats may be detrimental or hazardous to other species (e.g., other species that use the wetlands)

Technique	Strengths	Weaknesses	Opportunities	Threats
inaccessible or unpalatable food sources	discourage geese from feeding	no effect on population size; some solutions may be temporary (e.g., new turf); \$	altering the timing of harvests may provide additional benefits to farmers	goose unfriendly habitats may be detrimental or hazardous to other species; some chemical deterrents may be toxic or carcinogenic to humans, also; some alternative plantings suggested in the literature are invasive plants
removing domestic waterfowl	prevents concentrations of mixed domestic and wild fowl, known to spread diseases			
bait and lure crops	draw geese away from sensitive habitats and other sites where they are unwanted	effectiveness limited by the availability and quality of alternate food resources; attract other species and predators	may also be used to round up geese for banding, relocation, or extermination	without regular cleaning, bait pads may cause illness; bait and lure crops concentrate animals, making them more vulnerable to pathogens and parasites
hazing with dogs	scares geese from patrolled areas; canine programs have been successful in our area and other jurisdictions	moves birds to other areas; dogs not allowed on the PQBWMA during March and April and now have to be controlled at all times; bureaucratic gridlocks (e.g., for schools); requires willing trainers and dogs; \$	hazing may move geese into areas where hunting can occur or kill permits may be used	hazing activities may be detrimental or hazardous to other species (e.g., dogs may chase Brant); dogs may become ill from contact with goose feces; geese may move to areas where they cause significant damage; nesting or flightless birds cannot travel very quickly or very far, and may be injured by dogs

Technique	Strengths	Weaknesses	Opportunities	Threats
hazing with raptors	scares geese from patrolled areas	less effective than dogs per unit area; \$; raptors are not permitted to injure or kill geese but have the instinct to do so	hazing may move geese into areas where hunting can occur or kill permits may be used	goose unfriendly habitats may be detrimental or hazardous to other species; geese may move to areas where they cause significant damage
hazing with equipment (e.g., vehicles, predator decoys and calls, lasers, reflective tape, alarms and alert calls, cracker shells, propane cannons, drones, etc.)	scares geese from targeted areas, at least temporarily	geese readily habituate to some hazing techniques; certain geese may remain faithful to a site, returning again and again; techniques may work on one site but not another; may be time-consuming and \$; may upset people and pets	hazing may move geese into areas where hunting can occur or kill permits may be used	goose unfriendly habitats may be detrimental or hazardous to other species; geese may move to areas where they cause significant damage; some techniques may be unsafe, illegal, or unacceptable to the public in certain contexts
adult sterilization (i.e., oral contraceptives, gander vasectomies)	gander vasectomies prevent offspring from the mated pair	oral contraceptives must be added to bait and consumed every day for 21 days prior to nesting and throughout the nesting period, and its effects wear off in a few weeks; vasectomy involves capture and surgery, and only affects one female per gander		bait pads require regular cleaning to prevent illness; bait pads on the nesting grounds may attract predators and non-target species

Technique	Strengths	Weaknesses	Opportunities	Threats
culling	decreases a goose population, eliminating the need for many costly and labour-intensive efforts; when applied to a large number of birds at one time, the effects are obvious and immediate; fewer risks that survivors will return or cause problems elsewhere	logistics (e.g., capture, transport, killing, and disposal) are often challenging; \$	generates ethical discussions centred on humaneness and justice; carcasses may be used for food; sound-suppressed, small-calibre firearms may be safely used by experienced shooters on a well-defined site within a specific time period (see Cormorants)	repopulation is likely to occur, as moulting migrants return to nest, and as nearby populations grow and suitable habitats remain available; there may be considerable opposition, or a small but vocal one; safety issues if firearms are used in areas typically closed to hunting
renewable resources			demands for goose products (e.g., meat, down); new regulations for First Nations	
compensation	pays farmers for damage to forage crops	other field activities may mask damage; damage to crops grown for human consumption are covered by crop insurance programs, which are administered differently and require premiums	a portion of hunting license fees may be used to fund compensation programs (and restoration efforts on estuaries and other damaged sites); wildlife damage management programs may save damage and maintenance costs	

Chapter 13 - Carrying Capacity Highlights

This chapter discusses the concept of carrying capacity and its usefulness in setting limits or targets for goose populations. It contributes to Goal 5, integrating population, temporal, and spatial information and objectives into a strategic direction to inform management planning for the region.

Carrying capacity is often defined as the size of the population that can be sustained without degrading the health of the animal or its environment. It suggests there is an ideal number of animals, below which no damage would occur. It assumes that the environment establishes a limit to the growth of populations, and that populations grow until they stabilize at the limit. In practice, carrying capacity is very difficult to assess. Out of 342 sites identified as available goose habitat, geese were observed on only 232 of them, and flocks were frequently concentrated on only a handful of sites. Although mid-island estuarine marshes have been unable to sustain goose populations without degradation, it is unlikely that Canada Geese have exceeded the carrying capacity of the region, or that ecological factors will soon constrain the growth of goose populations.

We have likely exceeded our social carrying capacity for Canada Geese, as populations have adversely affected the tourism and agricultural sectors, sports and recreation, and the overall quality of life of community members.

Alternative measures to carrying capacity, such as Limits of Acceptable Change, Limits for Defining Change in Ecological Character, and Thresholds of Potential Concern, have been used in other jurisdictions to assess various environmental conditions and socioeconomic tolerance for change. These hold some promise for managing locally overabundant Canada Geese and affected resources or assets.

Citations, excluded here for brevity, can be found in the text of the document's chapters. Please do not cite highlights without consulting the chapters.

13.1 Biological Carrying Capacity



Canada Geese on the lower Little Qualicum River estuary (upper) where tall sedges growing on a thick marsh platform have been replaced by Sea Milkwort (*Glaux maritima*) and algae over gravelly substrates (lower).

Some have suggested that the degradation of the marshes has occurred because the number of geese have exceeded the carrying capacity of the estuaries or the region, and recovery will require reducing populations to a capacity that these areas can support (e.g., Dawe & Stewart 2010; Dawe et al. 2011).

Carrying capacity is often defined as the size of the population that can be sustained without degrading the health of the animal or its environment (Wagar 1964 in Cole & Stankey 1997; Cole & Stankey 1997; Freedman 2004). Yet, it is an elusive concept (Price 1999). Do populations grow to carrying capacity, or far beyond them? How are the boundaries of this environment identified? What indicators and thresholds are used to establish that the health of the population or the environment is diminishing? When the population is distributed over several types of habitats, on what basis is carrying capacity determined? Social factors such as family sizes or age structure of the population influence distribution and abundance, so what effect do they have on carrying capacity?

There is inherent complexity in identifying constraints on populations, and how these constraints operate (Price 1999). Every population is restricted in its growth potential by a range of conditions, such as the food supply, competition, predation, disease, parasites, and environmental variability, as well as by the dynamic interactions of these factors (Williams et al. 2001; del

Monte-Luna et al. 2004). What conditions are limiting our regional population or subpopulations, and how resilient are they to shifts in these conditions?

There are two major assumptions underlying the concept of carrying capacity: that the environment establishes a limit to the growth of populations, and that populations grow until they stabilize at the limit (Price 1999).

Canada Geese are 'leveling species', meaning that population sizes and densities tend to fluctuate within narrow limits but are otherwise relatively stable (Perrins & Birkhead 1983; Price 1999). Occasionally, leveling species grow wildly, such as when they are introduced into habitats with a vast abundance of resources but few predators or parasites. In these cases, populations tend to grow until resources are exhausted, causing them to crash (Price 1999).

Quebec's Greater Snow Goose Management Round Table reported, "these species [i.e., overabundant Greater Snow Geese] are not subject to nature's regulation; that is, their populations are not controlled by the carrying capacity of their environment, by competition or predators, or by the impact of human activities such as hunting or habitat encroachment" (Anonymous, 2013, p. 1). Truth or rant, this could also apply to Canada Geese.

It is also questionable whether the local environment establishes a limit to the growth of goose populations.

In their study of the carrying capacity of marshes for moulting geese in Greenland, Madsen et al. (2011) directly linked the condition of the marshes to carrying capacity, and certainly, few ungrazed areas and the loss of the marsh platforms are evidence of excessive numbers of geese on our estuaries. It is possible that the number of birds the area can support is limited by the condition of the estuarine marshes. These marshes are used year-round, and the greatest numbers of geese coincide with the highest levels of primary productivity on the estuaries, i.e., during the moult. Most upland sites are vacant at this time.

In a study of freshwater wetlands in Ohio, Brasher, Steckel, and Gates (2007) found that energetic carrying capacity for waterfowl declined each year by more than 80% between autumn and spring migration, a direct result of granivory (i.e., feeding on seeds and grains) and vegetative decomposition. While we have not investigated precisely when most grubbing of marsh platforms occurs, we expect the overwintering and spring migration periods are key times. Estuarine marshes are critical habitats when other areas are frozen.

Carrying capacity may be more broadly limited by the availability of freshwater, which in our area is restricted to select streams, springs along the foreshore, freshwater marshes, lakes, ponds, and estuaries. Although we have not classified estuaries as a freshwater habitat, they are of course linked to streams and also

have a freshwater lens on their surface that diminishes towards the marine environment. Canada Geese need freshwater for drinking and depend on these habitats for critical life stages, such as nesting and moulting. Barker, Cumming, and Darveau (2014) found that the abundance and distribution of most waterfowl species can be predicted most frequently by hydrological variables.

Yet, outside of the moulting period, our estuarine sites are part of larger 'habitat complexes' that include nearby meadows or lawns. Rarely are most suitable sites occupied or all available food eaten. Out of 342 sites identified as available goose habitat, geese were observed on only 232 of them. Flocks were frequently concentrated on a relative handful of sites. Sometimes geese were clustered on one site, but avoided a nearly identical site nearby, for no apparent reason. With an abundance of vacant potential habitat, it is unlikely that we are nearing a regional carrying capacity. Similarly, despite known problems with Canada Geese and a harvest surplus in excess of 20%, Puget Sound was declared to be well below carrying capacity (USDA 1999).

And, if carrying capacity were linked to estuarine ecosystems, the poor condition of the marshes should be suppressing carrying capacity, yet there is some evidence to the contrary, i.e., decreasing numbers of nests at the LQRE which is rehabilitating, and increasing numbers at the ERE where restoration is solely

needed. (Keep in mind that numbers of nesting birds at the LQRE are probably dropping due to the effect of addling, more than the condition of the estuary.)

To determine whether the condition of estuarine marshes is limiting or even influencing carrying capacity, we would need to track geese 24/7 using telemetry, calculate how much time they spend in each habitat, and analyze and compare the composition and nutritive quality of the vegetative resources in each habitat.

Additionally, the notion that reducing populations below a specific number will solve our problems, is ripe with complexity. If the 'too many geese' problem is related to 'too much goose habitat', then we may in fact need to significantly reduce the carrying capacity of non-estuarine habitats to revive estuarine ecosystems - by modifying grassy and ponded areas, altering farm practices, and implementing other control techniques. Yet there is a risk that reducing habitat elsewhere may inadvertently increase use of the estuaries.

Price (1999) noted, "carrying capacity is supposed to be a natural limit that regulates the growth of populations, but its existence is hard to document apart from its presumed effect (p. 18). Less complex, but not uncomplicated, is the concept of social carrying capacity.

13.2 Social Carrying Capacity



Canada Goose in Parksville Community Park

In most Canada Goose management strategies and plans, population targets are based on social carrying capacity, not biological carrying capacity. This is sometimes called 'wildlife acceptance capacity' or 'cultural carrying capacity', and is the maximum population that is acceptable to people (USDA 2004). Here, it is clear that Canada Geese have adversely impacted our communities in many ways, affecting the tourism and agricultural sectors, sports and recreation, and the overall quality

of life of community members. With tourists saying they'll never return because of the prevalence of goose feces; locals refusing to swim, walk and golf in favourite areas; and potential risks to the health of children and the elderly, it is clear that local goose populations have reached intolerable levels. Some of the more vociferous community members have stated that the geese are invasive and populations should be reduced to zero. We have likely exceeded our social carrying capacity for Canada Geese.

13.3 Alternatives to Carrying Capacity

Disagreement over the concept of carrying capacity engendered the Limits of Acceptable Change (LAC) and other measures that may be useful in assessing environmental conditions and the socioeconomic tolerance for Canada Geese. Developed by the U.S. Forest Service in 1985 (Cole & Stankey 1997), the LAC assessment was founded on the notion that capacity is a relative concept rather than an absolute number (Ashor 1985). LAC were designed as compromises, to balance conflicting recreation and wilderness protection mandates (Brunson 1997). As such, the assessment involved determining which conflicting goal would ultimately constrain another, identifying standards - absolute limits defining minimally acceptable conditions (not desired conditions or unacceptable conditions), monitoring to determine whether the standards

have been met, and developing appropriate management prescriptions for when the standards are not met (Cole & Stankey 1997).

Using LAC, Canada Geese would be managed in accordance with limits set for the region's estuaries, farms, community parks, school grounds, golf courses, and so on. The extent of Lyngbye's Sedge - Herbaceous Vegetation community, diversity and abundance of dabbling ducks, and the duration juvenile salmonids are in the estuary are some indicators that may be considered for mid-island estuaries. In wilderness situations, 'acceptable' future conditions are typically those within the natural historic or pre-settlement range of variability, whereas non-wilderness situations tend to require a new kind of sustainable condition (Brunson 1997). Ideally, LAC for sedge

communities would reflect vegetative conditions known to exist in the 1970s (Dawe & Lang 1980; Kennedy 1982; Dawe & White 1982, 1986), prior to the first records of breeding geese. However, it may be necessary to contemplate a new sustainable condition, considering losses to marsh platform, climate change, and other conditions that are irreversible in the short-term.

In 2012, LAC were redefined for Ramsar-designated wetlands as 'Limits for Defining Change in Ecological Character' (LDCEC). Article 3.2 of the Ramsar Convention requires countries to monitor and report if the ecological character of a Ramsar wetland has changed; LAC/LDCEC have been used by several countries for notification and to trigger additional higher-level management (Ramsar 2012; Rogers et al. 2013). An Australian

example is available at <http://www.environment.gov.au/system/files/resources/0c0185c8-8e0b-4194-a6ca-d0f795bef410/files/21-ecd-ch-4-5.pdf>. (See also Table 13-1)

Table 13-1. Examples of Limits of Acceptable Change for Gippsland Lakes Ramsar Site, Australia (Australian Department of Sustainability, Environment, Water, Population and Communities 2010).

Indicator for critical component/process/service for the LAC	Relevant timescale	Limits of acceptable change	Spatial scale/temporal scale of measurements	Underpinning baseline data
Abundance and diversity of waterbirds	Medium Term	The absence of any of the following species in five successive years will represent a change in character: [list of species]. (one of several criteria)	Sampling to be undertaken at least twice a year (during summer) at stations containing favourable habitat.	Records for these species are reliable. Birds Australia and Department of Sustainability data can be used to assess this qualitative LAC.
Marine sub-tidal aquatic beds	Long Term	Total seagrass extent will not decline by greater than 50% of the baseline value of Roob and Ball 1997 (i.e., 50% of 4,330 ha) in two successive decades at a whole of site scale. (one of several criteria)	Sampling to occur at least twice within the decade under consideration. Baseline mapping against which this LAC can be tested is within Roob and Ball 1997.	Recent quantitative data describes seagrass condition at various sites but over a limited timeframe. There is no available seagrass condition data prior to listing.

A similar assessment, 'Thresholds of Potential Concern' (TPC) was used in a South African national park to manage invasive plants (Southwestlearning.org n.d.). TPC are based on the premise that ecosystems are in perpetual flux, and that the eradication of all invasive or problem species is neither feasible or practical. TPC define the envelope of conditions within which desirable ecosystem states may fluctuate (Southwestlearning.org n.d.). Rates of movement towards or away from thresholds indicate how the ecosystem is tracking, and provides a measure of its resilience (Rogers et al. 2013). TPC for Kruger National Park in South Africa are shown at http://www.southwestlearning.org/download_product/812/0 (See Table 13-2 for an example).

Table 13-2. An example of Limits of Acceptable Change for Kruger National Park, South Africa (Whyte et al. 1999 in Southwestlearning.org n.d.).

Criterion	Measure	Within-zone TPC	Whole-park TPC
Erosion/piosphere	Bare ground index	When affected area > unaffected area (i.e., index > 50%) or when affected area < 5% (latter to guarantee some eroded habitat in any zone)	When aggregated whole-park bare ground index less than 2.5% or > 25%.

More recently, LAC were used in concert with TPC to assess wetland condition and vulnerability in Australia. (Rogers et al. 2013). Compared to LAC, TPC trigger management intervention at a finer scale. Roger et al. (2013) identified 4 ecological values with which to set LAC: vital habitat, representativeness, distinctiveness, and diversity (See Table 13-3 for an example). Indicators included integral vegetative communities, certain threatened and endangered species, species representing different guilds of waterbirds, and specialist fish species, among others. TPC were derived from the status of the asset under management and known threats to the condition of the asset (See Table 13-4 for an example). A 'red-amber-green' choropleth map was produced and scored to show the status of each indicator - red meaning the threshold had been crossed (Rogers et al. 2013).

Table 13-3. An example of Limits of Acceptable Change for Lowbidgee wetlands, Australia (Rogers et al. 2013).

Value	Component or process	Limit of acceptable change
Diversity	Supports extensive area and diversity of wetland habitat including Black Box woodland, lignum shrubland and spike rush	Reduction in extent of Black Box woodland and lignum shrubland by 20% each, reduction in extent of spike rush by 20% (measured post-flood against previous post-flood benchmarks)

Table 13-4. An example of thresholds of potential concern for Lowbidgee wetlands, Australia (Rogers et al. 2013).

Selected value/ component	Threat/condition indicator	Threshold of potential concern	Goal
Diversity/Black Box woodland, lignum shrubland and tall spike rush	Clearance of Black Box woodland, lignum shrubland and spike rush	Any loss to clearance of Black Box woodland, lignum shrubland, and spike rush	Restoration of Black Box woodland, lignum shrubland and spike rush

Chapter 14 - Strategic Direction

Highlights

This chapter provides recommendations for management with abridged supporting rationale. It outlines general responsibilities and timelines, as well as deliverables, targets or indicators specific to each objective or action item.

14.1 Responsibilities

Primary Objective:

1. Urge CWS to lead a regional working group that adequately funds Canada Goose management plans and action items.

A key question is, who is responsible for goose management? Responsible managers will commit sufficient resources to implement long-term solutions, as failing to do so will inevitably result in reversing the successes gained through the addling program and other initiatives.

Managers include those who have regulatory responsibility for Canada Geese, i.e., CWS and MFLNRO, as well as landowners and land managers. As the problem of local overabundance stems from introductions or relocations of geese from other areas already experiencing adverse impacts, the agencies that initiated and implemented these hold most of the responsibility for damages today. Responsibility also rests on the non-profit organizations that urged governments to move geese to sites on Vancouver Island, although volunteers and lobbyists are mostly unaccountable. Several municipal leaders and others have suggested a class action lawsuit be launched to require senior governments to take action and to pay for damages caused by excessive numbers of geese. In the U.S., federal and state governments have led and implemented culling initiatives, enabled provision of geese to food banks, and paid for agricultural damages, among other things. Both leadership and just compensation packages should be contemplated by senior governments here. Nonetheless, community leaders and their staff have effectively created urban

meccas for Canada Geese, with grassy areas juxtaposed with settling ponds and beaches. The City and school district administrators have refrained from taking bold steps to keep geese out of play areas.

Ideally, CWS and MFLNRO will lead a regional working group in MABR that dedicates and pools senior and local government resources and leverages monies from other stakeholders (e.g., estuary property landowners and land managers, golf course managers, farmers) to address the full breadth of problems caused by geese. In other B.C. jurisdictions, local governments, non-profit organizations, and other stakeholders are leading localized or piecemeal initiatives, whereas geese are not constricted by jurisdictional boundaries. Senior government leadership of multiple regional groups will allow for cohesive, seamless management efforts, as committed staff familiar with goose impacts, management options and their responses minimize trial and error initiatives and polarization within communities.



Captive geese at the Englishman River estuary, July 2010.

14.2 Population Objectives

14.2.1 Population Abundance

Although we have learned a great deal about the abundance of our regional Canada Goose population and subpopulations, there is more work to do before we can develop accurate model projections. Collectively, the multiple datasets examined in this study exhibited weak (i.e., statistically insignificant) and sometimes conflicting population trends. The lack of a clear linear trend was attributed to a number of factors, such as shifting spatial coverage and survey effort, an insufficient period of data collection, and a poor understanding of other contributing factors. The Coastal Waterbirds Survey and Christmas Bird Count, external datasets produced by volunteers, showed weakly increasing or possibly cyclic trends. In the absence of a statistically significant weight of evidence, we cannot report that Canada Geese in the region are increasing or decreasing at a given rate.

In recent years, the size of our regional overwintering population has remained relatively static, showing no statistically significant inter-annual differences since 2011. The total number of Canada Geese observed during routine population surveys in the overwintering season ranged from 992 to 1,285 in 2012 and 2013, respectively. However, a winter count in 2014 documented just over 1,500 geese. While the peak observed

during the winter of 2005-06 (2,061 geese) remains unrivaled, this higher-than-usual winter count may be of management concern. Only continued population monitoring can determine whether this crest represents a new trend upwards, a peak in a recurring cycle, or a standalone high. In 2014, moulting populations were also high, reaching nearly 1,200 birds during routine population counts, and more than 1,500 birds during the moult count when the southeast shoreline of Nanoose Bay was included. Notably, Canada Goose surveys in January and July each year provide the best snapshot of the overall size of our regional population and its effect on specific sites.

The highest count for geese in the nesting season was 446 in 2013, based on routine population counts conducted over only two years. (Routine population counts during the nesting season were only conducted for 2012 and 2013.) This value probably represents the bulk of the breeding and non-breeding local resident population. However, it neglects undetected nesting birds and moult out-migrants. Should addling crews consistently survey both breeding and non-breeding geese on and near the nesting grounds, a trend for local resident populations might emerge.

In recent years, our breeding subpopulations have fluctuated

in different directions, likely contributing to the lack of an overall population trend. At the LQRE, the number of nests have declined, and densities of birds during the moulting period have remained flat. At the ERE, densities of moulting birds have increased. At the ERE and NBE, nest numbers have also increased. This suggests that we are, in the main, losing ground. For those who have partaken in the struggle to reduce Canada Goose populations, it is important to remember that twelve years of egg addling have prevented at least 2,088 birds from becoming breeding adults. Given an average clutch size of 5.8 eggs, the addling program has prevented more than 6,000 additional eggs *per year*. (This assumes that half the birds are female, and that they nest locally. Many factors are disregarded in the calculation, such as mortality rates, immigration/emigration etc., as described in Chapter 10.3, Life History by the Numbers.

14.2.2 Population Structure

One of the most important findings of our study was to discover that moulting birds were not necessarily 'resident', i.e., they encompassed a variety of migrant types, including visitors from the U.S. and Alberta, and from other parts of Vancouver Island and the Lower Mainland. Despite strong site fidelity, Canada Geese are on the

move, whether due to climate change, habitat preferences and availability, or some other force. Due to these voluntary movements, and forced movements through translocations, a local flock of Canada Geese at nearly any time of year probably represents a genetic fusion of North American subspecies. Even the purity of the red-listed Dusky Canada Goose is in question; it was introduced to Washington in the 1950s, and populations there are now considered to be of three types: migrants, residents, and hybrids.

Currently, CWS sets regional (i.e., province-wide) population objectives for temperate-breeding Canada Geese, meaning that the same objectives apply to Canada Geese across B.C. Population objectives are the same for areas that have always supported breeding geese and those that have not. They are the same whether management units have 2000 hunters or 200. Population objectives should be based on the capability of habitats to support them. Consideration should also be given to sociocultural limitations, such as the number of hunters or monies available to control overpopulations.

Notably, no Dusky Geese were observed in the region during our study. However, Dusky Canada Geese could be protected in Canada where they are known to occur, by requiring hunters to learn to properly identify them, as is the case in

Washington and Oregon. Related to the management of distinct subpopulations is the relevance of B.C. and Canada's participation on the Pacific Flyway Council, a self-proclaimed policy and regulation-setting body. Canada does not recognize or use the Pacific Flyway subspecies for management purposes, nor the subspecies-specific Canada Goose management plans that have been developed. Canadian regulatory definitions and programs are inconsistent with those across the border. Canada's representation on this Council should be clarified or made explicit, and a more thorough integration of Canadian and U.S. policies and regulations considered.

It is surprising to many that Canada Geese have not been formally evaluated for overabundance. CWS biologists have justified this by saying that an overabundance designation would have little effect due to insufficient numbers of hunters and access to hunting areas. Given that 1) resident Canada Geese are designated as 'overly abundant' in parts of the U.S., 2) hunter numbers and goose harvests have risen in several provincial management units in recent years, 3) survey respondents have expressed interest in hunting or allowing hunters access, and 4) the overabundance designation can be applied to geese in some areas while excluding other areas, this evaluation should

proceed. And, it should proceed for temperate-breeding geese only, rather than the entire species.

It is important to apply the lessons learned in the subarctic estuarine marshes. Once goose herbivory was deemed a significant conservation issue, and it was recognized that population sizes and the survival rate of adult goose populations were detrimental to estuarine ecosystems, the *Migratory Bird Regulations* were amended and new tools invoked to help manage overabundant species (CWS Waterfowl Committee 2013). As the additional hunting opportunities afforded the 'overabundant' designation quickly halted the growth of Greater Snow Geese populations, it is plausible that similar efforts would work in concert with egg addling to reduce Canada Geese populations. If the designation, and the tools that accompany it prove insufficient, then the regulations should be amended to invoke new tools, such as bait and capture, and mechanisms that allow for greater use of geese as a renewable resource.

Snow Goose managers have recognized that goose populations have not decreased (only stabilized) since the overabundance measures were invoked, that geese adapt quickly to different management measures, and that new approaches must be considered (Anonymous 2013). We should examine their recommendations, and even consider integrating

Population Objectives:

2. Urge CWS to amend the process to set population objectives for temperate breeding geese.
3. Urge CWS to designate temperate-breeding Canada Geese as overabundant.

certain Snow Goose and temperate Canada Goose management initiatives (e.g., communication platforms) to take advantage of economies of scale (see Anonymous 2013 at http://www.ec.gc.ca/nature/FB11C691-2F04-4E8F-B4BF-88B5441BD6F3/900_SnowGeeseinQuebec2013-2018ActionPlan_e%20-v6%20FINAL-s.pdf).

Coastal estuarine marshes are too rare and valuable to be shortchanged by protecting animals that are common, widespread, and in this case, of a bloodline that was mostly introduced to the region.

14.3 Spatial Objectives

14.31 Distribution

Our study identified a number of Canada Goose hotspots, but none supported greater, year-round numbers than our mid-island estuaries. Across all seasons, population surveys conducted from 2011 through 2014 indicated Canada Goose counts were highest at estuarine sites (i.e., Craig Bay/CCE, LQRE, NBE and ERE sites). The highest year-round densities of geese occurred on sites with freshwater. (Recall that estuarine marshes are also freshwater sites.) Goose densities were also high on City of Parksville sites. These areas deserve focused management attention.

Canada Geese concentrate on the estuaries during the nesting season and for many pre-nesting rituals (e.g., jockeying for nesting territories). During the moult, Canada Geese were found almost exclusively in estuarine, freshwater, and marine habitats. During the fall and winter, geese used estuaries, agricultural fields, and greens/lawns and meadows - particularly those associated with freshwater.

Introduced birds were the catalysts for escalating goose populations, and abundant conservation lands and urban goose habitats promoted residency and entrenched the current population size and distribution. Disturbances from people and dogs, hunting pressure, agricultural practices, weather, and climate change all influence goose mobility, yet site fidelities keep many of them close to home.

Mid-island estuaries, and the LQRE, ERE, and CCE in particular, have borne the brunt of Canada Goose impacts. They require restoration to enhance the functioning of marsh ecosystems and reverse some of the impacts from Canada Geese. This strategy outlines basic restoration needs ahead of a more comprehensive restoration plan. Implementation of Canada Goose management plans are essential to avoid frivolous restoration efforts, and protect remaining sensitive ecosystems from further damage.

Spatial Objectives:

4. Develop management plans that are specific to each management zone.

Spatial Objectives, LQRE:

5. Commit to a long-term egg addling program.
6. Promote hunting.
7. Explore limited, coordinated hunting on the LQRE.
8. Attach transmitters to a subset of LQRE-nesting geese and monitor by satellite telemetry.
9. Encourage farmers to pursue and use kill permits outside of hunting seasons.
10. To maintain existing wetlands, including seasonal wetlands, suggest alternate habitat modifications to farmers and others.
11. Maintain and monitor LQRE exclosures until the estuarine marsh has recovered. Apply experimental restoration techniques as necessary.

14.32 Management Zones

Based on the year-round distributions of LQRE, ERE, and CCE subpopulations, three management zones have been identified.

1. LQRE zone: Includes the LQRE, Town of Qualicum Beach west to Qualicum Bay, parts of French Creek and West and East Errington, south to Sunnymere fields and Hamilton Marsh (Figure 14-1).
2. ERE zone: Includes the ERE and City of Parksville, and parts of French Creek, West and East Errington (Figure 14-2).
3. CCE zone: includes the CCE and Craig Bay, Nanoose Bay, and west Lantzville. The CCE zone overlaps the ERE zone in the ERE, where CCE-banded birds are known to nest, and in east Errington (Figure 14-3).

Little Qualicum River Estuary Zone

As the number of nests on the LQRE have decreased, and all LQRE-banded birds were huntable in our region, this cohort may be managed by egg addling, hunting, and kill permits. A long-term commitment to the egg addling program and a more concerted hunting effort (e.g., incentives to participate in the early autumn and spring hunts) should be considered. Opening the LQRE to hunting, similar to the limited opening on the Somass estuary in Port Alberni, could expedite the reduction of this subpopulation and reduce the costs of egg addling and efforts to encourage and coordinate hunting.

As half of LQRE-banded birds were either emigrants (39% of LQRE

birds) or Vancouver Island migrants (11%), any management plan associated with this cohort should be developed in collaboration with managers in other regions, Comox Valley and Campbell River in particular. To determine whether our addling adversely affects other areas, a sample of Canada Geese nesting on the LQRE should be collared, and preferably fitted with tracking devices, and their movements monitored after they have abandoned their addled eggs. Sex and age should be determined, if possible. Do the geese stay in the region or moult-migrate? How far do they travel? Hunters must be discouraged from taking these birds until sufficient data have been collected. In 2012, the CWS initiated a study of Canada Geese in Toronto, using satellite transmitters to track their movements (Hughes 2012); this effort may be a suitable model to emulate.

To discourage drainage of wetlands, alternative habitat modification measures should be recommended. It may also be necessary to protect wetlands with bylaws and policies, and/or to finance alternate modifications.

Exclosures on the LQRE must be maintained until Canada Goose numbers have decreased and vegetative productivity within and outside of exclosures is similar. Additional planting and large woody debris (LWD) may be required.

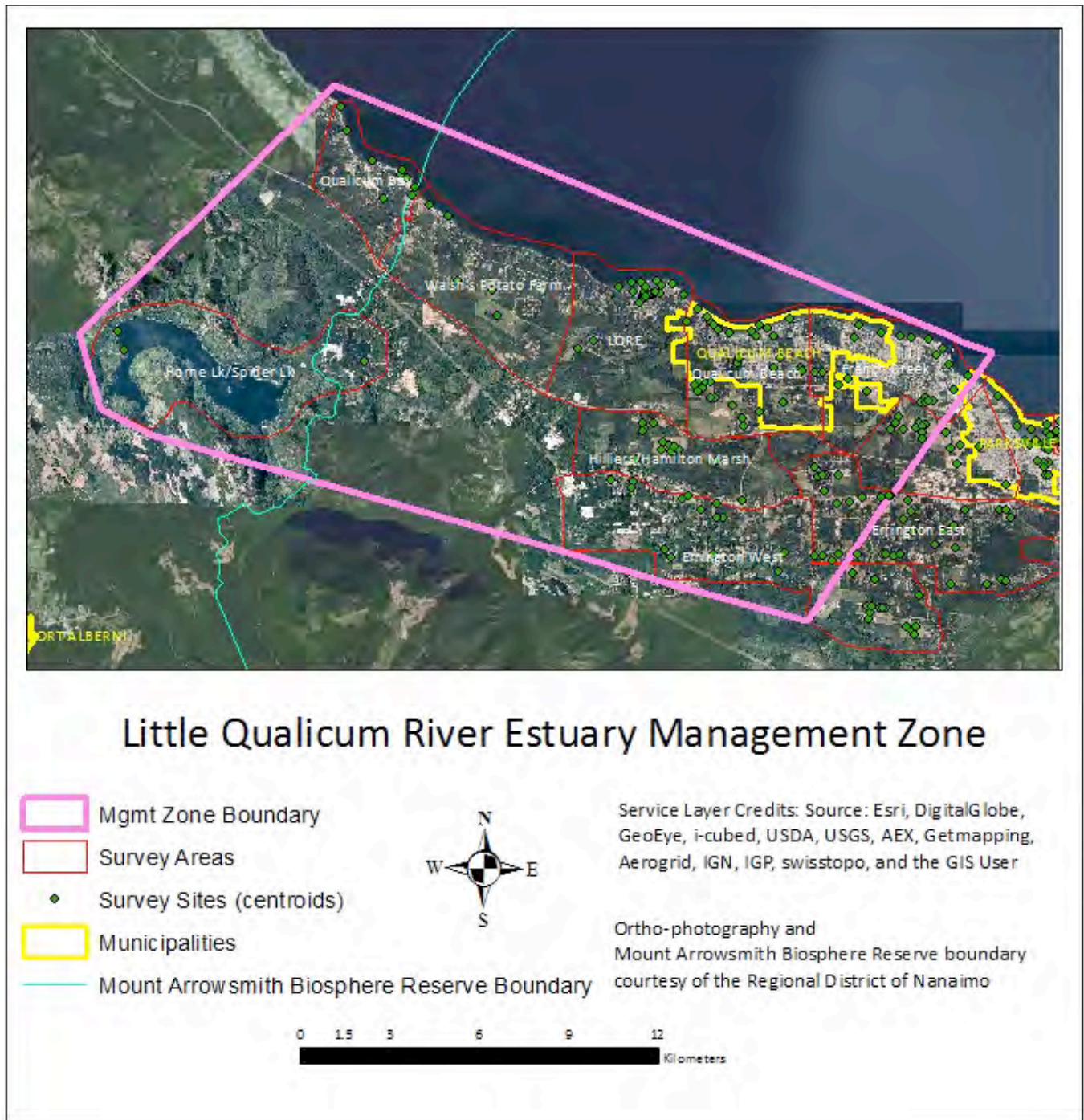


Figure 14-1. Little Qualicum River Estuary Management Zone

Spatial Objectives, ERE:

12. Capture and cull as many birds as possible during the moulting period.
13. As an alternative to culling, organize several large-scale hazing events to push geese into huntable areas.
14. Continue an egg addling program until the population is diminished.
15. Promote techniques to create goose unfriendly habitats and facilitate sharing of experiences and expertise.
16. Reduce exposure of children and seniors to goose feces.
17. Begin restoration of the ERE, using a variety of experimental techniques.

Englishman River Estuary Zone

The number of nests and moulting birds on the ERE have risen in recent years despite increased addling efforts. At least 45% of ERE-banded birds were local residents, and two-thirds of them were not huntable. Most stayed within the City, ERE, CCE and Craig Bay. Therefore, egg addling and hunting are insufficient to slow the growth of this cohort.

A roundup and cull is the most efficient way to decrease this subpopulation, with follow up to manage returning non-breeding geese, moult migrants, and in-migrants. A roundup during the moulting period is easier than attempting to capture geese when they can fly, and will remove resident as well as non-resident nuisance birds.

An alternative to culling is organized hazing into areas where the geese can be hunted. While this may be more acceptable to people, hazing geese from the estuaries and the City into areas that can be hunted will require extensive coordination, and cooperation from city staff, hunting groups, farmers, and other landowners. To achieve a significant reduction in the ERE subpopulation will likely require several such events. It will be challenging to sustain the interest and support needed.

The logistics of both methods are complicated and public acceptance will undoubtedly be contingent upon community members understanding the rationale and follow up for such control measures. If a cull is planned, policy changes to allow

the birds to be used for food will increase public acceptance.

The use of goose unfriendly habitats should be promoted, and expertise shared through workshops or a website. Goose avoidance of the new Parkville Community Parks sports fields should be formally monitored; if the grass-on-sand formula is successful in deterring geese over a period sufficiently long to be cost-effective elsewhere, it should be replicated on all fields used by young children.

Until a large reduction in Parkville's goose population is realized, a greater effort should be made to reduce the exposure of children and senior citizens to goose feces. This may require hazing on school fields, scheduling sporting events for children on the fields at Parkville Community Park, and washing walkways near facilities frequented by seniors, for example.

The ERE is heavily degraded and existing exclosures are doing little to restore it. This estuary requires a variety of bold experimental restoration efforts, such as large woody debris/exclosure structures to protect remaining stands of preferred species, structures to capture and deposit pulses of sediment from the river to rebuild the marsh platform, and planting in denuded areas with sufficient substrate. However, without a substantial decrease in goose numbers, most techniques are doomed to fail.

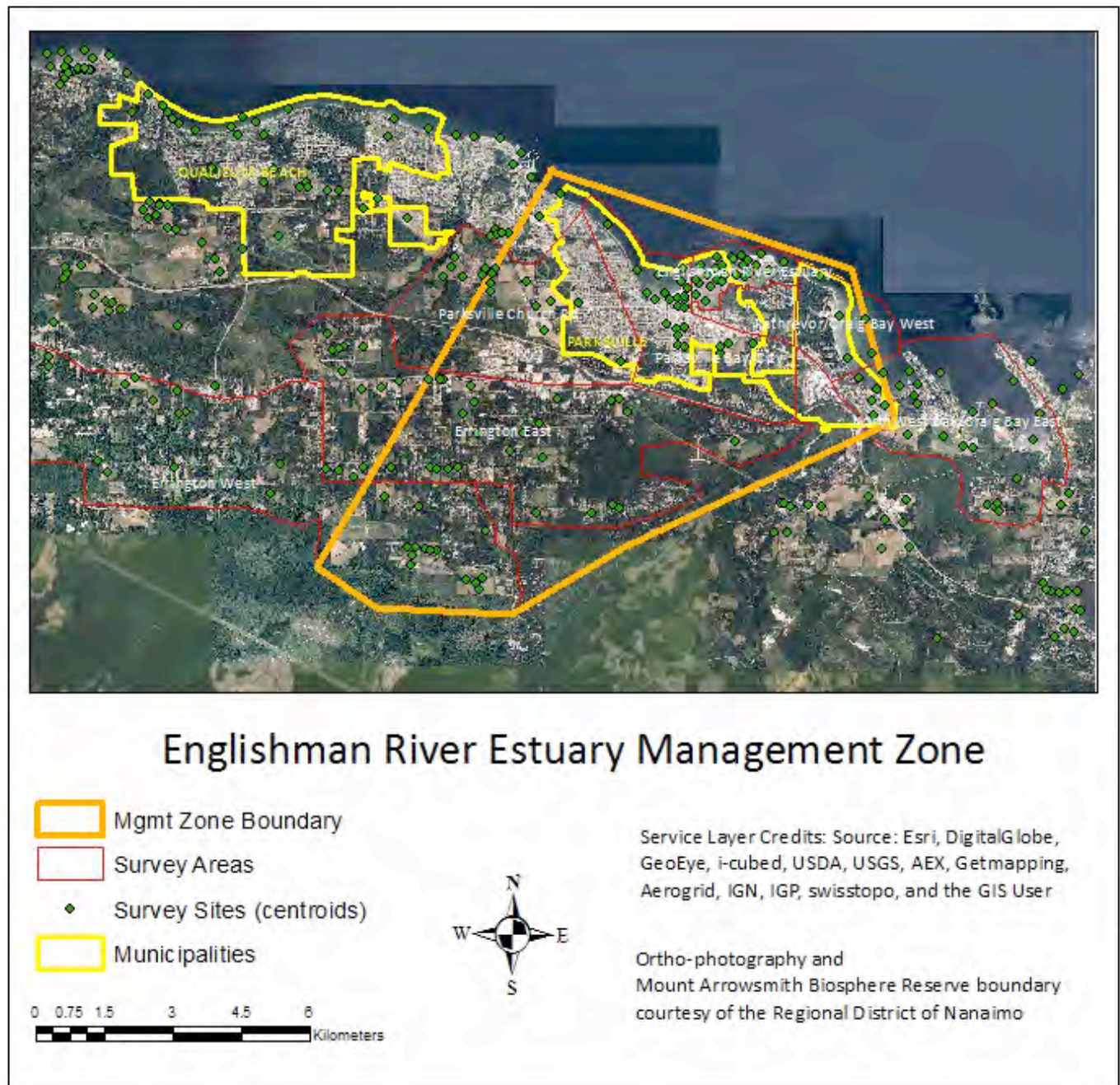


Figure 14-2. Englishman River Estuary Management Zone

Spatial Objectives, CCE:

18. In concert with ERE initiatives, plan a cull during the moulting period.
19. In concert with ERE initiatives, as an alternative to culling, organize hazing events to push geese into huntable areas.
20. Expand the egg addling program to encompass more areas and stakeholders.
21. Promote hunting.
22. Encourage limited, coordinated hunting of Canada Geese on the NBE.
23. Encourage hazing in non-huntable areas during hunting seasons.
24. Encourage affected farmers to pursue kill permits outside of hunting seasons.
25. Promote techniques to create goose unfriendly habitats and facilitate sharing of experiences and expertise.
26. Install goose exclosures on the CCE.

Craig Creek Estuary Zone

Mark-re-sight efforts have shown there is some mixing between CCE and ERE-banded birds, particularly on the estuaries. Fourteen 'T' birds nested on the easternmost part of the ERE, and one was paired with an ERE 'M' bird. Yet, this cohort was more widely distributed than the other two, and much more so than the ERE-banded birds - extending its reach to the NBE and Nanoose Peninsula, and to many farmlands in Nanoose Bay and Errington. It also had the highest proportions of moult migrant (15% of all CCE-banded birds), moult-winter resident (6%), and LR+ (27%) migrant types, suggesting its overall distribution lies beyond MABR boundaries.

Because CCE birds are already nesting on the ERE, culling ERE-banded birds without taking similar action at the CCE would likely result in more CCE birds using spaces vacated by ERE birds and an expansion of this subpopulation. Similarly, hazing to huntable areas would require simultaneous efforts in both jurisdictions. However, a broad distribution suggests that reducing this cohort will require greater diligence over a longer period, and more collaboration with managers outside of the region.

Here, a more comprehensive range of controls is necessary. The addling program should be expanded by enlisting the help of communities to find nests, ensuring the small outer islands are checked, promoting the use of addling permits among farmers, and collaborating with all permittees to

get a more complete picture of nesting CCE birds. Encouraging landowners to allow hunting, promoting hunting as an important means of control, and opening the NBE to hunting for short periods is recommended. Hazing geese out of non-huntable areas during hunting seasons can be encouraged to increase takes. Practices that create goose unfriendly habitats should be promoted, particularly along the periphery of Craig Bay.

The CCE is degrading, with overgrazed and denuded areas and some loss of the marsh platform. Goose exclosures, similar to those constructed at the LQRE and ERE, should be installed on the CCE estuarine marsh to protect remaining vegetation and the marsh platform, and to facilitate restoration of degraded areas.

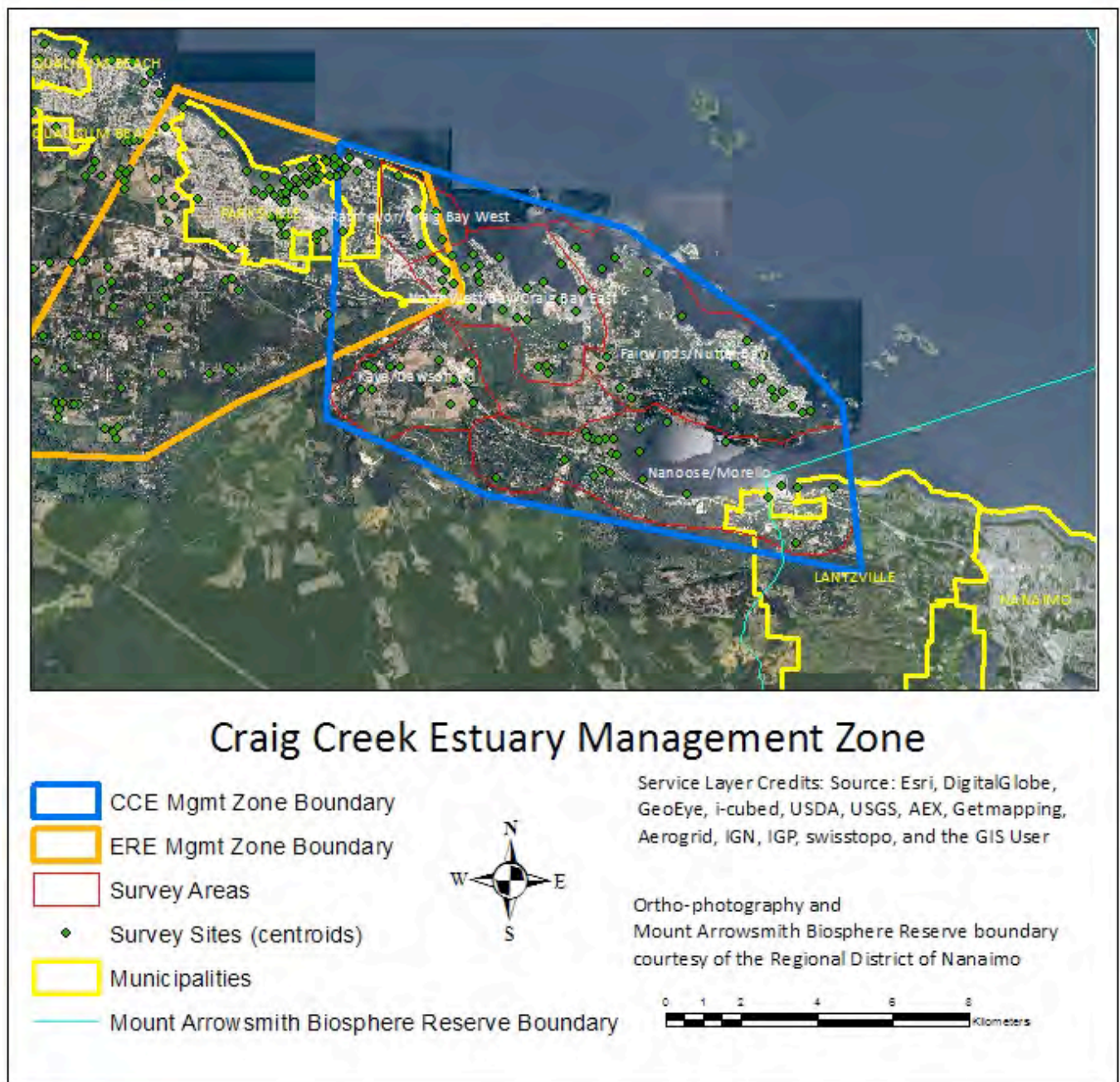


Figure 14-3. Craig Creek Estuary Management Zone

14.4 Temporal Objectives

Temporal Objectives:

27. Protect estuarine marshes year-round, with exclosures, fencing, LWD structures, and hazing until goose populations are substantially diminished.
28. Round up Canada Geese during the moulting period and transfer them to an appropriate farm or culling facility.
29. Capture Canada Geese at their nests for research purposes or to cull them.
30. Organize hunts on the LQRE and NBE during the spring hunting season.
31. Haze birds into huntable areas during the early autumn hunting season.
32. Promote hunting of traditional migrants during regular hunting seasons.

Canada Geese use the estuaries year-round. Marsh damage is a cumulative effect, stemming from large numbers of grazing geese over the summer growing season and moulting period. Overgrazed channel edges cause invertebrates, fish, and other species to seek overstream vegetation elsewhere, if they can find it. Then, outside of the summer months when above-ground vegetation is least available, resident and migratory geese grub the roots and rhizomes, damaging the marsh platform and reducing the area where vegetation can grow. Inputs to the detrital food web are reduced, and overall nutrient cycling is disrupted, affecting local and linked habitats. Channels fill with sediment or are flushed away with the tides. This cycle repeats, year after year.

Most terrestrial habitats, such as urban parks and agricultural fields benefit from an annual reprieve during the moulting season and the peak of the vegetative growing season. Estuaries only experience a reprieve of sorts after the moulting period, when flocks tend to forage elsewhere. Still, they return to roost, and will feed if other areas are exposed to hunting pressure. Large flocks of migrants arrive in the fall, and some stay for the winter. By the time geese begin to nest in the spring, the estuaries have had little time to recover. Therefore, reducing goose populations throughout the year is necessary to prevent further estuarine

damage.

Although we have identified 14 different migrant types, these can be amalgamated into three for management purposes: 1) full and part-time local residents (LR, LR+, MWR, a few M), 2) in-migrants (MM; M that revisit the region, including traditional migrants that stop in the area and move on; RJ; DJ and E that return as they reach breeding age), and 3) out-migrants (DJ, E, and M that do not return).

Management efforts should focus on reducing numbers of migrant types that cause the most damage in the area, namely full and part-time resident Canada Geese and in-migrants, and on preventing them from breeding and otherwise lingering on the estuaries and other areas where they are unwelcome. To target most non-breeding residents and in-migrants, and breeding residents that stay near the nesting grounds, population reduction should occur on the moulting areas. To target other breeding residents and potential offspring, population reduction must occur on the nesting grounds.

Roundups are best accomplished during the moult when birds cannot fly, and other methods, such as hunting and hazing are inappropriate at this time.

LQRE birds captured at the nest may be fitted with marks and/or transmitters and released. Only some birds can be captured at the nest by stealth and salmon

nets; the most aggressive will defend the nest and are easier to capture, while timid birds will fly away. As the less dominant birds are generally the least aggressive and most likely to leave the area after addling, other techniques such as trapping may need to be considered.

Hunting on the LQRE and NBE is best accomplished late in the spring hunting season, to take a

maximum number of breeding geese on their territories. Hazing into hunting areas is best accomplished during the first autumn hunt, when the majority of target birds are still in the area. Later hunts to target large flocks of traditional migrants are also necessary to reduce pressure on agricultural lands and some golf courses.

14.5 Social Objectives

Social Objective:

33. Examine health risks to people, livestock, and pets.
34. Urge senior governments to allow culled geese to be used for food.
35. Develop a communication protocol that includes interaction with other Canada Goose management committees or working groups and naturalist groups.
36. Engage stakeholders and the public regarding goose impacts and control techniques.
37. Urge CWS to make permits for controlling geese easier to obtain.
38. Consult and collaborate with First Nations.

In all management zones, there must be follow-up on the risk assessment commissioned by CWS (see Chapter 5, The Need for Action), to address important knowledge gaps identified by Fraser and Fraser (2010) on behalf of the Canadian Cooperative Wildlife Health Centre. Suggestions included improving traditional water quality indicators, and mitigating risks through fecal waste management and other strategies. They also recommended that the CWS invest in monitoring and research to develop an evidence-based risk assessment, and form a working group to develop national standards for the management of peri-urban goose populations.

While CWS should lead this effort, Island Health and Vancouver Island University could be encouraged to test shorelines near resorts as well as farm ponds, and frequently used terrestrial sites that attract geese (e.g., beach sand, grassy play areas) for harmful concentrations

of bacteria. In addition to helping assess risk to people and livestock, this is important to allay fears regarding the vulnerability of dogs used in hazing programs.

As other non-hunted wild game are consumed in Canada, and non-hunted migratory birds are donated as food in the U.S., it is without merit that senior government legislation and policies require or encourage managers to dispose of edible goose carcasses. CWS' concern that allowing birds killed under permit to be eaten would provide hunting opportunities outside of hunting seasons does not reconcile with the breadth of this problem nor the agency's assertion that there are fewer hunting opportunities due to a dearth of hunters and sites to hunt. An inspection system with standards for wild geese is needed and should be expedited to ease the burden on local governments and others concerned about opposition to managed kills.

Collaboration with other regions is necessary to discover where our part-time local residents are residing at other times of year, where our in-migrants are coming from, how many out-migrants our region is producing and where they are going. Sharing of management techniques and outcomes is also important.

Conversations with stakeholders prior to and during the development of this strategy have indicated the value and importance of meeting community needs, as well as ecological needs, with each management plan. Additional community members should be surveyed to identify other goose-related problems, to quantify damages and spending on controls, and to record attempts to control geese and the challenges and successes associated with those attempts. Impact surveys present a suite of opportunities for goose managers: to raise awareness of previously documented impacts and control techniques, to explore tolerances and attachments to Canada Geese, and to engage concerned citizens in open dialogue regarding the acceptability (e.g., humaneness)

of various methods of control.

Engagement should not end with a management plan. Rather, the management plan should promote ongoing communication. For example, hazing Canada Geese in most circumstances requires care and consideration for the birds and for other people. Given that Canada Geese are affecting conservation lands, urban and suburban areas, agricultural lands, etc., the availability and vulnerability of nearby habitats should always be considered. Hazing efforts should be coordinated with others who may be affected.

Survey respondents and others expressed some frustration over permitting processes to scare and kill geese. Not knowing how to apply for permits, applying too late to manage the processing time, having to provide extensive justification for permits, and trying to cope with permit restrictions (e.g., use of blinds) were some of the problems identified. Given the reports of expensive damage by Canada Geese, and the limitations of compensation programs, farmers require an easier road to controlling geese. Legislators and

farmers alike may benefit from a notification process similar to that used by the provincial government for straightforward changes in and about a stream (i.e., Section 9, *Water Act, 1996* applications) and Fisheries and Oceans Canada's Fish Protection Program. Applications are submitted online, and if the applicant does not hear from the Habitat Officer within a specified number of days, he or she may proceed without further ado.

Consultation and collaboration with First Nations groups and members are both important and valuable in goose management efforts. Canada Geese frequent reserve lands and adjacent estuaries and foreshores, and are likely to be a problem for First Nation communities. As these communities tend to have younger populations, health risks to children from goose feces must be considered. Importantly, First Nations have some latitude to manage geese by virtue of Aboriginal rights and title (e.g., through traditional harvesting rights and contemporary treaty agreements (See Chapter 4, Current Regulatory and Policy Framework)).

Guardians and CWS on the Little Qualicum River estuary, June 2014



Canada Geese are truly a part of Canadian culture. Honking geese during a TV interview in the lead-up to the 2015 federal election drew a spate of Tweets (CBC 2015, September 8). <http://www.cbc.ca/m/news/politics/canada-election-2015-trudeau-interview-geese-tweets-1.3220761>

14.6 Monitoring

Monitoring Objective:
39. Urge CWS to develop a monitoring program for temperate-nesting Canada Geese and a predictive population model encompassing multiple regions and interacting goose (sub)populations.

A standardized monitoring program, with indicators, will help assess the efficacy of management programs, better inform population models and predict future challenges and opportunities. A LAC and/or TPC program should be considered, that links monitoring to models to management actions to monitoring, in a cyclic fashion. In Ontario, the CWS has modeled the provincial temperate-breeding population and is using the results to improve management and monitoring programs (Hughes 2012). A similar program here should encompass all of the interacting goose (sub)populations on Vancouver

Island (and beyond, if necessary). Parts of this management strategy (e.g., 10.3, Life History by the Numbers) and survivorship estimates (from future University of Victoria math students, for example) offer a range of variables suitable for developing a comprehensive population model. When combined with estuarine monitoring, population thresholds can be determined, facilitating long-term management of geese and population numbers and trends that promote marsh rehabilitation. It is important that any monitoring program maintain consistency in its surveys and not rely on volunteers.

14.7 Timelines

This strategy focuses on solutions that provide long-term results, as most repetitive, short-term efforts (such as hazing) will prove largely inconsequential and costly. Although dialogue regarding controversial methods of control is necessary, the USDA (1999) showed that postponing lethal controls leads to substantially greater numbers of

geese being killed at a later date. Canada Goose populations grow, other methods are proven ineffective, and lethal controls are eventually implemented. Objectives should be incorporated into management plans and implemented within a 5-year period, with follow up as necessary.

14.8 Actions

Action items, in the form of management objectives, are prioritized with deliverables, targets, and indicators in Table 14-1.

Table 14-1. Management objectives.

Section	Objectives	Priority	Deliverables	Indicators/Targets
Responsibilities	1. Urge CWS to lead a regional working group that adequately funds Canada Goose management plans and action items.	1	Regional working group, management plans, funding agreements.	Amount of federal and leveraged funding for plans and programs, number of CWS and MFLNRO staff assigned to regional Canada Goose management
Population Objectives	2. Urge the CWS to amend the process to set population objectives for temperate-breeding Canada Geese.	1	Population objectives are set separately for temperate-breeding Canada Geese.	Population objectives are lower for temperate-breeding Canada Geese than objectives for migratory Canada Geese.
Population Objectives	3. Urge the CWS to designate temperate-breeding Canada Geese as overabundant.	1	Temperate-breeding Canada Geese are designated as overabundant.	Hunter use of new opportunities provided by an overabundance designation (survey), increase in numbers of hunters and harvested geese in the 1-5 and 1-6 management zones
Spatial Objectives	4. Develop management plans that are specific to each management zone.	1	Zone-based management plans	Number of management plans developed and implemented
LQRE Zone	5. Commit to a long-term egg addling program.	1	Egg addling program	Funding for program, recruitment is zero on LQRE
LQRE Zone	6. Promote hunting (LQRE zone outside of LQRE).	3	Consultation targeted to hunters, incentives for hunters	Increase in numbers of hunters and harvested geese in 1-5 and 1-6 management zones
LQRE Zone	7. Explore limited, coordinated hunting on the LQRE.	2	At least one hunt on the LQRE	Number of adults using the LQRE is reduced
LQRE Zone	8. Attach transmitters to a subset of LQRE-nesting geese and monitor by satellite telemetry.	3	Non-LR migrant types monitored over the seasons	Funding for satellite telemetry equipment and monitoring program, at least 5 birds tracked over 1+ years

Section	Objectives	Priority	Deliverables	Indicators/Targets
LQRE Zone	9. Encourage affected farmers to pursue and use kill permits outside of hunting seasons.	3	Farmers are protecting crops by controlling geese outside of the hunting season	Number of farmers using permits has increased, number of permits issued has increased
LQRE Zone	10. To maintain existing wetlands, including seasonal wetlands, suggest alternate habitat modifications to farmers and others.	1	Resources developed (e.g., fact sheet or brochure) re importance of wetlands and alternatives to drainage, distribution campaign	All wetlands are protected that were proposed for drainage because of geese, number of people contacted
LQRE Zone	11. Maintain and monitor LQRE exclosures until the estuarine marsh has recovered. Apply experimental restoration techniques as necessary.	1	Guardians maintain exclosures, monitor marsh recovery, and apply experimental restoration techniques such as anchored LWD.	Funding for maintenance and monitoring, vegetation and salinity data collected once every two years
ERE Zone	12. Capture and cull as many birds as possible during the moulting period.	1	At least one cull	Number of adults using the ERE is reduced
ERE Zone	13. As an alternative to culling, organize several large-scale hazing events to push geese into huntable areas.	1	At least one hazing/hunting event	Number of adults using the ERE is reduced
ERE Zone	14. Continue an egg addling program until the population is diminished.	1	Egg addling program	Funding for program, recruitment is zero on ERE
ERE Zone	15. Promote techniques to create goose unfriendly habitats and facilitate sharing of experiences and expertise.	1	Development of resources (e.g., webpages, guidebook), distribution plan (e.g., workshop, mailing list), ongoing sharing of experiences (e.g., dropbox, listserve, coordinator)	Number of goose unfriendly habitats in development, number of goose unfriendly habitats successfully created
ERE Zone	16. Reduce exposure of children and seniors to goose feces.	1	Mitigation plan	Plan developed and implemented, number of children and seniors protected from unnecessary exposure to goose feces

Section	Objectives	Priority	Deliverables	Indicators/Targets
ERE Zone	17. Begin restoration of the ERE, using a variety of experimental techniques.	1	LWD exclosures and sediment traps installed, sedges planted and protected from goose herbivory	Funding for installation, maintenance, and monitoring, number of LWD exclosures installed, species composition and forage height in exclosures in July, depth of sediment captured, occurrence of plants in sediment traps, number of sedges planted, survival of plants
CCE Zone	18. In concert with ERE initiatives, plan a cull during the moulting period.	1	see Objective 12	see Objective 12
CCE Zone	19. In concert with ERE initiatives, as an alternative to culling, organize hazing events to push geese into huntable areas.	1	see Objective 13	see Objective 13
CCE Zone	20: Expand the egg addling program to encompass more areas and stakeholders.	1	Egg addling program	Funding for program, recruitment is zero on NBE, numbers of nests found and eggs addled, number of goslings observed reduced
CCE Zone	21: Promote hunting.	2	Consultation targeted to hunters, incentives for hunters	Increase in numbers of hunters and harvested geese in the 1-5 management zone
CCE Zone	22. Encourage limited, coordinated hunting of Canada Geese on the NBE.	2	At least one hunt on the NBE	Number of adults using the NBE is reduced
CCE Zone	23: Encourage hazing in non-huntable areas during hunting seasons.	2	Hazing program during hunting seasons	Number of hazing initiatives during hunting seasons, increase in harvested geese in the 1-5 management zone
CCE Zone	24. Encourage affected farmers to pursue kill permits outside of hunting seasons.	3	See Objective 9	See Objective 9

Section	Objectives	Priority	Deliverables	Indicators/Targets
CCE Zone	25. Promote techniques to create goose unfriendly habitats and enable sharing of expertise.	1	See Objective 15	See Objective 15
CCE Zone	26: Install goose exclosures on the CCE.	1	Guardians install exclosures and monitor marsh recovery	Funding for installation, maintenance and monitoring, vegetation and salinity data collected once every year
Temporal Objectives	27. Protect estuarine marshes year-round, with exclosures, fencing, LWD structures, and hazing until goose populations are substantially diminished.	1	See Objectives 11, 17, and 26	See Objectives 11, 17, and 26
Temporal Objectives	28. Round up Canada Geese during the moulting period and transfer them to an appropriate farm or culling facility	1	See Objective 12	See Objective 12
Temporal Objectives	29. Capture Canada Geese at their nests for research purposes or to cull them.	1	See Objective 12	See Objective 12
Temporal Objectives	30. Organize hunts on the LQRE and NBE during the spring hunting season.	2	See Objectives 7, 22	See Objectives 7, 22
Temporal Objectives	31. Haze birds into huntable areas during the early autumn hunting season (all zones, with focus on CCE zone).	2	See Objectives 23	See Objective 23
Temporal Objectives	32. Promote hunting of traditional migrants during regular hunting seasons (LQRE and CCE zones, with focus on CCE zone).	3	Consultation targeted to hunters, incentives for hunters	Increase in numbers of hunters and harvested geese in the 1-5 and 1-6 management zones
Social Objectives	33. Examine health risks to people, livestock, and pets (all zones).	1	Standardized testing of beaches, ponds, heavily used terrestrial areas	Levels of bacteria are zero, follow up studies if levels are elevated

Section	Objectives	Priority	Deliverables	Indicators/Targets
Social Objectives	34. Urge senior governments to allow culled geese to be used for food (all zones).	1	Captured wild Canada Geese can be held in pens prior to transport and donation to food banks and/or other food distribution venues.	Funding for holding, processing, and transport of captured geese to food banks and/or other food distribution venues, number of geese held, processed, donated
Social Objectives	35. Develop a communication protocol that includes interaction with other Canada Goose management committees or working groups and naturalist groups.	2	Communication protocol with CWS	CWS central coordinator, number of meetings among working groups
Social Objectives	36. Engage stakeholders and the public regarding goose impacts and control techniques.	1	Stakeholder and public engagement in zone-based management plans	Number of surveys, number of communities with public open houses, number of stakeholders and members of the public engaged
Social Objectives	37. Urge the CWS to make permits for controlling Canada Geese easier to obtain.	1	Online permitting process, simple (e.g., one-page) guide	Increase in number of permit applications
Social Objectives	38. Consult and collaborate with First Nations.	1	First Nations represented on regional working group	Goose management on reserves is integrated with other sites in the region
Monitoring Objective	39. Urge CWS to develop a monitoring program for temperate-nesting Canada Geese and a predictive population model encompassing multiple regions and interacting goose (sub)populations.	1	Multi-region monitoring program	Predictive models for Vancouver Island

15.1 Personal Communications

Ken Ashley, B.C. Institute of Technology; Karen Barry, Bird Studies Canada; David Bradbeer, Vancouver Airport Authority; Andre Breault, Canadian Wildlife Service; Kevin Bridges, City of Nanaimo; Ken Brock, Canadian Wildlife Service; Dan Buffett, Ducks Unlimited Canada; Campbell River Environmental Committee; Drew Chapman, B.C. Parks; Myke Chutter, B.C. Ministry of Environment; Tim Clermont, Crown Land Securement Program; John Cooper, Cooper, Beauchesne & Associates; Bruce Cousens; Kevin Fort, Canadian Wildlife Service; Graeme Fowler, B.C. Ministry of Agriculture, Glen Gibson, Vancouver Island Health Authority; Sandra Gray; Erika Lok, Canadian Wildlife Service; Don Marshall, Town of Qualicum Beach; Dr. Jim McClendon, Canadian Food Inspection Agency; Alan Messner, Canadian Food Inspection Agency; Al Metcalf, City of Parksville; Guy Monty; Danielle Morrison; Warren Payne, City of Parksville; Sean Pendergast, B.C. Ministry of Forests, Lands, and Natural Resource Operations; Aaron Ritchie; Dr. Ken Roblesky, retired, CFIA/B.C. Ministry of Agriculture; Joseph Sands, U.S. Fish and Wildlife Service Migratory Birds and Habitat Programs; Blain Sepos, Oceanside Tourism Association; Terry Smith, U.S. Department of Agriculture, Animal Health and Plant Health Inspection Service, Wildlife Services, Washington/Alaska; Kim St. Claire, Capital Regional District Parks; Bob Weir, Town of Qualicum Beach; Ivy Whitehorne, Canadian Wildlife Service; Craig Wightman, B.C. Conservation Foundation

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