

# 2024 Moulting Survey Report

## Regional Canada Goose Management Strategy

**CRD** | ENVIRONMENTAL PROTECTION



Prepared by:

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## 1.0 Acknowledgements

The Capital Regional District (CRD) conducts its business within the traditional territories of over 20 First Nations, including Songhees, x̱w̱seps̱əm (Esquimalt), WJ̱O̱Ł̱E̱Ł̱P (Tsartlip), BO̱ḴE̱Ć̱EN (Pauquachin), S̱X̱Á̱UṮW̱ (Tsawout), W̱SI̱ḴEM (Tseycum), MÁ̱LEX̱E̱Ł̱ (Malahat), Sc̱'ianew (Beecher Bay), T'Sou-ke, Pacheedaht and Pune'laxutth' (Penelekut). All of whom have a long-standing relationship with the land and waters from time immemorial that continues to this day.

The CRD would like to recognize the hard work and dedication of the numerous groups who made this year's Canada goose population survey in the capital region possible. These groups are as follows:

- CRD staff and outreach team
- Malahat Nation
- Agile Drone Services
- Rocky Point Bird Observatory
- Galiano Island Conservancy
- Mayne Island Conservancy
- Saturna Island Marine Research and Education Society
- Pender Island Conservancy
- District of Saanich parks staff
- City of Victoria parks staff
- Town of Sidney staff
- Horticulture Centre of the Pacific
- Swan Lake Christmas Hill Sanctuary
- Numerous golf courses
- Individuals such as Jody Wells for counting geese and Bette Longland, Emily Harris, Jim Reisin and Larry Sluggett for allowing us onto their properties to use drone technology.

The CRD would also like to recognize the hard work and dedication of groups who contributed to Canada goose (CAGO) population surveys in the past including the Peninsula Area and Agricultural Commission, Guardians of our Salish Estuaries, Ministry of Agriculture and Rocky Point Bird Observatory.



Figure 1. Katie Lauer counting geese from a CRD boat (photo by Gabriel Junker)



Figure 2. Malahat Nation boat operator during moulting survey (photo by Samantha Hammond)

## 2.0 Introduction

Historically, Canada geese found on Vancouver Island were occasional migratory visitors over the autumn and winter months and were very rarely seen nesting. In the 1960's and 70's a CAGO introduction program was implemented by the Canadian Wildlife Service, BC Fish and Wildlife Branch and various other organizations to increase wildlife viewing and hunting opportunities in the capital region. The introduced geese were young birds from various subspecies of Canada geese who were unable to learn migrating behaviour patterns from their parents. Eventually these geese interbred, creating a hybrid population of non-migratory resident geese which are not native to the region [1][2].

According to Christmas Bird Count data, the current Vancouver Island CAGO population ranges from 16,000-21,000 with an estimated 9,000-11,000 birds overwintering in the capital region [3]. The exponential growth of the regional CAGO population is degrading coastal ecosystems and waterways by over-grazing, trampling vegetation, soil erosion and the spread of invasive species. These areas include endangered Garry Oak ecosystems, near-shore islands in ecological reserves, and estuaries that are critical habitats for young salmon [4][5][6]. Increased public health concerns have risen from public and private recreational sites including parks, sports fields, swimming beaches, golf courses and farmlands. These concerns are due to high densities of fecal matter, degradation and contamination of water sources, territorial goose conflicts and spread of disease [7]. Significant economic impacts have occurred with local farmers experiencing financial losses from CAGO damaging crops through grazing and soil erosion, increasing maintenance costs, and contaminating crops and water with their droppings. Poultry farms are also at risk of exposure of Highly Pathogenic Avian Influenza from CAGO [8]. These impacts have resulted in an increased pressure on local governments to take coordinated action.

In 2012, the CRD partnered with municipalities and other stakeholders to develop a Regional Canada Goose Management Strategy (RCGMS) to provide guidance for controlling the adverse impacts that the population of non-migratory, resident CAGO have in the capital region [2]. These management tools include population monitoring, preventing feeding, habitat modification, hazing, egg addling, hunting, harvesting and public outreach. Since its development, numerous actions have been undertaken with hazing strategies becoming the most popular. Unfortunately, without a coordinated approach, geese and their associated impacts have moved into new areas, expanding the nesting and overwintering populations.

In February 2023, the CRD Board approved the Canada Goose Management Service Establishment Bylaw No. 1, 2022 (Bylaw No. 4522) that aims to reduce the impact of the rapidly growing CAGO population in the region. This bylaw was adopted after receiving elector assent through a regional alternative approval process. The RCGMS includes:

- monitoring, mapping and reporting on CAGO populations and their impacts.
- coordinating and establishing collaborative partnerships with municipalities, First Nations, large landowners, Peninsula and Area Agricultural Commission, other government agencies and stewardship groups to implement the CRD's RCGMS.

- development and implementation of a communications strategy and public education program to support the management of CAGO populations.
- collaborating with other Vancouver Island regional districts, local governments and First Nations to reduce Canada goose populations through the Vancouver Island Canada Goose Management Working Group.

Population surveys are an important component of the RCGMS and are utilized to inform regional decisions and show the effectiveness of applied management techniques. Hot spot surveys in the region have been completed since 2021; however, a complete regional population survey that includes all municipalities and electoral districts has not been previously completed. In late June and July, CAGO moult their flight feathers and congregate with their young of the year near bodies of water. At this time, they are unable to fly and will stay in their chosen area for long periods, presenting a unique opportunity to conduct an accurate population count that includes young of the year amounts with little chance of overlapping results. A collaborative approach that includes partnership with CRD staff, local First Nations and local stewardship groups allowed us to conduct a coordinated moult survey of CAGO across the capital region. This report outlines the history, methods and results of the 2024 Regional Canada Goose Moulting Survey.

### 2.1 Canada Goose Moulting Survey History in the CRD (2017-2023)

In July 2017, Guardians of Our Salish Estuaries (GOOSE) conducted an aerial moult survey from Sooke to Sidney using a Jet Ranger helicopter. This survey observed 4,002 CAGO, and an additional 500 geese were estimated to be found in areas not covered by the survey, bringing the estimated total to 4,502. The highest concentrations were found in Sooke Basin, Esquimalt Lagoon and Saanich Peninsula and these areas were deemed local hot spots [9]. In June 2019, GOOSE conducted a drone survey from Sooke to Sidney and Salt Spring Island. This survey identified approximately 4,298 CAGO and it was noted that 35-40% of all geese counted were young of the year [9]. In late June 2020, GOOSE conducted a moult survey via kayak and counted 2,774 CAGO between Sooke and Sidney [9] (Figure 3).

In 2021, 2022 and 2023 GOOSE conducted moult surveys using various methods including kayaks, boats, land surveys and utilizing data from a naturalist website called eBird to determine local “hot spots” [10] [11]. The surveys covered locations from Sooke to North Saanich and in all three years, the largest concentrations of geese were found in Sooke, Esquimalt Lagoon, Oak Bay shoreline and the northeast coast of the Saanich Peninsula (Appendix A). The number of moulting Canada geese in the region was recorded as 1,902 in 2021, 3,616 in 2022, and 2,625 in 2023 (Figure 3). The figures from these reports are the only known documentation of summer CAGO population numbers from 2017 to 2023. However, large areas such as the Gulf Islands, Juan de Fuca Electoral Area and farmlands have not been included in these population estimates. Canada geese migrate seasonally and will move between municipalities and islands for breeding and feeding purposes. Therefore, CAGO from all regions need to be considered to have a comprehensive population estimate that can inform management efforts and ensure the RCGMS is successful.

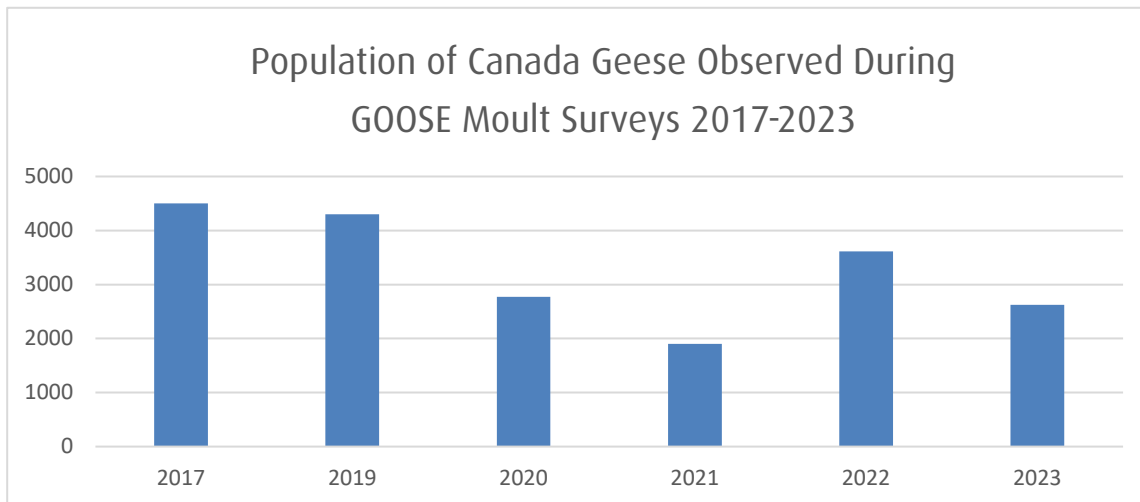


Figure 3. Total CAGO observed during GOOSE moulting surveys completed in the capital region from 2017-2023. Data compiled from [9] [10] [11]

### 3.0 Methods

The Regional Canada Goose Moulting Survey was initiated to create a baseline summer population estimate that can be utilized to inform regional decisions and show the effectiveness of applied management techniques. A collaborative approach was used, and the capital region was separated into marine and land-based surveys to ensure the maximum amount of area was covered by surveyors. The survey occurred between June 23-29, 2024.

#### 3.1 Collaboration and Training

The capital region is a large land mass consisting of 13 municipalities and electoral districts which include the Southern Gulf Islands. To reach as many locations as possible, numerous groups across the capital region were asked to participate in the survey:

- **First Nations:** A request was sent out to all local First Nation groups within the capital region requesting a partnership that included use of their boat, boat operator and staff member. Malahat Nation agreed to participate, and a contract was developed.
- **Stewardship groups:** Groups from all over the capital region were contracted to participate in the survey. These groups included Rocky Point Bird Observatory, Galiano Island Conservancy, Mayne Island Conservancy, Pender Island Conservancy and Saturna Island Marine Research and Education Society. A local birder named Jody Wells also contributed to the survey.
- **Large landowners and managers:** Staff from areas with large numbers of moulting CAGO were contacted and asked to count geese in their areas. Participants included CRD Parks, Saanich Parks, City of Victoria, Township of Sidney, Horticulture Centre of the Pacific, Swan Lake Christmas Hill Sanctuary, Royal Colwood Golf Club, Highland Pacific Golf and Victoria Golf Centre.
- **Training:** Training sessions were held on June 17 and June 20, 2024 using Microsoft Teams to ensure all participants in the survey followed the same data collection protocols, learned how to use the Geographic Information System (GIS) app called FULCRUM, and knew how to identify adult and juvenile CAGO.

- **Testing:** Participants were encouraged to test out the FULCRUM app in the field using yellow test points prior to the survey dates.

### 3.2 Data Collection

To ensure reliability of the CAGO survey results, the following measures were implemented to achieve high accuracy in the population counts:

- **Training and calibration:** All participants underwent training to ensure consistency in collecting data and identifying and counting CAGO.
- **Equipment:** Binoculars, cell phone or tablet, FULCRUM app, camera and printed data sheets (See Appendix B).
- **Data collection:** The FULCRUM app was used to track GPS locations, population counts, photos and additional data while in the field. The data was entered into FULCRUM on a phone or iPad and was also written on a hard paper copy (Appendix B).
- **Population counts:** Adult and juvenile CAGO population numbers were counted by two surveyors and compared for accuracy. One person entered the data into FULCRUM, the other wrote a hard copy. Pictures were taken at each moulting site that could be used to confirm numbers after.
- **Photographic evidence:** Photographs were taken during both marine and land surveys. These images were reviewed later to verify and cross-check the initial counts.
- **Standardized protocols:** Following standardized survey protocols ensured that all participants used the same methods and criteria for counting.
- **Cross-referencing with eBird data:** Comparing survey results with eBird data helped identify any additional geese that may have been missed during the survey.

### 3.3 Survey Zones

The shorelines of the capital region were separated into zones and assigned to each boat prior to the survey. The shorelines, lakes and other areas not covered by boat or drone were separated into zones and assigned to land groups prior to the survey.

- Canada geese congregate in large open areas that have access to sufficient food and water; protected shorelines are favoured where geese can move in and out of the water with ease. The topography of the region was reviewed and areas with a high probability of moulting CAGO were chosen for the survey.
- The suitable areas were sectioned by dates to reduce the chances of CAGO moving between areas and resulting in overlapping results (Table 1).
- Urban centres, forests and steep rocky shorelines were omitted from the survey.

*Table 1. Locations and groups by survey date (large landowners counted CAGO during survey dates but are not included below)*

Date	Survey Zones	Method	Groups Participating
June 23	Metchosin, Colwood, Esquimalt and Esquimalt harbour	Land and boat surveys	CRD staff, Parks Canada
June 24	Farmlands, Oak Bay islets, Gorge waterway, Victoria, Oak Bay, east coast from Cordova Bay to Sidney	Drone, land and boat surveys	CRD staff, Rocky Point Bird Observatory, Town of Sidney, City of Victoria
June 25	West coast from Saanich Inlet to Swartz Bay, Piers, Moresby and Portland Islands, east coast of Salt Spring Island, Galiano Island	Land and boat surveys	CRD staff, Malahat Nation, Galiano Island Conservancy, Rocky Point Bird Observatory
June 26	Municipal parks, west coast of Salt Spring Island, Pender Island, Mayne Island, Shirley to Jordan River	Land and boat surveys	CRD staff, Malahat Nation, Rocky Point Bird Observatory, Pender Island Conservancy, Mayne Island Conservancy, Saanich Parks
June 27	Becher Bay to Sooke, China Beach, Gordon Beach	Land surveys	CRD staff, Rocky Point Bird Observatory
June 28	Sombrio Beach, Port Renfrew	Land surveys	CRD staff
June 29	Saturna Island	Land surveys	Saturna Island Marine and Education Society

### 3.4 Marine and Land Surveys

Moulting CAGO congregate on or near water while they moult. Marine surveys were conducted using boats that moved slowly along the shorelines of the capital region to discover groups of moulting geese. Land surveys were conducted in all areas that the drone and boats were unable to access due to time and resource constraints.

- **Marine surveyors:** Malahat Nation and the CRD provided boats for the shoreline surveys of the region. A designated “Canada goose spotter”, boat operator and one additional staff member were aboard each boat to conduct the moult survey.
- **Drone technology:** A drone operator from Agile Drone Services was contracted to assist with aerial surveys over farmland in the region. The drone used in the survey was a DJI M300 RTK with a H20 T sensor. A CRD staff member assisted the drone operator with exploratory CAGO counts. Infrared cameras were used to help identify groups of CAGO in areas with tall grass (Appendix C).
- **Local stewardship groups:** Completed direct counts using scopes and binoculars at regional lakes, shorelines, farms and other areas.
- **Large landowners and managers:** Municipal parks staff, CRD parks staff, golf course attendants and various other large landowners counted geese in their areas during the moult survey.

- **Additional data:** eBird data was examined to discover if any additional CAGO were counted during the time of the survey.

## 4.0 Results

The 2024 Regional Canada Goose Moulting Survey was completed by all involved parties during the week of June 21-28 and covered all 13 municipalities and electoral districts in the CRD. A total of 492 locations were surveyed including over 650 km of shoreline. Of these locations, 258 were found to have no geese and 234 were found to have geese (Figure 4). The moulting survey training sessions were provided by Katie Lauer, Goose Management Technician and were well attended with 14 people in the first session and 22 attending the second. A total of 6,669 geese were counted in the CRD (Figure 5).

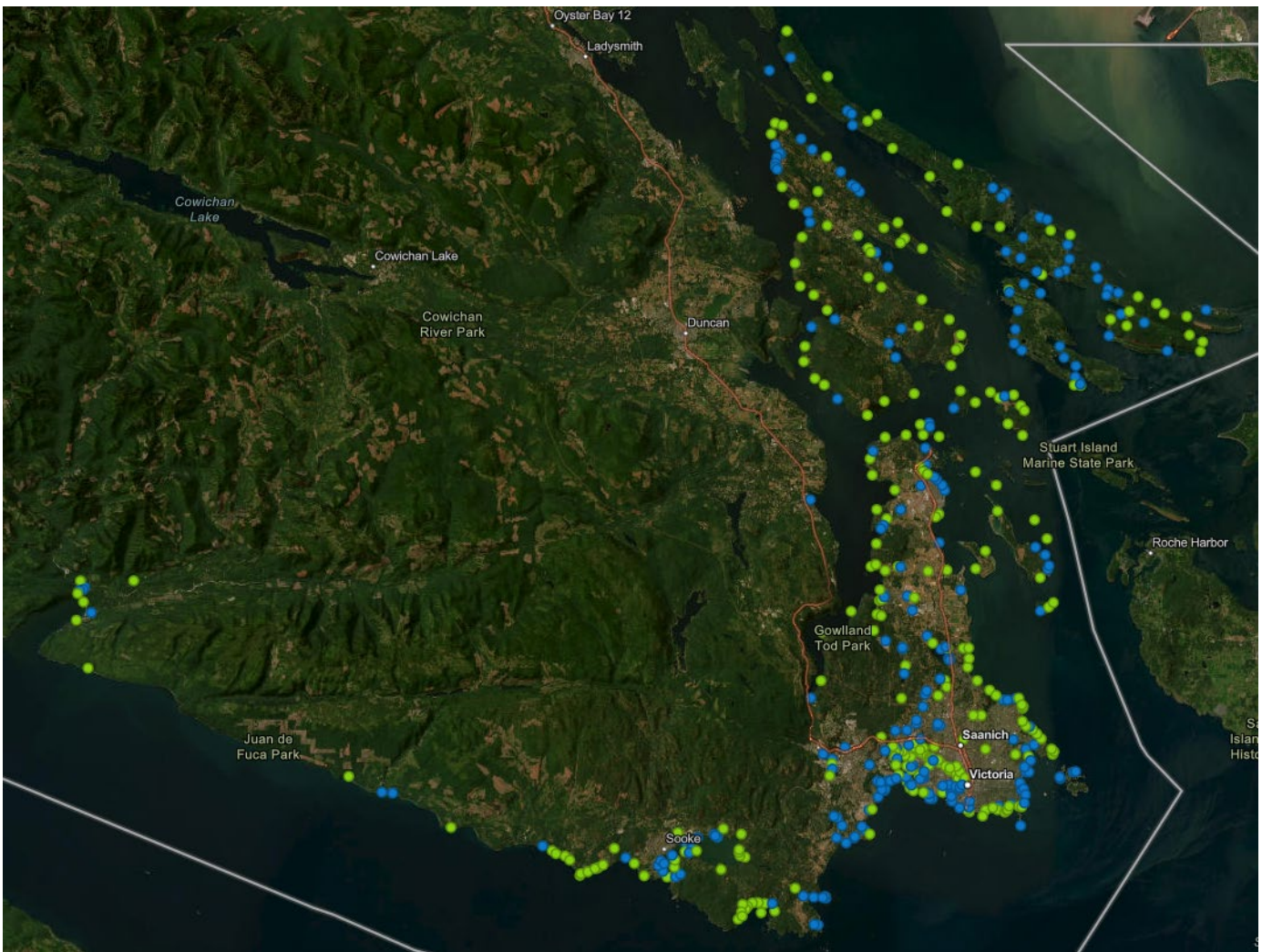


Figure 4. Data points collected in the FULCRUM app during the Regional Canada Goose Moulting Survey. Green dots represent sites with no geese and blue dots represent sites with geese.



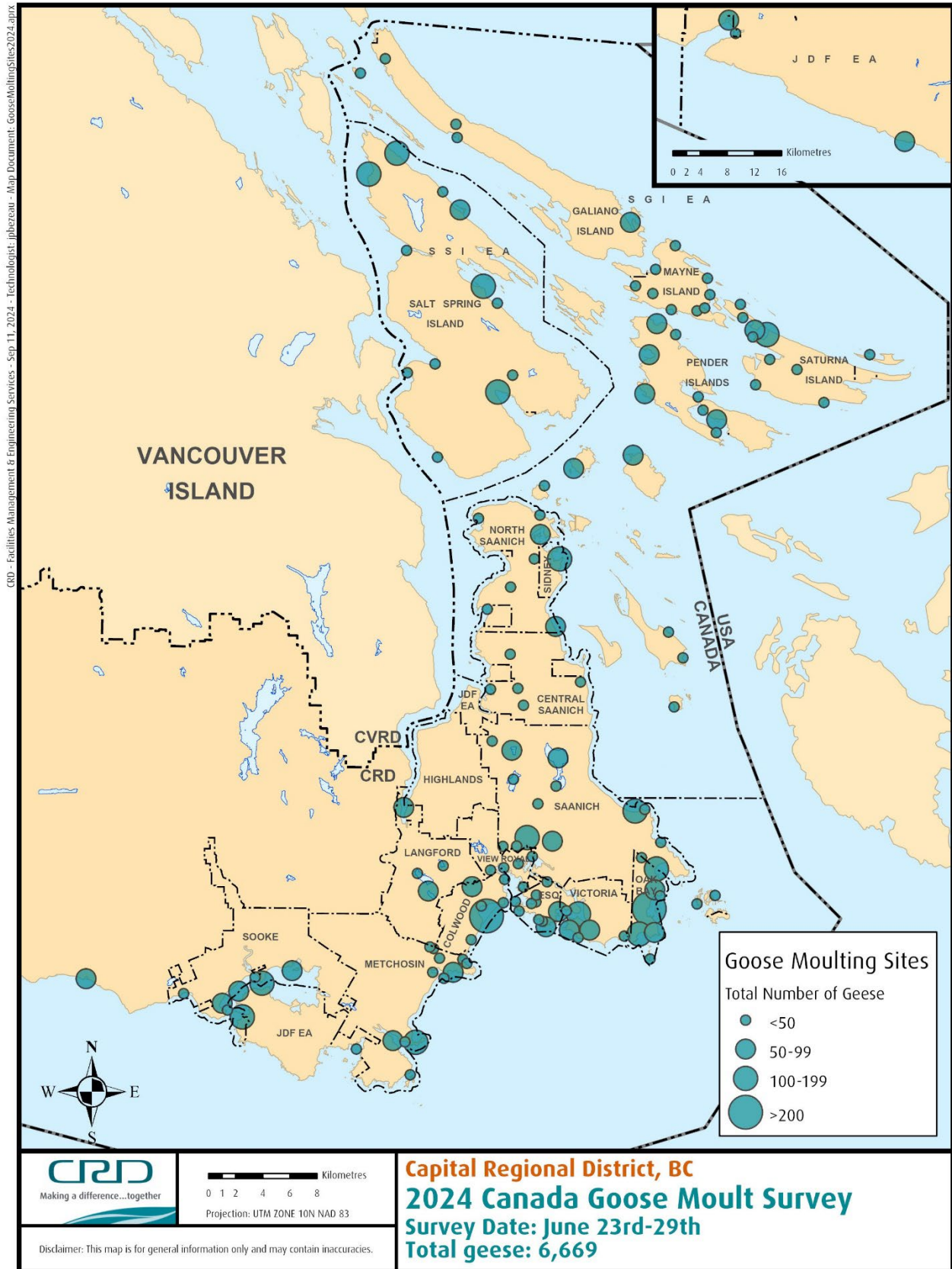


Figure 5. Results of the 2024 Regional Canada Goose Moulting Survey. Western portion of Juan de Fuca Electoral Area shown in upper corner of map.

A total of 5,645 adult and 1,025 juvenile CAGO were counted in the capital region bringing the total to 6,669. The largest concentrations of moulting CAGO were discovered in Sooke, Colwood, Oak Bay, Saanich and the Gulf Islands (Table 2). The Gulf Islands with the largest populations of CAGO were Salt Spring Island, Pender Island and Mayne Island (Table 3). Despite the scale of the survey conducted this year, it is unlikely that all geese in the capital region were counted, and the actual CAGO totals may be 500-1,000 higher.

*Table 2. Population totals of CAGO for the municipalities and electoral districts included in the 2024 Regional Canada Goose Moulting Survey*

Municipality	Adults	Juveniles	Total
Juan de Fuca	256	41	297
Sooke	562	25	587
Metchosin	339	17	356
Colwood	456	142	598
Langford	150	40	190
View Royal	46	48	94
Esquimalt	258	59	317
Victoria	278	30	308
Oak Bay	696	57	753
Saanich	485	155	640
Central Saanich	55	42	96
Sidney	85	75	160
North Saanich	206	36	242
Gulf Islands	1,773	258	2,031
<b>Totals:</b>	<b>5,645</b>	<b>1,025</b>	<b>6,669</b>

*Table 3. Population totals of CAGO for each of the Gulf Islands included in the 2024 Regional Canada Goose Moulting Survey*

Gulf Island	Adults	Juveniles	Total
Piers Island	13	3	16
Moresby Island	20	41	61
Sidney Island	52	16	68
D'Arcy Island	14	0	14
Pender Island	347	71	418
Saturna Island	128	25	153
Samuel Island	100	0	100
Mayne Island	207	40	247
Galiano Island	112	15	127
Salt Spring Island	658	43	701
Chatham Islands	49	4	53
Cabbage Island	18	0	18
Portland Island	55	0	55
<b>Totals:</b>	<b>1,773</b>	<b>258</b>	<b>2,031</b>

The survey showed a total of 1,025 juvenile CAGO with the largest numbers being seen in Colwood, Saanich and the Gulf Islands (Table 2, Figure 6). Numerous survey accounts indicated difficulty discerning between juveniles and adults during boat surveys where it was difficult to get close to moulting geese. This indicates that the overall number of juveniles is likely much higher in those survey areas.

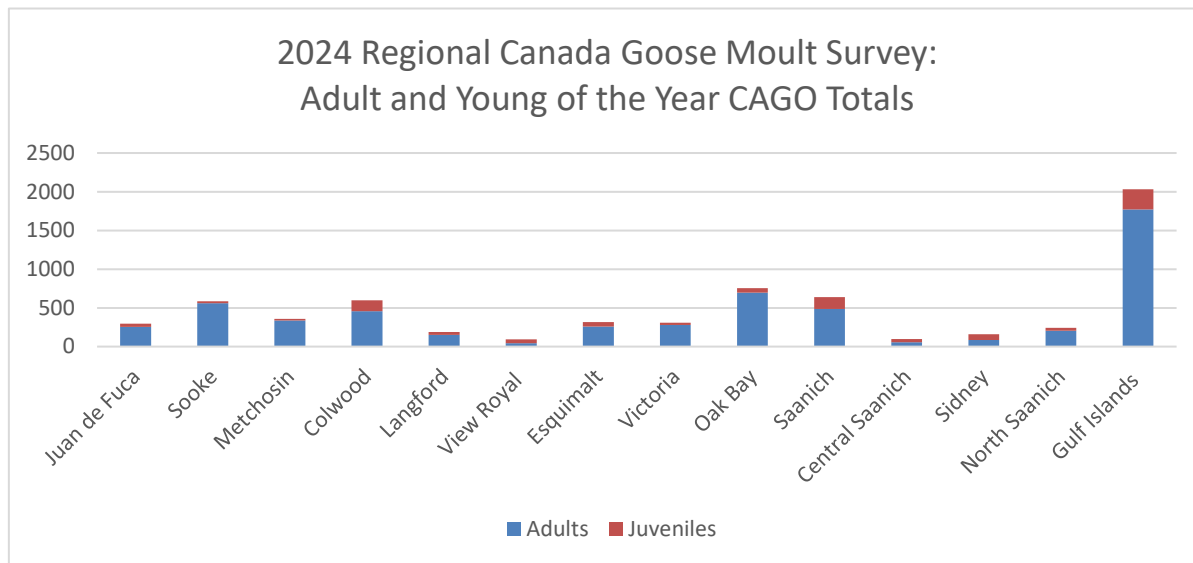


Figure 6. Bar graph showing the ratio of juvenile to adult CAGO counted during the 2024 Regional Canada Goose Moulting Survey

## 5.0 Discussion

### 5.1 Hot Spots

Hot spots are defined as areas with a significant concentration of moulting CAGO. This year's moulting survey confirmed previously identified hot spots from past surveys and identified several new ones. The shorelines of Sooke Harbour, Colwood, Esquimalt, Victoria, and Oak Bay continue to have the highest concentrations of moulting CAGO, accounting for 48% of the entire population. The 2024 Regional Canada Goose Moulting Survey expanded survey efforts to include large areas where CAGO had not been previously counted. These areas included the shorelines of Victoria, Metchosin, East Sooke, the Gulf Islands, private farmlands, golf courses, Juan de Fuca Electoral Area and lakes and ponds. Including these areas more than doubled the total population that was estimated in 2023.

Canada geese breeding further inland tend to walk to smaller bodies of water near their nesting sites instead of migrating to ocean shorelines. The population numbers in Saanich, including privately owned farmland, were much higher than previous surveys had suggested. One private property in Saanich had 110 CAGO in and around a small pond. These geese likely came from their nesting locations on surrounding properties to moult. Similar pockets were discovered throughout farmlands in Saanich, Central Saanich and North Saanich. These areas should be considered small hot spots, as the likelihood of agricultural impacts is drastically increased. The shorelines of Metchosin, particularly along William Head and Albert Head, should be considered new hot spots. The Gulf Islands also included a significant number of CAGO, comprising 30% of the total population in the capital region. The north end of Salt Spring Island, Pender Island and Mayne Island all had significant populations of moulting geese. Future management efforts should be expanded to include these locations, particularly the Gulf Islands, where no known egg addling or First Nation harvests are known to occur.

## 5.2 Juvenile Recruitment

This year's moulting survey included recruitment surveys which count the number of juvenile geese that have been recruited into the local population of CAGO. Recruitment surveys were also completed during the 2024 regional egg addling season. These surveys occurred in May while juvenile geese were still young and close to where they had hatched indicating areas with missed nests. The number of juvenile geese in a group of moulting geese was tallied whenever survey conditions allowed. Unfortunately, numerous surveyors recorded having difficulty distinguishing between juvenile and adult geese while in the field. Due to the timing of the survey, juvenile geese could have been between the ages of 2-12 weeks old. CAGO grow quickly and begin to look like adult CAGO at around 6-8 weeks of age; at this point it can be difficult for even the most seasoned birder to correctly identify juveniles from a distance. It was found that surveys completed on land or with drone technology had the least trouble correctly identifying juveniles.

Colwood, Saanich and the Gulf Islands had the most juveniles with 142, 155 and 258 respectively. The moulting recruitment surveys have highlighted numerous locations that need egg addling programs to effectively reduce the number of geese recruited into the population in 2025. Whereas areas with high adults to juvenile percentages will likely require additional removal methods to effectively see a reduced population.

## 5.3 Drone Test

In the capital region, CAGO frequently use privately owned farmlands as breeding grounds and will stay to moult if a water feature is within walking distance. While geese are moulting, they are more vulnerable to predation and will hide in tall grass and crops when approached or threatened - this makes surveying these areas challenging. To overcome this, drone technology was tested on farmlands and shorelines to determine its efficacy as a tool for future CAGO population surveys. The drone was flown at an average height of 400 feet and was able to cover up to 350 acres of farmland from one deployment zone. Permission was obtained from landowners at each deployment zone prior to the survey and airspace permission was approved from NavCanada. The drone was able to take clear pictures and video from an elevation of 400 feet while recording the GPS location and elevation. Most of the photos taken in the survey utilized a 5-10x zoom; however, up to 200x was available. This enabled surveyors to count juvenile and adult geese without disturbing them or scaring them into covered areas. Additional CAGO were discovered in areas missed by the surveyor's initial scan by using an infrared camera (Appendix C). The drone proved to be an asset that should be utilized in future surveys to cover areas of farmland and sections of shoreline not easily accessed by land.

## 5.4 Regional Population

Moulting surveys completed in the capital region from 2021-2023 showed a population of approximately 1,902-2,625 resident CAGO [11]. The 2024 Regional Canada Goose Moulting Survey indicates a population of approximately 6,669 resident CAGO, which is two to four times higher than estimated by previous surveys. CAGO are known winter migrants, and the population is expected to increase another 30-50% over the winter months, particularly in open fields and farmlands. The population of CAGO remains high despite the numerous mitigation strategies that have been applied to the region attempting to reduce the CAGO population. Over the last four years, egg

addling efforts have prevented 5,232 Canada geese from entering the resident population. Harvests led by First Nations across Vancouver Island have removed approximately 6,000 CAGO and an additional 28,119 CAGO have been hunted since 2012 [12].

Canada geese are incredibly resilient birds with high breeding success rates. Increased efforts to reduce the overall population of CAGO need to occur in all areas of the capital region, including new hot spots where mitigation efforts have yet to be applied. Collared CAGO were documented in two locations: Fort Rodd Hill and the Goldstream estuary. These geese were collared and banded in Nanaimo, BC during the spring of 2017 indicating that CAGO will migrate across Vancouver Island. Geese from Nanaimo have been observed beyond Vancouver Island in areas such as Vancouver, Washington and Oregon [13]. However, the movements of resident CAGO in the capital region has been poorly documented due to the lack of a banding program and it is unknown if any moult migrations occur within our resident population. Future strategies should include collaboration between all districts across Vancouver Island and other neighbouring cities to collar birds to monitor their movement and to ensure reduction methods are occurring everywhere.

## 6.0 Recommendations

### 6.1 Population Survey

- Completed full regional population surveys of CAGO are critical to understanding the effectiveness of applied reduction techniques.
- An annual Regional Canada Goose Moulting Survey should occur in the capital region when resources are available. At a minimum, a survey that occurs bi-annually is essential.
- Winter surveys need to be conducted to determine the population estimate of overwintering CAGO in the capital region.
- A banding program should be considered to study the movements of CAGO throughout the capital region and other jurisdictions.

### 6.2 Promote Collaboration

- Continue to develop working relationships with other groups to collaborate on future population surveys.
- Work directly with the farming community to gather information on CAGO population numbers, impacts, crop types and movements.
- Develop working relationships with landowners, First Nations, municipal staff, provincial staff, organizations and local governments.

### 6.3 Increase Mitigation Efforts

- Increase the goose management budget to include extra funds for increased reduction techniques to be applied in the capital region. This is necessary to reduce the population of CAGO in a meaningful way.
- Explore additional avenues of funding for CAGO mitigation efforts to increase the overall goose management budget.
- Explore additional opportunities for collaboration between municipalities, electoral districts and outside jurisdictions.

## 7.0 Conclusion

The 2024 Regional Canada Goose Moulting Survey was successfully conducted with participation from over 16 groups including First Nations, stewardship groups, municipalities and large landowners. Despite numerous efforts to reduce the overall population, the survey reveals an estimated 6,669 resident CAGO, which is much higher than anticipated. The data collected has established a baseline CAGO population that can inform regional management decisions, focus mitigation efforts, and ensure the effectiveness of management techniques. A comprehensive Regional Canada Goose Moulting Survey and a regional overwintering Canada goose population survey should occur every one to two years to ensure effective management is occurring across all areas. To achieve meaningful results, it will be crucial to allocate additional resources, increase collaboration and implement further reduction measures to enhance the success of the Regional Canada Goose Moulting Survey.



*Figure 7. Juvenile and adult CAGO at Esquimalt Gorge Park on June 24, 2024 (photo by Anne Nightengale)*

## References

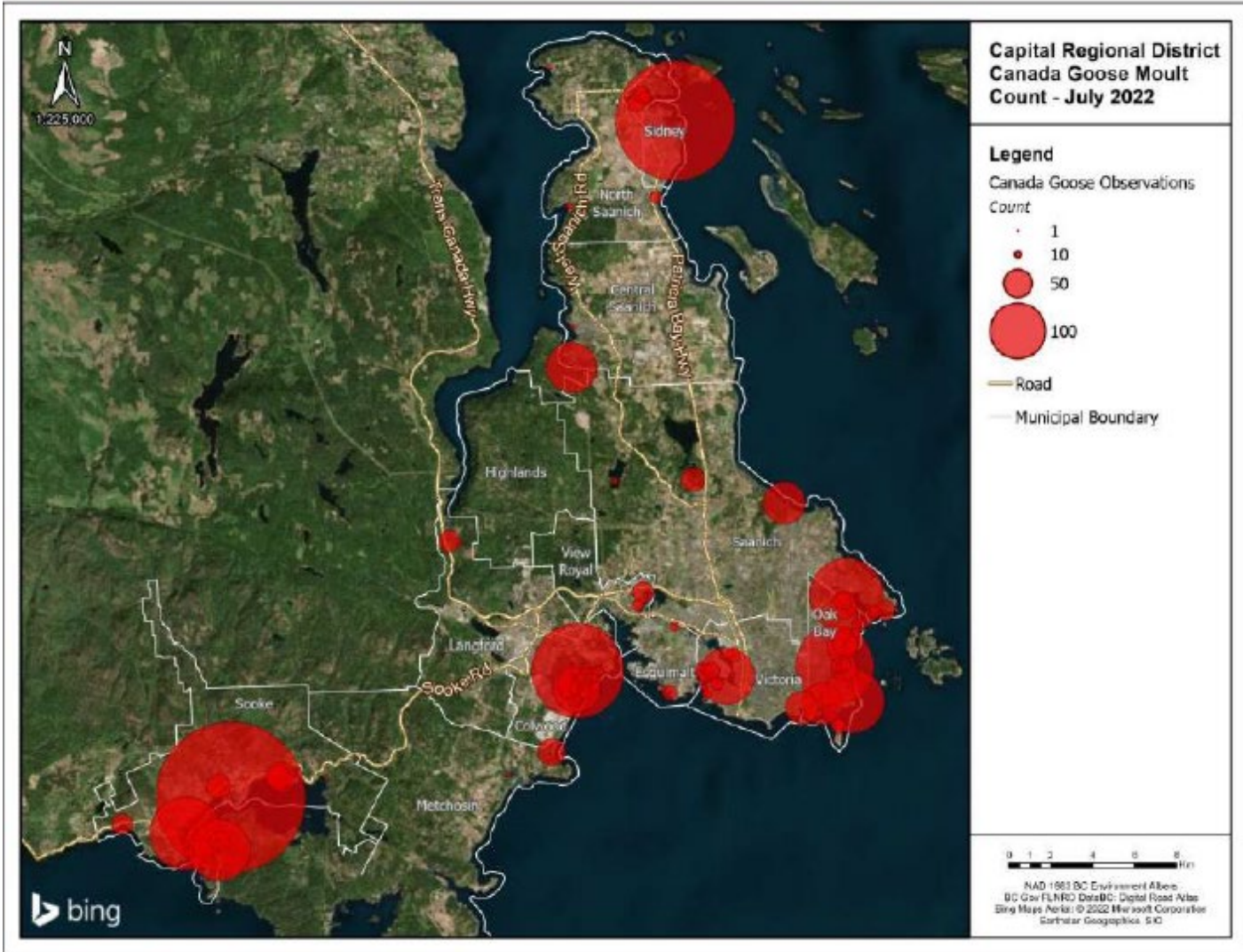
- [1] A. C. S. Neil K. Dawe, "The Canada Goose (*Branta canadensis*) on Vancouver Island, British Columbia," *British Columbia Birds*, vol. 20, pp. 24-40, 2010.
- [2] CRD, "Regional Canada Goose Management Strategy," CRD, Victoria, 2012.
- [3] N. A. Society, "The Christmas Bird Count Historical Results [online]," 2020. [Online]. Available: <http://www.christmasbirdcount.org>. [Accessed 12 February 2024].
- [4] R. Best, "Exotic Grasses and Feces Deposition by an Exotic Herbivore Combine to Reduce the Relative Abundance of Native Forbs," *Oecologia*, vol. 158, pp. 319-327, 2008.
- [5] J. R. B. R. J. B. P. A. M. Isaac-Renton, "Effects of Introduced Canada Geese (*Branta canadensis*) on Native Plant Communities of the Southern Gulf Island, British Columbia," *Ecoscience*, vol. 17, no. 4, pp. 394-399, 2010.
- [6] G. o. M.-I. E. Society, "Canada goose Management Strategy for Mount Arrowsmith Biosphere Region," Towards the Region of Goose-Damaged estuaries, 2015.
- [7] R. H. a. J. E. Lisa Dessborn, "Geese as vectors of nitrogen and phosphorus to freshwater systems," *Inland Waters*, vol. 6, pp. 111-122, 2016.
- [8] G. o. Canada, "Animals susceptible to H5N1 highly pathogenic avian influenza (HPAI)," 31 Aug 2023. [Online]. Available: <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/reportable/avian-influenza/animals-susceptible-to-h5n1-hpai/eng/1375992449648/1375992451039>.
- [9] G. o. M.-I. E. Society, "Canada Goose Mitigation and Population Monitoring," Submitted to Capital Regional District, Victoria, 2022.
- [10] G. o. M.-I. E. Society, "Canada Goose Mitigation and Population Monitoring 2022," Submitted to the Capital Regional District, Victoria, 2022.
- [11] G. o. O. S. Estuaries, "Canada Goose Mitigation and Population Monitoring in the Capital Regional District 2023," Submitted to the Capital Regional District, 2023.
- [12] G. o. B. Columbia, "Data Catalogue," 09 11 2023. [Online]. Available: <https://catalogue.data.gov.bc.ca/dataset/hunter-sample-survey-estimates-1976-to-current/resource/e3a8de8c-dbc8-498d-8a70-8f578ef548de>. [Accessed 30 08 2024].
- [13] S. P. a. E. Demers, "Abundance, distribution, movement and mortality of Canada Geese (*Branta canadensis*) in Nanaimo, British Columbia," *British Columbia Birds*, vol. 29, pp. 36-43, 2019.

## Appendix A - Maps of past Canada Goose Moulting Surveys in the Capital Region

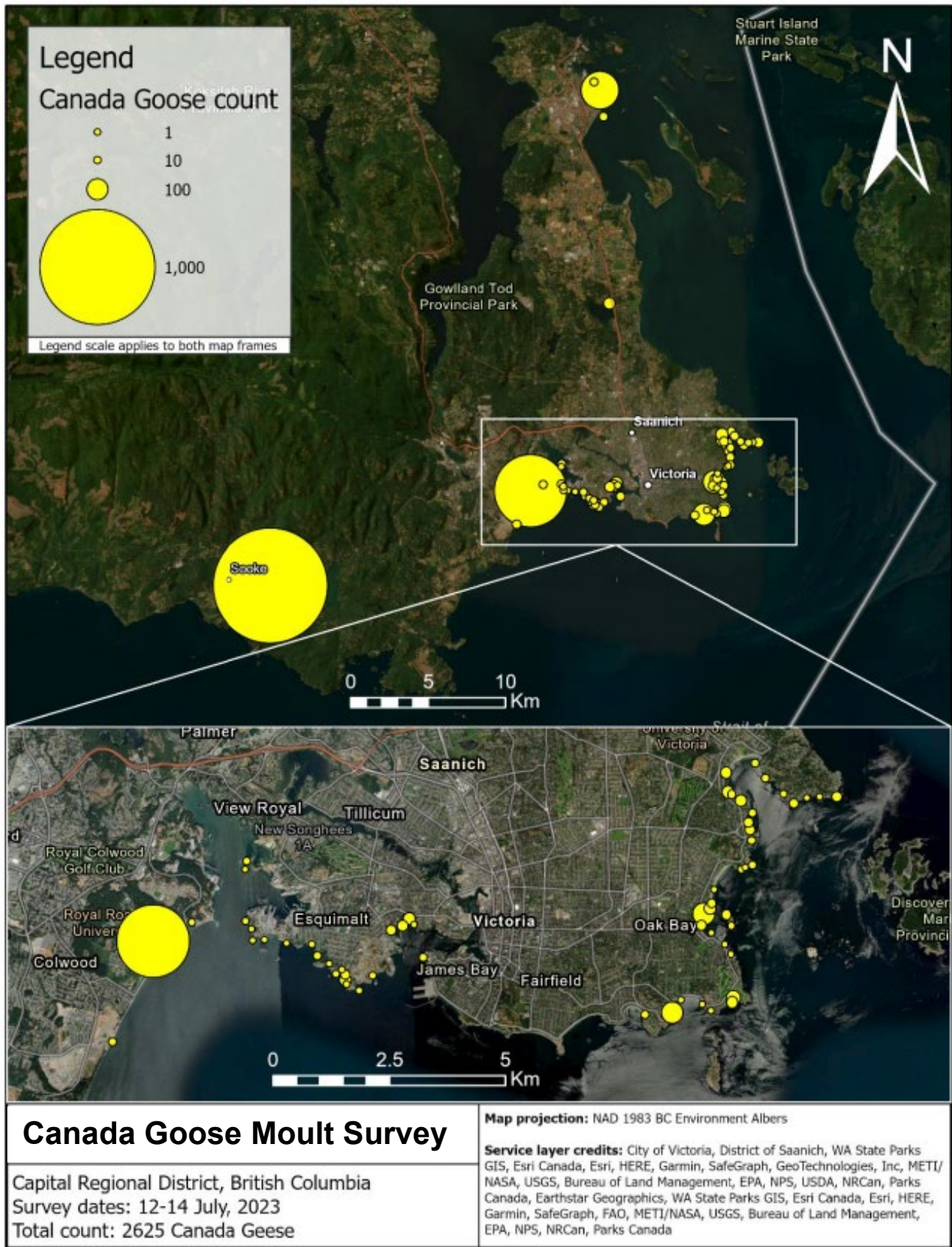


Map 1. 2021 CRD CAGO Moulting Survey completed by GOOSE. CAGO population totals and survey locations are white numbers outlined in red.





Map 2. 2022 CRD CAGO Moulting Survey completed by GOOSE



### Canada Goose Moulting Survey

Capital Regional District, British Columbia  
 Survey dates: 12-14 July, 2023  
 Total count: 2625 Canada Geese

Map 3. Map showing the results of the 2023 CRD CAGO moulting survey completed by GOOSE.



## Appendix C - Sample Photos Taken From Drone Survey (June 24, 2024)

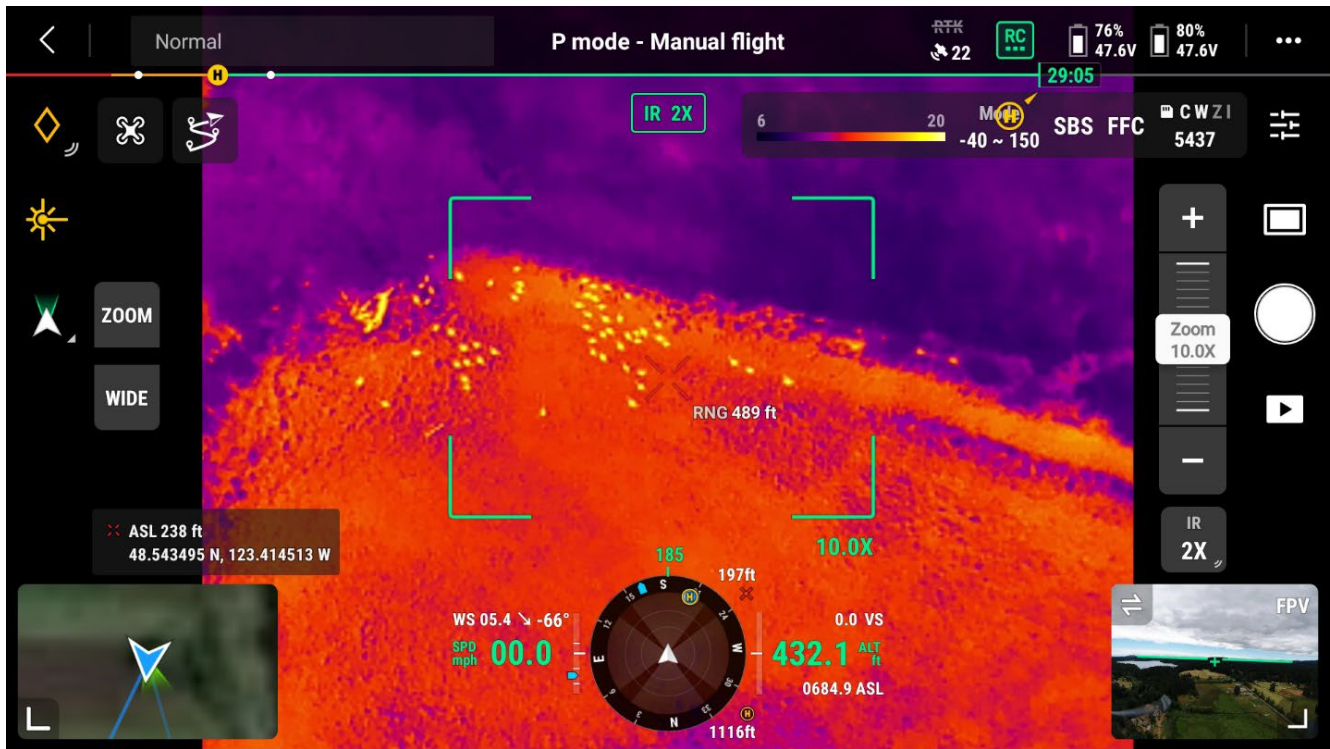


Photo 1. Photo taken on June 24, 2024 with DJI M300 RTK drone from Agile Drone Services. Photo shows Canada geese in field from an elevation of 489 feet with an infrared optical camera at 10.0x zoom.



Photo 2. Photo taken on June 24, 2024 with DJI M300 RTK drone from Agile Drone Services. Photo shows Canada geese from Photo 1 with a regular camera at a distance of 490 feet with 8.7x zoom.

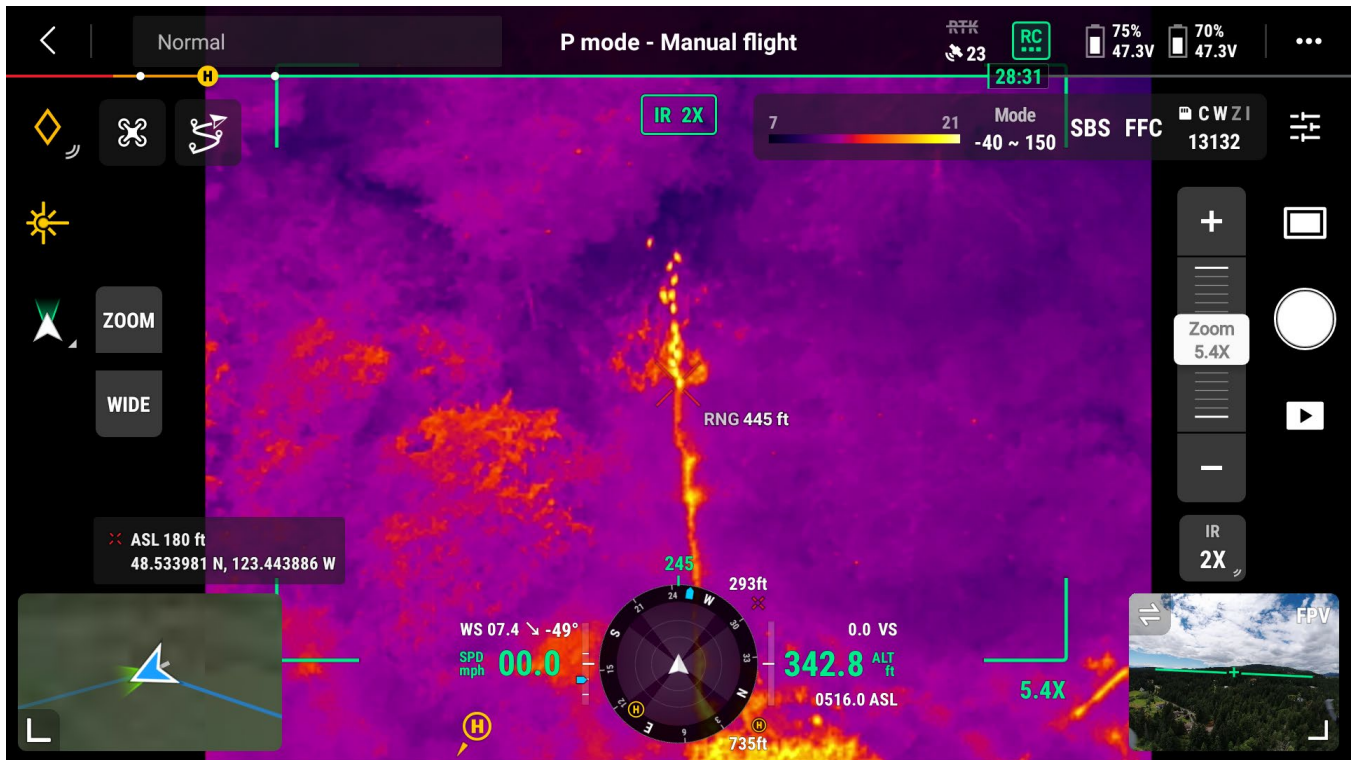


Photo 3. Photo taken on June 24, 2024 with DJI M300 RTK drone from Agile Drone Services. Photo shows Canada geese in tall vegetation with an infrared camera at distance of 445 feet with 5.4x zoom.

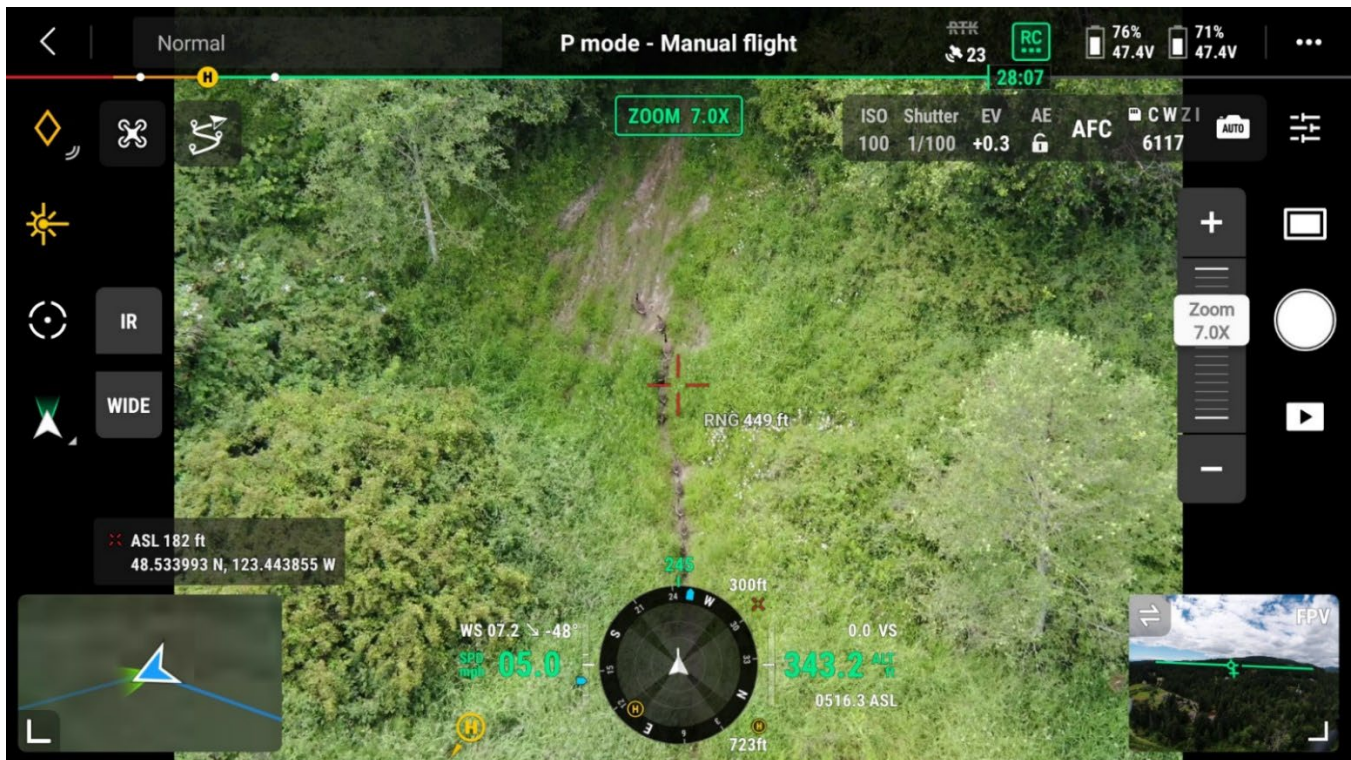


Photo 4. Photo taken on June 24, 2024 with DJI M300 RTK drone from Agile Drone Services. Photo shows Canada geese from Photo 3 with a regular camera at a distance of 449 feet with 7.0x zoom.



Photo 5. Photo taken on June 24, 2024, with DJI M300 RTK drone from Agile Drone Services. Photo shows Canada geese from Photo 4 further zoomed in at 13.1x zoom.