

British Columbia Birds



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Abstract: We speculate on the occurrence and distribution of the native Canada Goose on Vancouver Island before the arrival of the first Europeans and discuss the current taxonomy and status of native Canada Goose subspecies that breed, migrate through, or winter on the island. We also document Canada Goose introductions and consider the status of these exotic, 'resident' birds, their dispersal, and population growth. We conclude that before the introductions, the Canada Goose was only a rare breeding bird on the northern half of Vancouver Island.

Key words: Canada Goose, *Branta canadensis*, Vancouver Island, introductions, subspecies.

Introduction

Campbell *et al.* (1990) describe the Canada Goose (*Branta canadensis*) as a *very abundant* spring and autumn migrant throughout British Columbia, including Vancouver Island; it is locally *very common* to *very abundant* in winter along the coast. Today, this species is also a widespread breeder throughout much of Vancouver Island, with resident populations now well established. This was not always the case.

Several authors (e.g., Guiguet 1958; Munro 1979; Best 2008; Best and Arcese 2008; Isaac-Renton *et al.*, in press) have referred to the resident populations of Canada Geese on Vancouver Island and the adjacent Gulf Islands as introduced, yet we could find few published details about these introductions.

Although small, early introductions of Canada Geese had apparently taken place (Guiguet 1958), it was not until the 1970s that government and non-government agencies began an organized effort to introduce geese to the province. Initially, this program occurred on the southwest mainland coast of British Columbia and shortly after, expanded to Vancouver Island (Smith 2000). The transplanted geese came from a variety of sources and did not include the breeding subspecies, *B. c. fulva*, which was native to Vancouver Island.

During the past 3 decades, Canada Goose numbers on southern Vancouver Island have increased rapidly. Introductions have been quite successful, much to the chagrin of the agricultural community, water quality managers, health officers, greens keepers, airport managers, swimmers, habitat managers, and others.

As a result of their negative impacts on farms, parks, and natural habitats, egg-addling programs were initiated in the early 1990s in some areas including the Capital Regional District (Victoria area), Cowichan River valley, Nanoose and Bonell creeks, Englishman River estuary and Little Qualicum River estuary (Cooper 2001, 2003, 2006; Smith 2010). These efforts have had varying degrees of success. For example, in 2001, high natural predation rates coupled with earlier egg addling efforts resulted in a 60% decrease in nesting geese on Quamichan Lake (Cooper 2001). However, it is possible that predation pressure and the egg-addling measures may have simply caused the resident geese to nest in other areas (Cooper 2003).

Here, we speculate on the distribution of the native Canada Goose on Vancouver Island prior to European influence. We also discuss the taxonomy and status of the native subspecies that nest, migrate through, or winter on the island. We refer to the exotic, introduced birds as 'resident' Canada Geese, document their introductions and discuss their status, dispersal, and population growth.

Methods

We reviewed historical and current literature, the grey literature (Wikipedia 2010), unpublished field notes, and records from the files of the BC Ministry of Environment (MoE) offices in Victoria and Nanaimo, the B.C. Ministry of Forests and Range Library (Victoria), the BC Legislative Library (Victoria), the BC Provincial Archives (Victoria), and the Royal Ontario Museum (Toronto).

We used data from the wildlife observation records and BC Nest Record Scheme at the Royal British Columbia Museum (RBCM) and the British Columbia Breeding Bird Atlas (BCBBA 2008). We also reviewed Breeding Bird Survey data (USGS 2010) and Vancouver Island bird banding schedules and band recovery records for the Canada Goose provided by the Bird Banding Office, Canadian Wildlife Service (CWS: Ottawa) and MoE. In addition, we interviewed several naturalists and biologists familiar with Canada Goose introductions to Vancouver Island.

We used Christmas Bird Count (CBC) data to estimate population growth rates on Vancouver Island. We summed Canada Goose numbers from 6 CBC count areas: Pender Island, Duncan, Nanaimo, Deep Bay, Comox, and Campbell River. These 6 counts, excepting Victoria, had data from at least 1976 to 2009. The Victoria CBC data had the longest history (1958 to 2009) and was therefore more appropriate to analyse separately for long term patterns. We conducted a regression analysis on the natural log of the raw data to determine growth trends and tested their significance with Analysis of Variance (ANOVA) (Zar 1974, p.205).

Results and Discussion

Status of the native Canada Goose prior to European contact

In the Americas, hunter-gather societies have been implicated in megafaunal extinctions and major alterations of ecosystems through exploitation of keystone species and the use of fire (Rick and Erlanson 2009). So, one could ask the question, “Is there evidence that, before the arrival of the first Europeans, west coast First Nations played a role in reducing or eliminating early and once-large nesting populations of the Canada Goose on southeastern Vancouver Island?”

Butler and Campbell (2004) look at animal resource use by First Nations on the Pacific Northwest Coast. Their study extends back between 10,000 and 7,000 years BP. Although they do not specifically mention Canada Geese, they found Anatidae the most ubiquitous and highest-ranking bird family in middens. Bird bone frequency was generally much lower than fish and mammals and fish outnumbered both mammals and birds by an order of magnitude. Even that was considered an underestimate due to differences in recovery methods. Butler and Campbell (2004) conclude that intensive use of the same species over the millennia did not deplete the animal populations because they found little change in proportions of the different resources used in the faunal remains they examined.

Miller (1960) describes the avian families or species from 500 bones or fragments found in 9 middens along the shores of Puget Sound. Anatidae made up 61% of the avian samples; however, goose bones were “few.” The dominant waterfowl were the salt-water and estuarine

ducks, with the Mallard (*Anas platyrhynchos*) and scoters (*Melanitta* spp.) being the most plentiful.

Hobson and Driver (1989) summarize the archaeological evidence for use of the Strait of Georgia by marine birds. They mention Canada Goose remains as being the most widespread of all the swans and geese; however, relative abundance and seasonal data are not given. They conclude marine and associated bird use of the strait had changed little during the last 5,500 years.

Sprot (1928) discusses a variety of trapping methods used by Indian wildfowlers on Vancouver Island, including flight nets, dip nets, drop nets, and other means. All these methods of trapping waterfowl were only used during migration periods or winter. There was no mention of egg gathering or of taking geese on the nest.

Wigen (1980) examined the faunal remains in midden deposits near the mouth of the Tsable River and at Buckley Bay on the southeast coast of Vancouver Island. Among the bird remains found at both sites, fewer than 10% were goose bones, identified only to Brant (*Branta bernicla*), *Anser* sp. and *Anserinae*; Canada Geese were not specifically identified. The Buckley Bay deposits were about 2000 years BP; the Tsable River deposits ranged from 1000–4000 years BP.

There have also been several other archeological excavations along southeastern Vancouver Island, mostly related to development proposals. Unfortunately, much of this work remains unpublished, existing largely in the form of confidential government reports, not readily available to the public. However, Wigen (2010) analyzed the contents from many of these excavations and found that Canada Goose remains are relatively scarce in middens from this part of Vancouver Island. She also indicates that juvenile goose bones are easily distinguished from adult bones and she has not detected the former in any of her samples.

Many west coast Native peoples have traditionally harvested seabird eggs each spring in a sustainable manner including those on the west coast of Vancouver Island (Canadian Wildlife Service 2004). Thus, the possibility does exist that egg gathering activities could have taken place on the east coast estuaries of Vancouver Island, as well. However, we found no evidence of such activities. Indeed, we found no evidence that the Canada Goose—and specifically nesting birds—ever formed a significant part of the diet of the early Native peoples of Vancouver Island. When Canada Geese were a part of their diet, it appears they were taken only during autumn migration or in winter. We found no evidence that large, nesting populations of the Canada Goose were extant on southern Vancouver Island prior to the arrival of the first Europeans.

Status of the native Canada Goose post-European contact

The first report of geese from the Vancouver Island area comes from Pearse (1968) who includes an annotated comment from Haswell, on the sailing vessel *Columbia-Rediviva*:

“1st September 1791: [Somewhere off the southern end of Vancouver Island] ‘Geese were in tolerable abundance.’ This date is early for all kinds except *B. c. fulva*, which could have been resident then.”

Pearse (1968) gives no further details and his comment that the unidentified geese could have been resident or even Canada Geese is conjecture. He goes on to describe natives and sportsmen from Haswell’s ship taking both ducks and geese at Clayoquot in October.

Other early reports from Vancouver Island mention the Canada Goose only as a migrant or wintering bird (e.g., Mayne 1862, p. 418; Lord 1866, p. 111–112).

Brown (1868, p. 416 and 425) has the Canada Goose occurring and perhaps breeding on Vancouver Island. Unfortunately he gives no details other than a general mention in his discussion of the interior of the island, which “is very bare of bird-life...” He notes that occasionally birds are seen by the lakes and rivers, and grouse and woodpeckers are the only sounds, “save the cry of the Heron and the noise of the Geese and Ducks which resort for breeding-purposes to the solitary inland waters.” The evidence for and locations of these “breeding” geese are not provided.

Swarth (1912) and his expedition to collect specimens and records of the higher vertebrates of Vancouver Island, spent from 23 April to 28 September 1910 in the mid-island region. Much of that time was spent within the general area of Parksville, French Creek, Little Qualicum River, and Errington as well as the Nanaimo and Alberni areas and Nootka Sound north to Tahsis. Canada Geese were not reported.

During the summer of 1917, Taverner (1918) spent early August in the Alert Bay area, including the Nimpkish River estuary. He records only one Canada Goose flock flying “up the main steamer channel.”

Alford (1928) reports birds he encountered between 1912 and 1920 on southern Vancouver Island; he notes the Canada Goose only as “common in winter.”

As increasing ornithological research took place in the province, an often-clouded but improving picture of the native Canada Goose subspecies occurring on Vancouver Island began to emerge. Current names and subspecies are described (Mowbray *et al.* 2002; R. C. Banks *et al.* 2004):

Atlantic Canada Goose (*B. c. canadensis*)

In the first distributional list of the birds of British Columbia, Brooks and Swarth (1925) report this race as a common resident, breeding almost throughout the province and wintering on the coast. They include but one nest record from Vancouver Island at Campbell Lakes. By the early 1940s, the name *B. c. canadensis* began to be restricted to the pale-breasted birds of the Atlantic coast (Aldrich 1946) although Munro and Cowan (1947) still included this subspecies as a summer visitor to the British Columbia interior. Munro

and Cowan (1947) do not mention any Vancouver Island records nor do they reference nesting geese at Campbell Lakes. They included *B. c. occidentalis* as the coastal race for the large-bodied subspecies. Campbell *et al.* (1990) do not list *B. c. canadensis* at all and this race is no longer considered to occur naturally in British Columbia and probably never did. We believe the Campbell Lakes birds mentioned in Brooks and Swarth (1925) were most likely *B. c. fulva*.

Great Basin Canada Goose (*B. c. moffitti*)

Brooks and Swarth (1925), Munro and Cowan (1947), and Campbell *et al.* (1990) do not mention this subspecies on the British Columbia coast; however, our review of banding data shows that this race regularly visits Vancouver Island.

The first Canada Goose banding records reported from Vancouver Island were of single band recoveries made in 1949 and 1953. Hunters shot these birds in September somewhere near Victoria. Ian McTaggart-Cowan had banded both geese “within the range ascribed to *Branta canadensis moffitti*” (Cowan 1954). The initial goose recovery was of a local bird (L; young bird incapable of sustained flight) banded in the summer of 1949 at Phililloo Lake; the second goose had been banded in the summer of 1951 as a one year old or older (AHY; bird known to have hatched before the calendar year of banding) at Simon Lake. Both lakes are located near Lac la Hache in the southern Cariboo region.

In July 1967, a goose banded in the Kelowna area of the Okanagan was shot west of Duncan in November 1969. In 1968, 3 L geese banded by H.T. Butler near Francois Lake in the north-central interior were found the following winter on Vancouver Island. Two were recaptured, one near Victoria, and one at Refuge Cove; the third was shot northwest of Ucluelet.

In June, 1984, a Canada Goose banded as an L bird in the Chilcotin near Lees Corner, 70 km west of Williams Lake, was shot near Campbell River in September of that year. Six L Canada Geese banded in the Chilanko Forks-Puntzi Lake region of the Chilcotin in June 1985, were shot in the Duncan area in December 1985 and January 1986. Also, an L goose banded northwest of Prince George in June 1987 was later shot in the Nanaimo area in January 1998. Banding records also indicate that individuals of this race banded as L birds in western Washington and Oregon were reported from southern Vancouver Island during autumn migration, winter, and summer (see also, **Potential gene pool mixing**, below).

The majority of these band recoveries indicate the birds were wintering on Vancouver Island, which to our knowledge has not been reported before for the *moffitti* subspecies.

Aleutian Canada Goose (*B. c. leucoparia*)

Known as Hutchins Goose (*B. c. hutchinsi*) in Brooks and Swarth (1925), the Aleutian Canada Goose was considered a common migrant, with numbers remaining throughout the winter on the southwestern coast. By the time of Munro and Cowan (1947), the race was known as the Lesser Canada Goose (*B. leucopareia*) and was considered a transient on the coast; it was not known to nest in the province. Neither Munro and Cowan (1947) nor Campbell *et al.* (1990) could substantiate the statement in Brooks and Swarth (1925) that these birds wintered on the southern part of the coast.

Dusky Canada Goose (*B. c. occidentalis*)

Known as the White-cheeked Goose in Brooks and Swarth (1925), they report the Dusky Canada Goose as confined to the coastal strip of British Columbia, breeding only in the northern portion of its range. Vancouver Island records are not mentioned. Later Brooks (1926) describes this subspecies as occurring "south to, but not perhaps including, Vancouver Island." Taverner (1928) also notes that this subspecies "breeds along the coast from the Queen Charlotte Islands (perhaps from Vancouver Island) to Prince William Sound, Alaska."

In the late 1940s, Munro and Cowan (1947) describe *B. c. occidentalis* as a resident on the coastal strip of the province north of latitude 50° 30' with a probable centre of abundance on the Queen Charlotte Islands. They include Laing's (1935) nesting record from Caribou Creek, a tributary of the Oyster River, in the Courtenay region, Vancouver Island; however, see *B. c. fulva*, below.

Munro and Cowan (1947) note an autumn movement, which brings some birds to the southern part of the British Columbia coast to winter including Port Hardy, Quatsino, and Nanaimo. Bellrose (1976) reports that a few Dusky Canada Geese stop on Vancouver Island but most make landfall in southwest Washington.

On the west coast of the island, Hatler *et al.* (1978) report some 2,000 Canada Geese using Pacific Rim National Park and the surrounding area during autumn migration, with occasional numbers reaching upwards of 10,000 birds. They believe most are of the subspecies *B. c. occidentalis*.

Banding returns indicate that Dusky Canada Geese, banded on the Copper River delta, Alaska, migrated along both the east and west coasts of Vancouver Island, where birds were harvested or their bands read from October through January. Birds encountered in December and January are likely overwintering birds.

Banding data also suggest that small numbers of this subspecies stopover or winter in the Victoria area. For example, on the 1991 and 1993 Vancouver Island Canada Goose surveys of late November, when most of the Canada Goose migrants have dwindled (Campbell *et al.* 1990), 103 and 25 Dusky Canada Geese, respectively, were reported from the Swan and Blenkinsop lakes area near Victoria (Dawe *et al.* 1994). In 1991, 4 of the birds were observed wearing red neck collars while 3 collared birds were found in 1993, 2 of which were also seen in 1991. These birds were collared west of Alaganik, Alaska, on the Copper River delta. We also have reports of collared birds in December and January.

Based on current genetic research and banding returns, we now know that *B. c. occidentalis* breeds only in Alaska, on the Copper River delta, on several islands in the Gulf of Alaska, and in Prince William Sound and winters primarily in Washington and Oregon (Campbell *et al.* 1990; Mowbray *et al.* 2002).

Some authors believe that *B. c. occidentalis* and *B. c. fulva* are morphologically inseparable (e.g., Palmer 1976), which likely explains the apparent confusion by Brooks and Swarth (1925), Taverner (1928), and Munro and Cowan (1947). These 2 subspecies maintain their current taxonomic status based on their disjunct breeding and wintering distributions, moderate differences in morphology, and differences in mtDNA (Mowbray *et al.* 2002).

Vancouver Canada Goose (*B. c. fulva*)

The Vancouver Canada Goose is considered a breeding bird from southeastern Alaska through northwest British Columbia, including the Queen Charlotte Islands and northern Vancouver Island (Mowbray *et al.* 2002).

Bellrose (1976) reports that *B. c. fulva* is mainly non-migratory and notes that 62% of banded birds had traveled less than 100 miles [160 km] from Glacier Bay, Alaska. He reports that 17% of the birds were recovered south of Vancouver Island, which may explain the few birds that winter on the island.

Recently, Hupp *et al.* (2010) surgically implanted 166 adult female Vancouver Canada Geese in southeast Alaska with very high frequency radio-transmitters. During winter radio-tracking flights, they detected 155 geese, most of which moved \pm 30 km between November and March. No radio-marked females were detected in coastal British Columbia, Washington, or Oregon. They conclude likely <2% of Vancouver Canada Geese nesting in southeast Alaska migrate to wintering areas in Washington and Oregon.

In 1933, Laing (1935) located and collected a pair of nesting geese and their clutch of 5 eggs from Caribou (= Woodhus) Creek. We believe at least part

of this clutch (3 eggs) resides at the Canadian Museum of Nature (specimen no. CMNAVE2184); however, we could not locate the adult specimens, which may represent the only examples of the native race of Canada Goose that originally nested on central Vancouver Island. Laing (1935) considered the pair to be of the race *B. c. occidentalis*. Because of the difficulty in separating *B. c. occidentalis* and *B. c. fulva* in the hand and our current understanding that *B. c. occidentalis* breeds only in Alaska, it is more probable that Laing's birds were of the race *B. c. fulva*, but this awaits confirmation.

Don Robinson (2010) recalled a story often recounted by his uncles (A.B.C. Brown and C.E.A. Brown) who lived for years by Great Central Lake. There they often fished McBride Lake and drainage at the western end of Great Central Lake. In late July of either 1935 or 1936, while walking back from McBride Lake to Great Central Lake, "they flushed a family of Canada Geese while crossing a swamp area. The geese could not fly and appeared to be a pair of adults with several young; all quickly scattered into the swampy area." Robinson's uncles continued fishing McBride Lake and its tributaries until the early 1970s but that was their only summer contact with Canada Geese. The habitat suggests these birds were *B. c. fulva* and, if so, it would make this the southernmost nesting record for this subspecies. We also believe the nesting record first reported by Brooks and Swarth (1925) at Campbell Lakes was of this subspecies.

Richardson (1971) reports the Canada Goose, only as a winter resident (120 birds) and migrant (1,000 birds) in the Grant Bay, Browning Inlet region near the northwest tip of Vancouver Island some 41 km southeast of Cape Scott. He does not differentiate the subspecies but these birds are most likely *B. c. fulva*.

Hatler *et al.* (1978) report that in the late 1960s and early 1970s, small numbers, "usually less than 50" geese, winter in Pacific Rim National Park; "most of these appear to be ... *B. c. fulva*." Today, a few hundred geese, likely this subspecies, winter there (501 Canada Geese were reported on the Tofino Christmas Bird Count, 28 December 2002 (CBC 2010). The geese spend most of their time moving between the golf course and the Tofino mudflats (Clarkson 2009).

Recently, Cooper (2009) found what he believes to be a few native geese nesting on the estuaries and larger bogs at the north end of the island. During aerial surveys in 2004, he recorded 2 broods in 50 km² of bog habitat near Knob Hill. He notes a few pairs have also bred at Holberg on the Goodspeed River estuary (Cooper 2009). The latter birds possibly originated from the Nimpkish River area introductions but that has not been determined.

Based on our analysis, we believe *B. c. fulva* is most probably the native Canada Goose subspecies

that nested on Vancouver Island and likely still does, if only at the northern end of the island. Leach (1982) came to a similar conclusion in his historical review of waterfowl on the Fraser River delta: "If any subspecies of Canada Goose once nested on the lower mainland coast it was more likely to have been the Vancouver Canada Goose...."

Cackling Goose (*B. hutchinsii*)

Brooks and Swarth (1925) considered the Cackling Canada Goose (*B. c. minima*) a fairly common migrant along the coast and list one December record from Parksville. Munro and Cowan (1947) describe the Cackling Goose as a distinct species (*B. minima*) that is a transient along the coast with a few birds wintering. They list records from Parksville, Qualicum Beach, and Victoria. Campbell *et al.* (1990) describe the race *B. c. minima* as occurring regularly as a spring and autumn migrant in the province but usually in small numbers. Today, the Cackling Goose is considered a distinct species (Banks *et al.* 2004). We have excluded Cackling Goose records from our analysis and do not discuss this species further.

In summary, before the 1970s, the Canada Goose was primarily a migrant and winter visitant to Vancouver Island. Laing's (1935) comment, "April 21, 22 and 23 [1933] were spent on an expedition in quest of the breeding form of *Branta canadensis*," and the fact he considered the nesting pair he found, a note "worthy of record," strongly suggest that nesting Canada Geese were scarce on Vancouver Island in the 1930s. This is supported by the scarcity of early nesting records of the native Canada Goose subspecies, which are very rare with none known from south of the Great Central Lake area.

By the early 1970s, the status of the Canada Goose on southern Vancouver Island began to noticeably change. There, a small, resident breeding population in the Victoria and Quamichan Lake areas had grown to about 200+ birds from earlier introductions in the late 1920s and early 1930s (Guiguet 1958; see also **The introduced, resident...**, below). Elsewhere, most geese were still either migrants or winter visitants. Except for new information about the regular occurrence of native *B. c. moffitti* on Vancouver Island, even our current knowledge of the known native subspecies occurring on the island suggests their status is still much the same as it has been historically. So why is the Canada Goose now a widespread breeder on Vancouver Island, particularly along the southeast coast?

The introduced, resident Canada Goose on Vancouver Island

As early as 1918 (Alford 1928) and through the early 1930s, the Province of British Columbia operated one or more game farms near Victoria, apparently near Colquitz River (Cummins 1920), Cedar Hill (Munro 1921) and Elk Lake (Jones

1927). Following the closure of the Colquitz and Cedar Hill game farms, the Elk Lake Game Farm was established in 1926 and focused on rearing Ring-necked Pheasants (*Phasianus colchicus*; 2,300 birds at the year end). The game farm also had 10 adult Canada Geese (Jones 1927), from which 5 young were produced in 1928 (H.M Laing field notes; Jones 1929); the source stock of those birds is not mentioned.

An entry in Jones (1930), suggests that in 1929, 16 Canada Geese were liberated from the Elk Lake Game Farm and likely released at nearby Elk Lake. This is the earliest introduction of Canada Geese on Vancouver Island we could find. Private game-bird farming regulations were also instituted in 1929 and the game commission began to receive applications for permits to engage in the business of game-bird farming (Jones 1930).

In 1930, 2 “settings” of goose eggs were obtained from Penticton but only 1 young was produced; it was released at Elk Lake (Jones 1931). In 1931, another 2 settings of goose eggs were received from Penticton and 2 young were raised and released at Elk Lake (Jones 1932). Guiguet (1958) suggests that James A. Munro played a role in these early goose introductions. Munro lived in the Okanagan at that time and may have been supplying the eggs to Jones. For example, a gosling specimen collected from an egg in 1930 near Vaseux Lake (ROM 84105) and Munro’s own field notes indicate he regularly looked for nesting geese in the Okanagan in the 1930s and earlier. His field notes do not specifically mention collecting eggs for the game farm (Pudden 2010). However, it is likely that Munro was the source of these “Penticton” goose clutches.

There was no mention of geese at the Elk Lake Game Farm in the 1932 game commission report (Jones 1933). In 1933, the game farm once again had 12 geese in their pens and they hoped “to have some young next year” (Jones 1934).

In 1934, the Elk Lake Game Farm ceased operations in favour of privately run game farms which apparently could produce birds at lower cost (Province of British Columbia 1935, p. R6); the numbers of geese held in the game farm pens or their fate is not discussed. However, based on the earlier releases, it is likely they would have been liberated at Elk Lake and are probably some of the birds mentioned by Guiguet (1958). In 1934, there were as many as 161 licensed game-bird farmers in the province. These game farms collectively held a total of 15 geese (Province of British Columbia 1935, p. R43). We found no evidence that the Province ever purchased geese from the farms during the 1930s or 1940s.

By 1939, there were up to 184 licensed game-bird farmers in the province (Province of British Columbia 1940, p. L77). These private game farms could have been the source of additional goose introductions to Vancouver Island (Cowan 2006); however, if they occurred, they were not documented and therefore were likely unauthorized (but see Ed Wood comment, below).

The 1943 Game Commission Report notes “Canada Geese are to be observed in small numbers on Quamichan Lake” (Province of British Columbia 1944, p. JJ11). This is the first mention of what appears to be an established resident population on Vancouver Island, likely resulting from the 1934

and earlier releases of geese on Elk Lake. These birds were probably part of the population mentioned by Guiguet (1958) that moved between Elk Lake and Quamichan Lake:

“The geese resident at Elk Lake on the south end of Vancouver Island are of this subspecies [*B. c. canadensis*]. About a dozen birds were placed there some years ago by Game Warden Jones and the late J.A. Munro, then Dominion Wildlife Officer. The birds have increased in numbers, and we have recorded as many as 200 on occasion at Elk Lake. They trade back and forth to Quamichan Lake, and feed in surrounding fields on the Saanich Peninsula. These geese nest and raise their young in the vicinity of both lakes and other small lakes in the vicinity.”

According to a report in the MoE files (Anonymous 1989), Canada Geese were also introduced to the Nanaimo area of Vancouver Island as early as 1946; however, we could find no details of introductions this early for that area. In any case, such introductions, if they occurred, did not appear to make any significant changes to the status of the Canada Goose in the Nanaimo area.

The first Canada Goose banding efforts on Vancouver Island are attributed to Ed Wood, who banded a total of 11 individuals in 1955 and 1956, somewhere in the Saanichton area, just north of Victoria. The records show that he banded both L and older birds during these years, including 4 hand-reared geese in 1956. Although it is unclear precisely where these geese were banded, we believe it was at Elk Lake, where breeding was first recorded in 1954. The latter record coincides with a photo sequence of a gosling hatching from an egg, illustrated in *Wildlife Review* (Anonymous 1957). The egg was apparently hatched at the Island View Game Farm, privately operated by E.C. Wood, likely the same person as the above-noted bander. It is unclear whether this egg was collected from the wild or produced by captive geese.

In the late 1950s and early 1960s, the Canada Goose was still a rare bird in the Victoria to Sidney area. Allen Poynter’s first contact with the Canada Goose on Vancouver Island was in 1958 or 1959 when he was told about a pair nesting on the shore of a small lake on private property just south of Beaver Lake near Victoria. He later found the nest with a clutch of 6 or 7 eggs. Poynter recalls that, at that time, it was a noteworthy event to find a Canada Goose nest anywhere in the Victoria area (Poynter 2010). In the winter of 1962–1963, David Hancock conducted a series of aerial waterfowl surveys from Patricia Bay around the Saanich Peninsula including Sidney Island south to Trial Island (Hancock 1963). Between the end of September 1962 to the end of February 1963, Hancock flew a total of 11 surveys and did not report any Canada Geese.

By the late 1960s, Canada Geese became more prevalent on the southern part of Vancouver Island. In 1967, Bill Morris, a CWS biologist, banded 84 geese on Quamichan Lake



Figure 1. Provincial Fish and Wildlife Branch biologists, Ray Halladay (left) and Ian Smith, capturing a Canada Goose at Quamichan Lake. In 1971, a total of 12 geese were translocated from this lake near Duncan to Klaklakama Lakes in the Nimpkish River valley area. Image 68980 courtesy of Royal BC Museum, BC Archives; photographed for *Beautiful British Columbia* by Rob d'Estrube, 7 Jul 1971.

(including 32 L birds) and another 32 AHY geese on Elk Lake. During the following 2 years he banded 5 AHY geese at Honeymoon Bay on Lake Cowichan and 9 geese at Thetis Lake, 8 of which were L birds. Re-encounters of these marked birds between 1967 and 1974 clearly show their movements between the 4 banding sites. Another 2 records show that a goose banded at Elk Lake was later shot by a hunter near Shawnigan Lake and a Quamichan Lake goose was found dead near Sooke.

Then, in the early 1970s, the British Columbia Fish and Wildlife Branch embarked on a program to introduce Canada Geese to various locations on the B.C. Lower Mainland with partners that included Ducks Unlimited Canada, Douglas College, Pitt Waterfowl Management Association, Kortright Waterfowl Park (Guelph, Ontario), CWS, BC Waterfowl Society, BC Wildlife Federation, Vancouver Natural History Society, and Royal Canadian Engineers¹. The purpose of the introductions was to provide sportsmen with a harvestable surplus of Canada Geese and to increase wildlife viewing opportunities (Anonymous 1988; Smith 2000).

According to Smith (2000), the introduced birds on the southwest mainland coast of British Columbia originated from Alberta, Saskatchewan, Ontario, Minnesota, and south-central British Columbia. The Lower Mainland goose population is now composed of multi-race hybrids resulting from

the interbreeding of at least 3 subspecies from 2 major sources: *B. c. moffitti*, obtained from southern Alberta and hybrids of *B. c. maxima* and *B. c. interior* from southern Ontario (Smith 2000; Forbes 2009).

The BC Fish and Wildlife Branch also carried out similar introductions on Vancouver Island. In 1971, Ray Halladay and Ian Smith, biologists with the BC Fish and Wildlife Branch, began trapping geese on Quamichan Lake (Fig. 1) to transplant to Klaklakama Lakes in the Nimpkish River valley area of northern Vancouver Island (Halladay 1972). All the transplanted birds were young of the year, pre-flight goslings (Halladay 2010) of the subspecies *B. c. moffitti* (Smith 1972).

During this project Halladay and Smith recaptured 13 of the geese banded by Bill Morris. All but one had been banded at Quamichan Lake in 1967; the remaining goose was banded in 1968 at or near Honeymoon Bay, Lake Cowichan. All of these previously banded geese were returned to Quamichan Lake and were not part of the transplant to the Klaklakama Lakes. All geese transplanted in the second and third years of this project came either from private game farms, the George C. Reifel Bird Sanctuary, or Stanley Park on the Lower Mainland (Table 1).

Other introduction sites on Vancouver Island followed in 1973 and continued through the 1980s (Fig. 2). Table 1 shows the source locations, race, release locations, and numbers of

¹ Details in a letter from D.R. Halladay, B.C. Fish & Wildlife Branch, Victoria to F.G. Cooch, CWS, Ottawa.

Table 1. Known or suspected locations of Canada Goose introductions on Vancouver Island, 1929 – 1991.

Date	General Location	Number introduced	Release site	Source stock	Comments
1929	Victoria?	16	Elk Lake?	Unknown, B. c. moffitti?	Jones 1930
1930	Victoria	1	Elk Lake	Penticton, B. c. moffitti	Jones 1931
1931	Victoria	2	Elk Lake Game Farm	Penticton, B. c. moffitti	Jones 1932
1934	Victoria	~12	Elk Lake?	Okanagan?, B. c. moffitti?	These were likely birds released to Elk Lake when the Provincial Game Farm was closed although this is not certain. It agrees somewhat with Guiguet's (1958) comments that birds were introduced by J.A. Munro and Game Warden Jones "some years ago". See text.
1946	Nanaimo	?	?	Fraser valley	CWS and MoE unpublished report; unable to confirm if this actually occurred
late 1960s - early 1970s	Parksville	20–30	Craig Bay	Fraser valley	Released by a private game farm; no government involvement; pers. comm. Bud Smith and A. Poynter
late 1960s - early 1970s	Nanaimo	?	Jesse Island	Alberta?, B. c. moffitti?	Unknown number of Canada Geese released by a private game farm; no government involvement; pers. comm. Bud Smith
1971	Nimpkish valley	22	Klalkakama Lakes	Quamichan Lake, B. c. moffitti; private game farm, hybrid ²	F&W Branch, unpublished report ¹
1972	Nimpkish valley	18	Klalkakama Lakes	Abbotsford, private game farm, hybrid; Aldergrove, private game farm, hybrid	F&W Branch, unpublished report
1973	Nimpkish valley	22	Klalkakama Lakes	George C. Reifel Bird Sanctuary, hybrid	F&W Branch, unpublished report
1973	Comox	10	?	?	Province of British Columbia (1973, p. AA 56)
1973	Nimpkish valley	25	Upper Klalkakama Lake	Abbotsford, private game farm, hybrid	Purchased and released by Canadian Forest Products
1974	Nanaimo	43	Buttertubs Marsh	George C. Reifel Bird Sanctuary and Stanley Park, hybrid	F&W Branch, unpublished report
1974	Courtenay	?	"Marriott Reserve"	Stanley Park, Vancouver	Letter from W.D. Haddelton, Regional Protection Officer, F&W Branch, to a private game farm. Not known if carried out.
1976	Lantzville	4	Private property		Memo in Wildlife Branch files of people or organizations interested in obtaining noted numbers of Canada Geese for release; it is not known if these releases were carried out.
1976	Gabriola Island	10	Private property		
1976	Nimpkish valley	10	Klalkakama Lakes		
1976	Duncan	6	Quennell Lake		
1976	Nanaimo	15	Buttertubs Marsh	George C. Reifel Bird Sanctuary, hybrid	MoE unpublished report
1976	Nimpkish valley	7	Klalkakama Lakes	George C. Reifel Bird Sanctuary, hybrid	MoE unpublished report
1976	Cedar	4	?	George C. Reifel Bird Sanctuary, hybrid	MoE unpublished report
1976	Nanaimo	3	Hammond Bay	George C. Reifel Bird Sanctuary, hybrid	MoE unpublished report
1976	Woss	4	Woss Lake	Coal Harbour	MoE unpublished report
1976	Parksville	?	Englishman River estuary		Letter from Stan Devereaux (MoE) to a private citizen re request for Canada Geese; not known if any transplants were released.
1985	Sidney Island	50	Sidney Island	Nanaimo area, hybrid	Permit to Sallas Forest Limited partnership to capture up to 50 geese; likely carried out in 1986
1986	Sidney Island	~50	Sidney Island	Westwood Lake, Nanaimo, hybrid	MoE banding data plus photographs supplied by Jim Hatter
1989	Nimpkish valley	22	Upper Klalkakama Lake	Nanaimo area, hybrid	MoE banding data
1991	Duncan	488	Cowichan River estuary	Elk and Beaver lakes, Victoria, hybrid	Young of the year; CWS banding data

¹Much of these data were gathered from Ministry of Environment files in Nanaimo, BC; however, we could not ascertain whether or not the information on Canada Goose introductions with which we were provided was complete.

²Indicates a hybrid subspecies mix of B. c. moffitti, B. c. maxima, and B. c. interior.



Figure 2. Peter Janus, caretaker, feeding a flock of Canada Geese on Sidney Island, 1986. These unbanded geese were introduced to the island as goslings from the Nanaimo area and were reared and released on Sidney Island under permit from the Wildlife Branch. Photo: Jim Hatter.

birds where known, for Canada Goose introductions on Vancouver Island. The multi-race hybrids from the Lower Mainland apparently formed much of the initial stock for the 1970s introductions on Vancouver Island and later mixed in the Victoria area with the Okanagan birds from the earlier Elk Lake introductions. The native nesting subspecies (*B. c. fulva*) was not used for any of the Vancouver Island introductions.

Population increases and spread of resident Canada Geese

After the introductions of the 1930s, Canada Goose numbers on the southern part of Vancouver Island grew only slowly until the late 1960s, when their populations began expanding from their pioneering breeding areas at Elk and Quamichan lakes (see Figure 5).

A waterfowl survey conducted during the 1974 nesting season by Robinson and Dorst (1974), provides a snapshot of Canada Goose breeding distribution on southern Vancouver Island at that time. During the summer, geese were found or known to be nesting only in the Victoria, Duncan, and Nanaimo areas (Table 2). Nesting geese rapidly colonized many other sites over the following decades, sites that had no geese before 1974. Some examples follow.

As noted before, aerial surveys by Hancock (1963) revealed no Canada Geese on Sidney Island in late 1962 and early 1963. A total of 50 geese were introduced to this island in 1986 (Table 1). In 1988, Butler (2010) recorded 2 adults and 17 young on the island and in August 1997 he recorded 300 geese in the island lagoon.

A survey of the Nanaimo River estuary from January

Table 2. Robinson and Dorst (1974) Canada Goose survey results from southern Vancouver Island showing locations surveyed, Canada Goose findings, and first nesting dates recorded in Royal BC Museum files.

Location	Results	Year of first Canada Goose nesting record
Quamichan Lake, Duncan	Canada Goose breeding recorded	1950
Elk Lake, Victoria	Canada Goose breeding recorded	1954
Thetis Lake, Victoria	Canada Goose breeding recorded	1968
Long Lake, Nanaimo	Canada Goose breeding recorded; bird nesting in artificial nest tub	1974
Cowichan Estuary, Duncan	Canada Goose breeding reported by locals but not recorded on survey	1974
Whitty's Lagoon, Victoria	Geese not recorded	1977
Albert Head Lagoon, Victoria	Geese not recorded	1977
Esquimalt Lagoon, Victoria	Geese not recorded	1979
Somenos Lake, Duncan	Geese not recorded	1981
Blenkinsop Lake, Victoria	Geese not recorded	1982
Portage Inlet, Victoria	Geese not recorded	1983
Mesachie Lake, Lake Cowichan	Geese not recorded	1984
Sooke Estuary	Geese not recorded	1985
Englishman River estuary, Parksville	Geese not recorded	1989
Cameron Lake, Whisky Creek	Geese not recorded	1989

through April 1973, recorded a maximum of 9 Canada Geese on the estuary (Vaudry and Land 1973). Surveys for the same period in 1999 recorded a high of more than 190 Canada Geese and, in July of that same year, 420 geese were recorded (Monty *et al.* 2007).

Despite the earlier introduction of around 20–30 Canada Geese at Craig Bay in the late 1960s or early 1970s (Table 1), populations took some time to establish and increase in abundance in the Parksville-Qualicum Beach area.

For example, a foot-survey of the Englishman River estuary in June 1974 did not find any nesting Canada Geese (Robinson and Dorst 1974) and weekly surveys conducted from 17 June 1979–29 June 1980, recorded only 3 observations of Canada Geese (8 birds was the highest number reported). During weekly surveys conducted from 3 November 1988–24 May 1989, Canada Geese were reported on every survey day with a high count of 233 birds. By 2003, breeding was well established on the estuary and an egg-addling program was initiated to control the goose population (Cooper 2003). At least 73 pairs were reported nesting on the Englishman River estuary in 2007 (Lynch and Clermont 2008), the highest known density of nesting Canada Geese on Vancouver Island.

On the Little Qualicum River estuary, only 31 records of the Canada Goose were made over the period January 1975 through September 1984 (Dawe and Buechert 1995–146 surveys between 19 January 1975 and 25 May 1979; NKD unpublished data). Most of the geese were seen during migration or in winter with only 4 summer records, all of which occurred from 1983 or later. In the summer of 1984, the first pair of Canada Geese nested on the estuary. By 2010, at least 45 pairs of geese nested on the Little Qualicum River estuary (Fig. 3; H. Clermont 2010), despite 4 consecutive years of egg-addling.

In 1981, a breeding waterbird survey of 31 wetlands was conducted in the mid-island area from Boomerang Lake, just north of Nanaimo, west to the Port Alberni area, and north to Cumberland (NKD unpublished data). Nesting Canada Geese were found only on Enos Lake on the Nanoose Peninsula although there was a possible breeding pair on Patterson Lake in the Port Alberni area.

Hamilton Marsh, a 36 ha wetland ca. 6 km southeast of the Little Qualicum River estuary turned out to be the most productive waterbird breeding site of the 31 wetlands but Canada Geese were not found there in 1981. A pair with 3 goslings was seen at Hamilton Marsh in 1988 (RBCM files) and by 1995, at least 10 pairs nested there (Cousens *et al.* 1996). In 2007, 40 adult geese and 18 nests were found at Hamilton Marsh during a late-April goose survey (Cooper 2009).

In 1989, CWS and MoE began regular surveys to monitor changes in Canada Goose numbers between Victoria and Courtenay. They were conducted again in 1990, 1991 and in 1993 (Dawe and Morrison 1990, 1991; Dawe *et al.* 1994) and were repeated specific to the Nanoose, Parksville, and Qualicum Beach areas in 2006. The number of Canada Geese in the latter areas increased from 532 birds in 1989 to 2,061 birds in 2006 (Fig. 4; Dawe *et al.* 2006).



Figure 3. Canada Goose nesting on a large stump in the Little Qualicum River estuary, 23 April 2007. Photo: Neil K. Dawe.

Further north on the Campbell River estuary, a total of 31 Canada Geese were recorded during 59 surveys over the period 31 October 1982–18 March 1984 with only 2 birds seen during the nesting season (Dawe *et al.* 1995). The maximum number seen at any one time was 2, except on 23 January 1984 when 25 birds were recorded flying over the estuary. In July 2001, more than 500 Canada Geese were found on the estuary (Badzinski *et al.* 2008) and on 20 July 2009, similar numbers were recorded there (NKD unpublished data).

The spread of the resident Canada Goose on Vancouver Island is illustrated in Figure 5. Today, resident geese are nesting in large numbers in suitable habitats along the east coast of Vancouver Island from Victoria north to Campbell River. A few resident geese also now occur in the Sayward area (T. Clermont 2010). An estimated 500 birds are resident from the Nimpkish River valley area to the Port McNeill, Port Hardy, and Rupert Inlet areas at the north end of the island (Koch 2009).

On the west coast, resident geese have been confirmed nesting from Sooke, north to Bamfield (BCBBA 2008; Fig. 5). Summering birds are occasionally reported from the Tofino-Ucluelet area, although nesting there has not been reported (Dorst 2009).

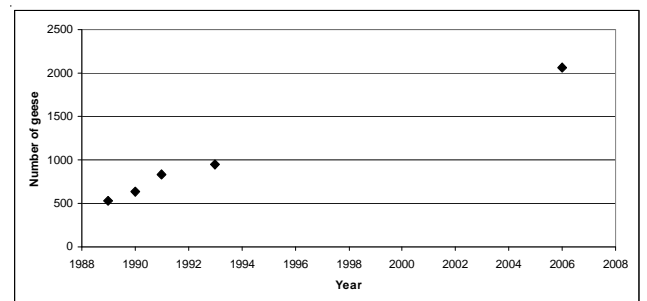


Figure 4. Growth in Canada Goose numbers in the Nanoose, Parksville, and Qualicum Beach areas, 1989–2006.

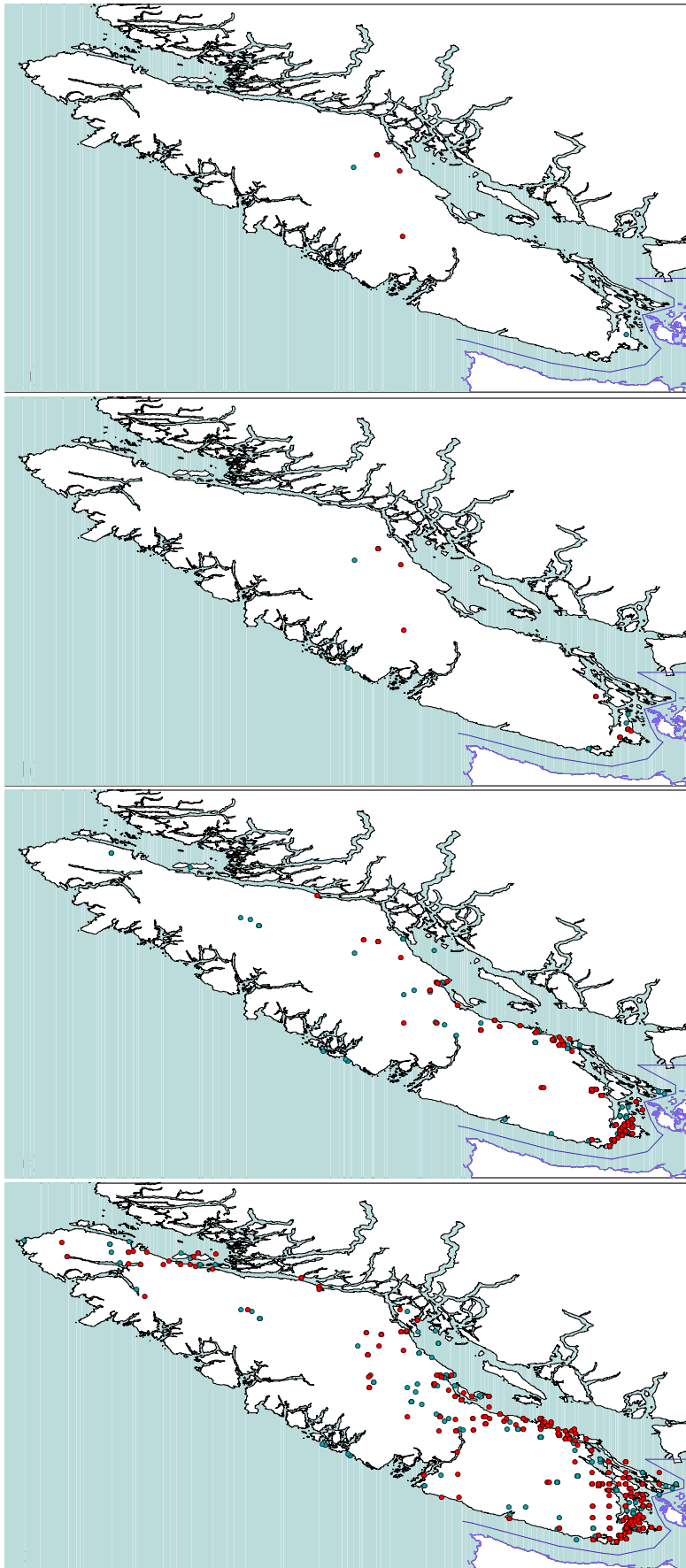


Figure 5. Range expansion of summering and nesting Canada Geese on Vancouver Island: a) prior to the 1940s, native Canada Geese only nested north of the Port Alberni area; b) by the late 1960s, resident geese first introduced to Elk Lake in 1929 (southern population) had expanded their range north to the Duncan area (Quamichan Lake) and west to Thetis Lake and Sooke; c) during the 1970s and 1980s, a number of introductions took place along the southeast coast of the island and in the Nimpkish River valley area in the north, while the southern population expansion continued; d) from the 1990s through 2010, significant expansion of the introduced birds occurred along the eastern coast of the island and into the Gulf Islands; presumed native geese confirmed nesting at the northern tip of Vancouver Island. Documented nesting (red) and summer occurrence (June and July; green) records are shown. Data are from Royal BC Museum and BC Breeding Bird Atlas files.

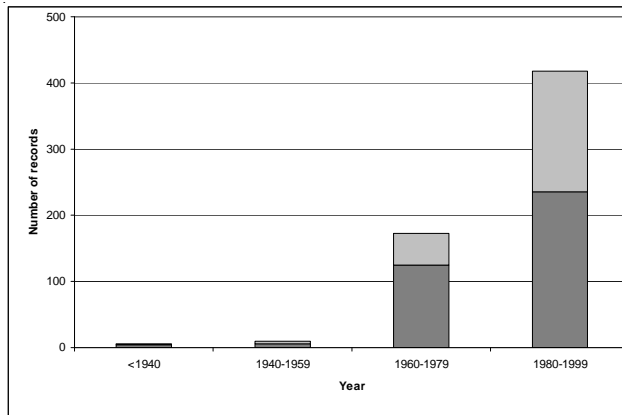


Figure 6. Increase in the number of summer occurrence (dark grey) and nesting (light grey) records for the Canada Goose on Vancouver Island (Royal BC Museum data). With the growing interest in birding since the 1970s, an unknown increase in observer effort should be factored into the increase in records.

Population growth rates and numbers of resident Canada Geese

Canada Goose introductions on Vancouver Island have been very successful, as exemplified by the increase in the number of summer and nesting records after the 1960s (Fig. 6).

CBC trends provide another coarse indicator of Canada Goose population increases on Vancouver Island. The CBC count data from Victoria (Fig. 7; CBC 2010) suggest 3 different growth phases: 1) from 1958 to 1976 the population grew slowly or not at all ($F_{1,16} = 1.91$; $p > 0.05$; 1958 outlier datum removed); 2) from 1977 to 1997, goose abundance increased exponentially at a high average annual rate of ca. 16% ($F_{1,19} = 497.3$; $p < 0.001$); and 3) from 1998 to the present, numbers appear to have stabilized ($F_{1,10} = 0.027$; $p > 0.05$). The change from exponential to low linear or no growth may have resulted from a combination of high predation rates (Cooper 2006), egg-addling (Cooper 2001, 2003, 2006, Smith 2010), hunting, and agency-issued kill permits. Alternatively, or in conjunction with the above factors, the geese may have simply exceeded the local carrying capacity of the Victoria CBC circle and have been dispersing into adjacent areas.

In contrast to the apparent leveling off of Canada Goose numbers in the Victoria CBC count circle, the combined data from 6 other CBC circles on the east coast of the island, ranging from Duncan to Campbell River (Fig. 8; CBC 2010), suggest an average annual growth rate of ca. 8.5% ($F_{1,32} = 168.4$; $p < 0.001$) over the period 1976–2009. In other words, the number of Canada Geese appears to be increasing at a high rate over a large part of Vancouver Island.

Crewe *et al.* (2009) report a significant steady increase of 7.2%/year to the Canada Goose population index from British Columbia Coastal Waterbird Survey data for the Georgia Basin.

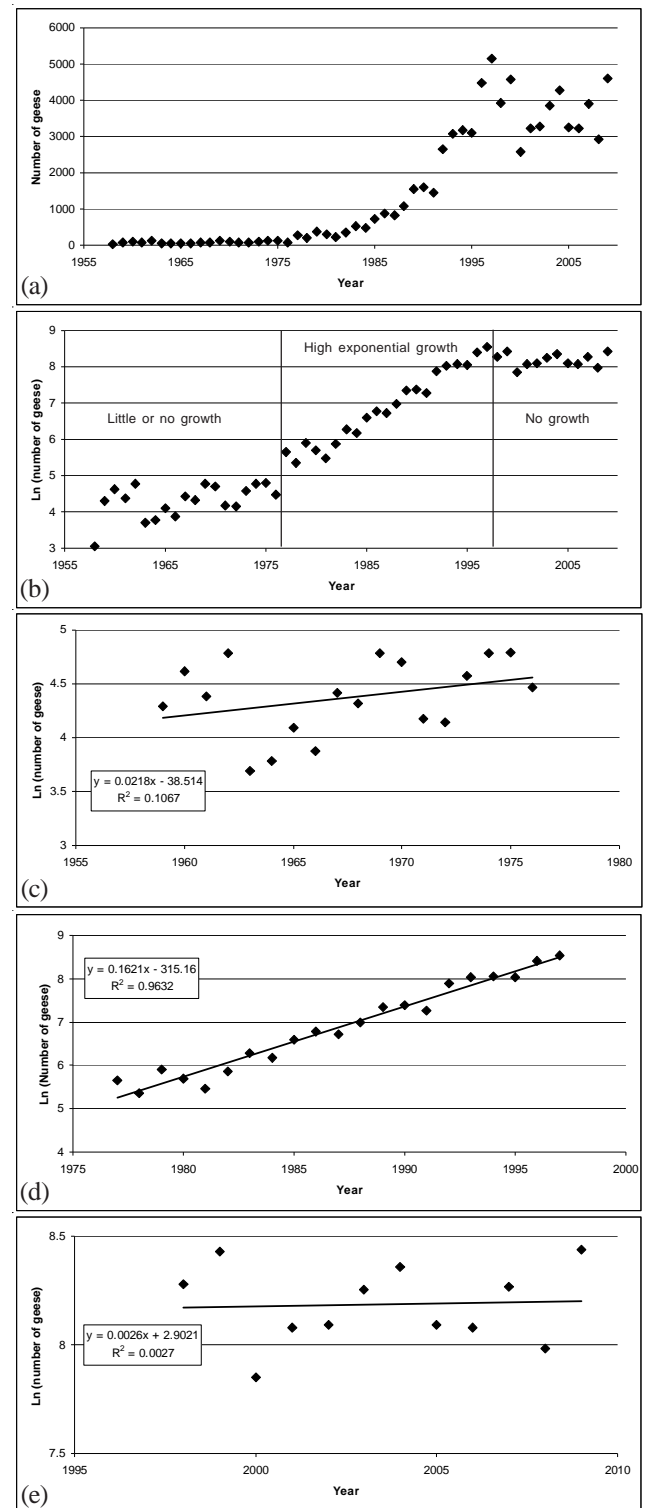


Figure 7. Canada Goose numbers on Victoria, BC Christmas Bird Counts, 1958–2009 (CBC 2010). (a) Total number of geese reported over the count period. (b) Growth of goose numbers showing three different periods of growth. (c) 1959–1976: little or no growth occurred over this period (1958 outlier removed). (d) 1977–1997: a period of high exponential growth at an average annual rate of 16%. (e) 1998–2009: goose numbers in the count area appear to have stabilized.

As they point out, however, this survey is not the best monitor of Canada Geese. Populations of native migrant geese that winter in small numbers on Vancouver Island do not appear to be faring as well. In 2009, the Dusky Canada Goose spring population estimate was the lowest on record since 1986 (US Fish & Wildlife Service 2009). In the US, growth rates of resident Canada Goose populations in all 4 flyways range between 2% and 7% (U.S. Fish & Wildlife Service 2005, p. I5-I6).

We estimate the total wintering population of Canada Geese from Sooke north to Campbell River to be at least 15,000 birds. This estimate is based on the ca. 16,200+ Canada Geese reported from 14 Christmas Bird Counts² from Sooke to Campbell River in the winter of 2009–2010 (CBC 2010). We believe a majority of these wintering birds are resident geese but this awaits confirmation. Our estimate is substantially higher than the ca. 5,000+ birds reported in McFarlane-Tranquilla *et al.* (2008).

Potential gene pool mixing between resident Canada Geese and geese from other regions

The Great Basin or Western Canada Goose (*B. c. moffitti*) is the only goose that nests in Washington and Oregon; wintering populations consist of both resident and migrant birds (Subcommittee on Pacific Population of Western Canada

Geese 2000). Originally, it was a race from east of the Cascade Mountains but now occurs in significant numbers west of the Cascades, a result of natural pioneering and introduction programs (Warran 2006). Failed breeders and nonbreeders are known to make long distance moult migrations as well as shorter movements to large, permanent bodies of water near their breeding grounds.

Banding returns indicate that some of these geese from Washington and Oregon mix with the resident Vancouver Island geese although the extent to which this mixing occurs is not known. For example, from the nearly 500 L birds that were captured, marked, and translocated from Elk Lake to the Cowichan River estuary in July 1991 (Table 1), at least 24 birds were taken by hunters in Washington and Oregon during autumn and winter between 1991 and 2008. More recently, from 70 birds banded as moulting birds (but unaged) on the Englishman River estuary in July 2010, 4 were encountered in Oregon in September and 1 in Washington in November of that year (Cooper 2011).

Banding data also indicate that some L geese banded in Washington and Oregon were later recaptured as moulters at Elk Lake or shot in the Duncan and Nanaimo areas of the island. While some of these birds were encountered during the autumn migration or winter, there are also 5 records from June and July, suggesting the possibility that some birds from western Washington and Oregon move to southern Vancouver Island to moult or possibly to nest.

Banding returns also show that a few of the mixed-race, hybrid geese from the Lower Mainland have made what were possibly dispersal flights to Vancouver Island.

Earlier, we discussed wintering numbers of the Dusky and Vancouver Canada Goose. Although the timing of pair-formation has received little attention for the Canada Goose, it likely occurs in winter and spring (Mowbray *et al.* 2002). Thus, the potential exists for pairing and gene pool mixing between these native wintering races and resident geese.

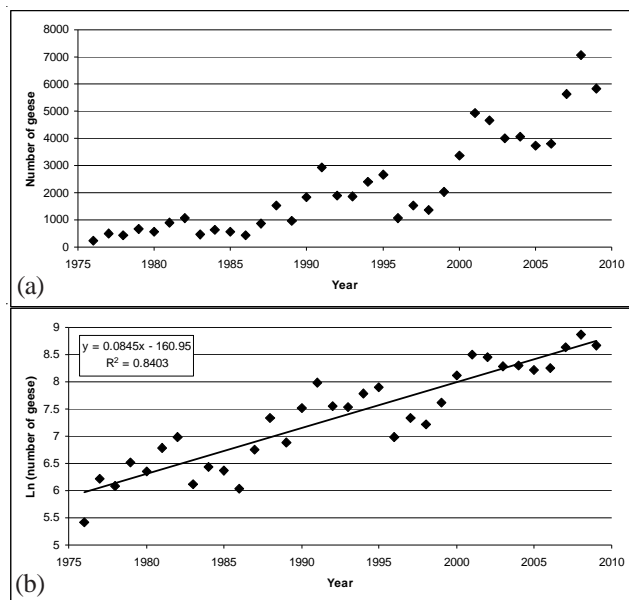


Figure 8. Canada Goose Christmas Bird Counts between Duncan and Campbell River (Campbell River, Comox, Deep Bay, Duncan, Nanaimo, and Pender Island count areas) Data are for the winters of 1976–2009. (a) Summed totals of geese for the six count areas. (b) Growth of goose numbers over the period 1976–2009. The slope of the curve suggests an average annual growth rate of ca. 8.5%.

² Campbell River, Comox, Deep Bay, Duncan, Galiano-North Saltspring, Nanaimo, Nanoose Bay, Parksville-Qualicum Beach, Pender Harbour, Pender Island, Port Alberni, Sidney-South Saltspring, Sooke, Victoria.

Synthesis

We conclude that the native, breeding goose on Vancouver Island was the Vancouver Canada Goose (*B. c. fulva*), but it was likely never numerous; there is no indication it nested south of Great Central Lake.

We document the early introductions of Canada Geese (likely *B. c. moffitti*) on southern Vancouver Island in the late 1920s and early 1930s. We believe these early introductions eventually established a small, local breeding population that had increased to perhaps several hundred birds and by the early 1970s had begun to expand from its 2 central areas, Elk and Quamichan lakes. It is likely that this small population would have continued its expansion to suitable

areas further north and west on its own, without any further introductions, but that is speculation.

We do know that beginning in the early 1970s, the introduction of hundreds of individuals of the non-native, hybrid subspecies have lead to at least 15,000 resident Canada Geese on the east coast of Vancouver Island. These birds are present year round and, in many places, the geese are causing significant damage to both human-modified landscapes and to native habitats (for examples of the latter, see Best and Arcese 2008; Dawe *et al.* In preparation). Concern about these and other impacts resulted in egg-addling, scare, and kill programs in an attempt to control their numbers. Egg addling began in the early 1990s in the Capitol Regional District (CRD) at the south end of Vancouver Island and southern Gulf Islands and by 1995, 2651 eggs had been addled (Smith 2010). Egg-addling began in the Cowichan River valley in the late 1990s (Cooper 2001) and was occurring in the Parksville area by 2003 (Cooper 2003).

Explosive growth of Canada Goose populations has been found virtually everywhere the birds have been introduced in North America and Europe and along with them, their significant and numerous impacts (U.S. Fish & Wildlife Service 2005; Banks *et al.* 2008). On Vancouver Island, resident Canada Goose populations have increased significantly since the mid-1980s. Based on CBC data, we estimate that the Canada Goose population between Duncan and Campbell River has been growing at an alarming rate of 8.5% over the last 33 years. In the Victoria area, a very high annual growth rate of around 16% occurred between 1977 and 1997, after which numbers appear to have stabilized; this latter result is perhaps due to a combination of egg-addling, predation, hunting, and the issuance of special kill permits or the geese exceeding the local carrying capacity.

Czech *et al.* (2000) point out that exotics include North American species, which have “become prominent in areas where they were historically rare and relatively unimportant.” Such is the case with the resident Canada Goose hybrid race now established on Vancouver Island. In our opinion, these resident geese should be considered an exotic, invasive species, similar to the European Starling (*Sturnus vulgaris*) and the House Sparrow (*Passer domesticus*). This designation is suggested not only because nesting Canada Geese were historically rare on the island but because the resident birds are now causing significant damage to native estuarine ecosystems and other habitats. In addition, the resident geese consist of multi-race hybrids from at least 3 subspecies, none of which include the native breeding subspecies of Vancouver Island.

Government agencies can better justify and document their wildlife introduction activities. Much of the provincial and federal government data we tried to access for this paper was either inadequately recorded, incomplete, or missing altogether. Governments need to adopt adaptive management strategies, which include better and timelier monitoring programs to evaluate the success or failure of any introduction programs.

We encourage research on the current breeding range and winter status of the native subspecies of Canada Goose that nests on Vancouver Island as existing information is scarce. There is some urgency as this race could face extirpation on Vancouver Island through inbreeding with an expanding resident goose population. We also need to learn more about the interchange between resident geese and birds from Washington and Oregon that move north to spend time on Vancouver Island. Another area for study must address the extensive damage resident geese are inflicting on native habitats on Vancouver Island and the Gulf Islands, including severe impacts to estuarine marsh ecosystems and rare plant communities in the Garry oak meadow ecosystem. Resident Canada Goose numbers on Vancouver Island will have to be significantly reduced if we hope to initiate recovery efforts on these important systems. Resident Canada Goose impacts to one estuarine marsh on the east coast of Vancouver Island are the subject of a companion paper to come (Dawe *et al.* In preparation).

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Literature Cited

- Aldrich, J. W. 1946. Speciation in the white-cheeked geese. *Wilson Bulletin* 58(2):94-103.
- Alford, C. E. 1928. Field notes on the birds of Vancouver Island. *Ibis* 4:181-209.
- Anonymous. 1957. Life begins for a Canada Goose. *Wildlife Review* 1(9):27.
- Anonymous. 1988. *Draft management plan for Fraser Valley Canada Geese*. Canadian Wildlife Service and B.C. Ministry of Environment, Delta, B.C.
- Anonymous. 1989. *Management plan for Canada Geese, Region I*. Canadian Wildlife Service and B.C. Ministry of Environment, Nanaimo, B.C.
- Badzinski, S., R. Cannings, T. Armenta, J. Komaromi and P. Davidson. 2008. Monitoring coastal bird populations in B.C. The first five years of the Coastal Waterbird Survey (1999-2004). *British Columbia Birds* 17:1-35.
- Banks, A., L. Wright, I. Maclean, C. Hann and M. Rehfish. 2008. *Review of the status of introduced non-native waterbird species in the area of the African-Eurasian Waterbird Agreement: 2007 Update*. British Trust for Ornithology.
- Banks, R. C., C. Cicero, J. L. Dunn, A. W. Kratter, P. C. Rasmussen, J. V. J. Remsen, J. D. Rising and D. F. Stotz. 2004. Forty-Fifth Supplement to the American Ornithologists' Union Check-List of North American Birds. *Auk* 121:985-995.
- BCBBA: British Columbia Breeding Bird Atlas. 2008. Data accessed from NatureCounts, a node of the Avian Knowledge Network, Bird Studies Canada. <http://www.naturecounts.ca/>. Accessed 2011 January 20.
- Bellrose, F. 1976. *Ducks, geese & swans of North America: a completely new and expanded version of the classic work by F. H. Kortright*. 2nd ed. Stackpole Books, Harrisburg Pa.
- Best, R. J. 2008. Exotic grasses and feces deposition by an exotic herbivore combine to reduce the relative abundance of native forbs. *Oecologia* 158:319-327.
- Best, R. J. and P. Arcese. 2008. Exotic herbivores directly facilitate the exotic grasses they graze: mechanisms for an unexpected positive feedback between invaders. *Oecologia* 159:139-150.
- Brooks, A. 1926. Notes on the geese of the *Branta canadensis* group. *Ibis* 68:339-346.
- Brooks, A. and H. S. Swarth. 1925. *A distributional list of the birds of British Columbia*. Cooper Ornithological Club, Berkeley, California.
- Brown, R. 1868. Synopsis of the birds of Vancouver Island. *Ibis* 10:414-428.
- Butler, R. W. 2010. Personal communication, 2010 December 26, correspondence to N.K. Dawe.
- Butler, V. L. and S. K. Campbell. 2004. Resource intensification and resource depression in the Pacific Northwest of North America: A zooarchaeological review. *Journal of World Prehistory* 18(4):327-405.
- Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. K. Kaiser and M. C. E. McNall. 1990. *The birds of British Columbia, Volume I*. Royal British Columbia Museum, Victoria, B.C.
- Canadian Wildlife Service. 2004. Sustainable harvesting of seabird eggs. http://www.westcoastaquatic.ca/article_seabird_egg_harvest0304.htm. Accessed 2010 November 4.
- CBC: Christmas Bird Count. 2010. Christmas Bird Count: Historical Results. *Audubon*. <http://www.audubon.org/BIRD/CBC/hr/index.html>. Accessed 2010 January 20.
- Clarkson, P. 2009. Personal communication, 2009 August. e-mail to N.K. Dawe.
- Clermont, H. 2010. Personal communication, 2010 May 4. e-mail to N.K. Dawe.
- Clermont, T. 2010. Personal communication, 2010 August 24. e-mail to N.K. Dawe.
- Cooper, J. M. 2001. *Canada Goose egg addling program in the Cowichan Valley-2001*. The Nature Trust of British Columbia, Nanaimo, B.C.
- Cooper, J. M. 2003. *Canada Goose egg addling program on Nature Trust Lands, Cowichan Valley, Englishman River and Nanoose Bay, 2003*. The Nature Trust of British Columbia, Nanaimo, B.C.
- Cooper, J. M. 2006. *Canada Goose egg addling program on lands managed by The Nature Trust: Cowichan Valley, Englishman River and Nanoose Bay, 2006*. The Nature Trust of British Columbia, Nanaimo, B.C.
- Cooper, J. M. 2009. Cooper Beauchesne and Associates Ltd, personal communication, 2009 June 10. e-mail to N.K. Dawe.
- Cooper, J. M. 2011. Cooper Beauchesne and Associates Ltd, personal communication, 2011 January 17. e-mail to N.K. Dawe.
- Cousens, N. B. F., J. C. Lee and D. A. Blood. 1996. *Management plan for Hamilton Marsh. Part 1 - Historical perspective, existing conditions and wetland management options*. MacMillan Bloedel Limited.
- Cowan, I. M. 1954. An indication of population mixing in Canada Geese. *Murrelet* 35:45.
- Cowan, I. M. 2006. Personal communication, 2006 January 31. Notes made during discussion with A.C. Stewart.
- Crewe, T., K. Barry, D. Lepage, P. Davidson and S. Badzinski. 2009. *Coastal waterbird population trends in the Georgia Basin 1999-2009: results from the first decade of the Coastal Waterbird Survey*. A report to the Habitat Conservation Trust Foundation for project CAT09-0-357. Bird Studies Canada, Port Rowan, Ont.

- Cummins, A. 1920. Report from provincial constable A.P. Cummins on the operations of the Colquitz pheasant-farm, April 1st to December 31st, 1919., Province of British Columbia. 1920. Annual Report of the Game Warden for the year ended December 31, 1919, Victoria, B.C., p. O 27.
- Czech, B., P. Krausman and P. Devers. 2000. Economic associations among causes of species endangerment in the United States. *Bioscience* 50:593-601.
- Dawe, N. K., W. S. Boyd, R. Buechert and A. C. Stewart. In preparation. Impacts to estuarine marsh vegetation by introduced, resident Canada Geese (*Branta canadensis*) on the Little Qualicum River estuary, Vancouver Island.
- Dawe, N. K. and R. Buechert. 1995. *Bird use of the Little Qualicum River estuary, Vancouver Island, British Columbia, 1975-1979*. Technical Report Series Number 240. Canadian Wildlife Service, Pacific & Yukon Region, Delta, B.C.
- Dawe, N. K., R. Buechert and D. E. C. Trethewey. 1995. *Bird use of the Campbell River estuary, Vancouver Island, British Columbia, 1982-1984*. Technical Report Series Number 233. Canadian Wildlife Service, Pacific & Yukon Region, Delta, B.C.
- Dawe, N. K., T. Martin and K. Morrison. 1994. *Vancouver Island Canada Goose survey, 1991 & 1993*. Canadian Wildlife Service, Delta, B.C.
- Dawe, N. K., G. Monty and T. Clermont. 2006. *Nanoose, Parksville, Qualicum Beach, and area Canada Goose surveys, 23 November 2005 & 18 January 2006*. Canadian Wildlife Service, Delta, B.C.
- Dawe, N. K. and K. Morrison. 1990. *Vancouver Island Canada Goose survey*. Canadian Wildlife Service, Delta, B.C.
- Dawe, N. K. and K. Morrison. 1991. *Vancouver Island Canada Goose survey, 1990*. Canadian Wildlife Service, Delta, B.C.
- Dorst, A. 2009. Personal communication, 2009 October 8. e-mail to N.K. Dawe.
- Forbes, R. 2009. Personal communication, 2009 March 25. letter to Jim Hatter.
- Guiguet, C. J. 1958. *The birds of British Columbia, waterfowl*. British Columbia Provincial Museum, Victoria, B.C.
- Halladay, R. 1972. New homes for Canada Geese. *Beautiful British Columbia* Fall: 19-21.
- Halladay, R. 2010. Personal communication, 2010 September 8. e-mail to N.K. Dawe.
- Hancock, D. 1963. *The abundance of wintering waterfowl in the Victoria, B.C. area*. Victoria College, Victoria, BC.
- Hatler, D. F., R. W. Campbell and A. Dorst. 1978. *Birds of Pacific Rim National Park*. British Columbia Provincial Museum, Victoria, B.C.
- Hobson, K. A. and J. C. Driver. 1989. Archaeological evidence for use of the Strait of Georgia by marine birds, p.168-173 in Vermeer, K. and R.W. Butler (eds.). 1989. The Ecology and status of marine and shoreline birds in the Strait of Georgia, British Columbia. Special Publication Canadian Wildlife Service, Ottawa.
- Hupp, J. W., J. I. Hodges, B. P. Conant, B. W. Meixell and D. J. Groves. 2010. Winter distribution, movements, and annual survival of radiomarked Vancouver Canada Geese in southeast Alaska. *Journal of Wildlife Management* 74:274-284.
- Isaac-Renton, M., J. R. Bennett, R. J. Best and P. Arcese. In press. Effects of introduced Canada Geese (*Branta canadensis*) on native plant communities of the southern Gulf Islands, British Columbia. *Ecoscience*.
- Jones, J. W. 1927. Report on operations of Elk Lake Game Farm, Province of British Columbia. 1927. Report of the Provincial Game Warden for the year ended December 31, 1926, Department of the Attorney General, Victoria, B.C. p. H 30.
- Jones, J. W. 1929. Report on operations of Elk Lake Game Farm, Province of British Columbia. 1929. Report of the Provincial Game Warden for the year ended December 31, 1928, Department of the Attorney General, Victoria, B.C. p. H 35.
- Jones, J. W. 1930. Report on operations of Elk Lake Game Farm, Province of British Columbia. 1930. Report of the Provincial Game Commissioner for the year ended December 31, 1929, Department of the Attorney General, Victoria, B.C. p. H 29.
- Jones, J. W. 1931. Report on operations of Elk Lake Game Farm, Province of British Columbia. 1931. Report of the Provincial Game Commissioner for the year ended December 31, 1930, Department of the Attorney General, Victoria, B.C. p. D 29.
- Jones, J. W. 1932. Report on operations of Elk Lake Game Farm, Province of British Columbia. 1932. Report of the Provincial Game Warden for the year ended December 31, 1931, Department of the Attorney General, Victoria, B.C. p. H 25 - H26.
- Jones, J. W. 1933. Report on operations of Elk Lake Game Farm, Province of British Columbia. 1933. Report of the Provincial Game Commissioner for the year ended December 31, 1932, Department of the Attorney General, Victoria, B.C. p. J 23 - J 24.
- Jones, J. W. 1934. Report on operations of Elk Lake Game Farm, Province of British Columbia. 1934. Report of the Provincial Game Commissioner for the year ended December 31, 1933, Department of the Attorney General, Victoria, B.C. p. I 25 - I 26.
- Koch, A. 2009. Personal communication, 2009 August 27. e-mail to N.K. Dawe.
- Laing, H. M. 1935. Bird notes from Vancouver Island, 1933. *Canadian Field-Naturalist* 49:56-57.
- Leach, B. A. 1982. *Waterfowl on a Pacific estuary*. British Columbia Provincial Museum, Victoria, B.C.
- Lord, J. K. 1866. *The naturalist in Vancouver Island and British Columbia*. Richard Bentley, London.
- Lynch, L. and T. Clermont. 2008. *Canada Goose egg addling program 2007 Vancouver Island-Nature Trust of BC*. The Nature Trust of British Columbia, Nanaimo, B.C.

- Mayne, R. C. 1862. *Four years in British Columbia and Vancouver Island. An account of their forests, rivers, coasts, goldfields, and resources for colonisation.* John Murray, London.
- McFarlane-Tranquilla, L., D. W. Smith, G. Grigg and G. White. 2008. Canada Geese: Control and management in southwestern British Columbia. *Environment Canada - CWS Publications*. http://www.cws-scf.ec.gc.ca/publications/pyt/index_e.cfm#summ. Accessed 2009 November 6.
- Miller, L. 1960. Some Indian midden birds from the Puget Sound area. *Wilson Bulletin* 72:392-397.
- Monty, G. L., B. Merilees and N. K. Dawe. 2007. *Bird use of the Nanaimo River estuary, Vancouver Island, British Columbia: November 1988 – October 1999.* The Nature Trust of British Columbia, North Vancouver, B.C.
- Mowbray, T., C. Ely, J. Sedinger and R. Trost. 2002. Canada Goose (*Branta canadensis*), The Birds of North America Online. (A. Poole, ed.), Cornell Lab of Ornithology, Ithaca, N.Y. <http://bna.birds.cornell.edu/bna/species/682/articles/introduction>. Accessed 2009 September 18.
- Munro, J. A. 1921. British Columbia bird notes. *Murrelet* 2:15-17.
- Munro, J. A. and I. M. Cowan. 1947. *A review of the bird fauna of British Columbia.* British Columbia Provincial Museum, Victoria, B.C.
- Munro, W. T. 1979. *Preliminary Canada Goose management plan for British Columbia.* British Columbia Ministry of the Environment, Fish and Wildlife Branch, Victoria, B.C.
- Palmer, R. (ed.). 1976. *Handbook of North American birds.* Yale University Press, New Haven and London.
- Pearse, T. 1968. *Birds of the early explorers in the northern Pacific.* Self published, Comox, B.C.
- Poynter, G. A. 2010. Personal communication, 2010 September 12. e-mail to N.K. Dawe.
- Province of British Columbia. 1935. *Report of the Provincial Game Commissioner for the year ended December 31, 1934.* Department of the Attorney General, Victoria, B.C.
- Province of British Columbia. 1940. *Report of the Provincial Game Commission for the year ended December 31, 1939.* Department of the Attorney General, Victoria, B.C.
- Province of British Columbia. 1944. *Report of the Provincial Game Commission for the year ended December 31, 1943.* Department of the Attorney General, Victoria, B.C.
- Province of British Columbia. 1973. Department of Recreation and Conservation Annual Report. Victoria, B.C.
- Pudden, J. 2010. Personal communication, 2010 March 23. e-mail to A.C. Stewart.
- Richardson, F. 1971. Birds of Grant Bay and Browning Inlet, northwest Vancouver Island, British Columbia: a year's phenology. *Murrelet* 52:29-40.
- Rick, T. C. and J. M. Erlandson. 2009. Coastal exploitation. *Science* 325:952-953.
- Robinson, D. 2010. Personal communication, 2010 October 20. letter to the authors.
- Robinson, S. and A. Dorst. 1974. *Waterfowl survey of southern Vancouver Island lakes; April to August 1974.* B.C. Fish and Wildlife Branch, Victoria, B.C.
- Smith, D. W. 2000. Management of Canada Geese in the lower Fraser Valley, southwestern British Columbia. p. 151-158 in Dickson, K.M. 2000. Towards conservation of the diversity of Canada Geese (*Branta canadensis*). Canadian Wildlife Service, Ottawa.
- Smith, D. W. 2010. Personal communication, 2010 September 30. e-mail to N.K. Dawe.
- Smith, I. D. 1972. Status of the Nimpkish Canada Goose transplant program: October 30 1972. Report to Wildlife Management Division, British Columbia Fish and Wildlife Branch: 2.
- Sprot, G. D. 1928. The early Indian wildfowler of Vancouver Island. *Canadian Field-Naturalist* 42:139-143.
- Subcommittee on Pacific Population of Western Canada Geese. 2000. *Pacific Flyway Management Plan for the Pacific Population of Western Canada Geese.* Pacific Flyway Study Committee. (c/o USFWS, MBMO), Portland, Oregon. http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/cangeese/Final_EIS/Pac%20Pop%20West%20CG%20-%20plan.pdf.
- Swarth, H. S. 1912. Report on a collection of birds and mammals from Vancouver Island. *University of California Publications in Zoology* 10:1-124.
- Taverner, P. A. 1918. Some summer birds of Alert Bay, British Columbia. *Condor* 20:183-186.
- Taverner, P. A. 1928. *Birds of Western Canada.* Second Edition (Revised). National Museum of Canada, Ottawa.
- U.S. Fish & Wildlife Service. 2005. Final Environmental Impact Statement: Resident Canada Goose Management. *U.S. Fish & Wildlife Service, Migratory Birds*. <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/cangeese/finaeis.htm>. Accessed 2010 March 11.
- US Fish & Wildlife Service. 2009. *Waterfowl population status, 2009.* U.S. Department of the Interior, Washington, D.C.
- USGS Patuxent Wildlife Research Center. 2010. North American Breeding Bird Survey Internet data set. <https://www.pwrc.usgs.gov/BBS/PublicDataInterface/index.cfm>. Accessed 2010 February 12.
- Vaudry, A. and J. Land. 1973. *A migratory bird survey of the Nanaimo River estuary, October 1972 to May 1973.* Canadian Wildlife Service, Delta, B.C.
- Warran, K. 2006. *Identification field guide to the geese of the Willamette Valley and Lower Columbia River, 2nd Edition.* Wild Spirit Resources LLC. http://www.dfw.state.or.us/resources/hunting/waterfowl/goose-permits/docs/Goosefieldguide_front_and_ch1-2.pdf.
- Wigen, R. 1980. A faunal analysis of two middens on the east coast of Vancouver Island. MA Thesis, University of Victoria, Victoria, B.C.
- Wigen, R. 2010. Lab instructor, Department of Anthropology, University of Victoria. Personal communication, 2010 December 14. e-mail to A.C. Stewart.
- Wikipedia. 2010. Gray literature. http://en.wikipedia.org/wiki/Gray_literature. Accessed 2010 September 29.
- Zar, J. 1974. *Biostatistical analysis.* Prentice-Hall, Englewood Cliffs, N.J.