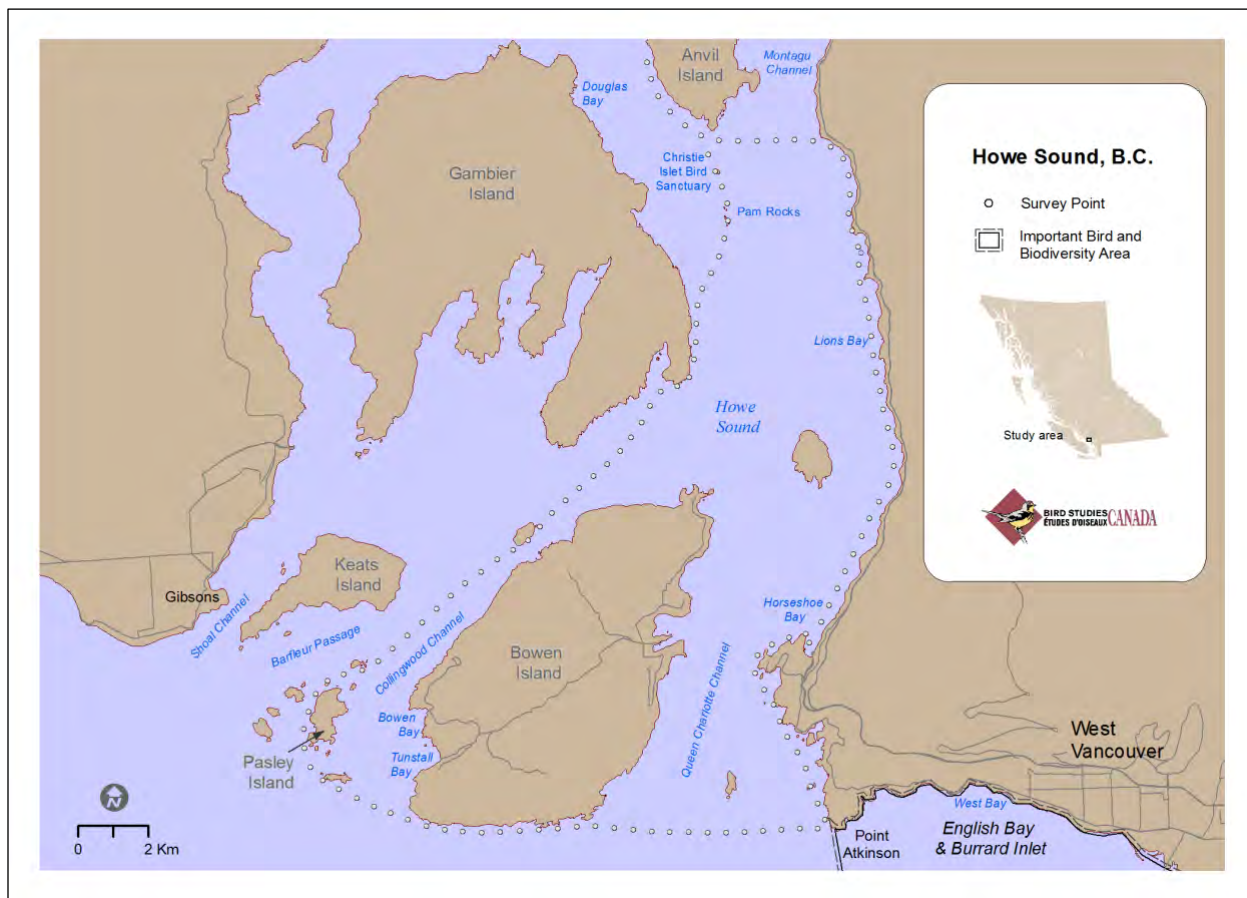


Status and Distribution of ^[SEP] Marine Birds and Mammals in Southern Howe Sound, British Columbia 2014-15

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Executive Summary

Howe Sound, located northwest of Vancouver, is used for shipping, industry, urban development, recreation and tourism. It is also of importance for marine birds and mammals of conservation concern: there are 13 regularly occurring species of birds and mammals that are federally designated as Endangered, Threatened, or Special Concern, or provincially Red- or Blue-listed by the government of British Columbia, in Howe Sound.

We report on a systematic, boat-based survey conducted along a transect through southern Howe Sound every month except September 2014 between 9 June 2014 and 14 May 2015. We added a survey on 12 September 2015 to complete a survey in every month. Our records include 44 marine bird species and 6 mammal species. Our purpose was to document the seasonal abundance and distribution of marine birds and mammals through a year. We compare the results with existing information on the distribution, abundance and trends of marine birds and mammals in the region. Our key findings indicate:

- Several federally-listed and provincially-listed species at risk were detected in Howe Sound including Marbled Murrelet, Double-crested Cormorant, Brandt's Cormorant, Western Grebe, Horned Grebe, Common Murre, Surf Scoter, Long-tailed Duck, California Gull, Peregrine Falcon, Pacific Great Blue Heron, Harbour Porpoise, and Killer Whale.
- Barfleur Passage, Christie Islet and Pam Rocks, and Collingwood Channel were areas of special importance to birds.
- The shoreline was used by important numbers of diving ducks and gulls that rely on mussels for food, in particular Surf Scoter, Barrow's Goldeneye and Glaucous-winged Gull. Tracking the location and extent of mussel beds would provide an indicator of the health of their prey.
- A large number of Marbled Murrelets present in winter suggests that Howe Sound serves as an important location for the imperiled population, BC's south coast murrelets, and should be considered in Critical Habitat identification under the Species at Risk Act. Further, the ecological factors drawing Marbled Murrelets to Howe Sound should be a research priority with the aim of securing the ecological function that supports the large numbers observed.
- The region of southern Howe Sound has sufficiently large numbers of Surf Scoters, Barrow's Goldeneyes and Marbled Murrelets to qualify as an Important Bird and Biodiversity Area. Studies of the movement of birds indicate the birds use southern Howe Sound, English Bay, Burrard Inlet and Indian Arm interchangeably. Our recommendation is to extend the boundaries of English Bay/Burrard Inlet IBA to include southern Howe Sound to reflect this connection.
- A recommendation for an extension of Christie Islet Migratory Bird Sanctuary to include Pam Rocks within the sanctuary boundary.

- Protection for the Grebe Islets at the southeast entrance to Howe Sound should be considered given its use by sea ducks and shorebirds, and the islets' popularity among the birding fraternity as a location to see west coast endemic birds in close proximity to Metro Vancouver.
- Future studies utilizing the Vancouver Aquarium's [Pollution Tracker](#) program to quantify contaminant levels in mussels for birds and overall ecosystem health of the Sound may add further understanding for the management of this ecosystem.

1. Introduction

1.1 Background and context

Howe Sound, 42 km long and 21 km wide at its entrance, is subject to daily tides that ebb and flow in the Salish Sea and the outflow of the Squamish River entering at its head. The freshwater of the river is clearly visible on some days as a silty grey colour arising from glacial and mountain water entering the river from the surrounding mountains.

Howe Sound has a cluster of large and small islands, islets, rocks and reefs. The indigenous people of Howe Sound resided along its shore where they harvested fish, shellfish, birds and mammals (Reimer 2012). The Squamish (Sḵw̓x̓wú7mesh) knew Bowen Island as Xwlil'xhwm, Passage Island as Smetlmetllel'ch, Anvil Island as Tlaxwm and Horseshoe Bay as Ch'axhai' (Corrigan 2001). Howe Sound, its seven large islands and some of the smaller islands bear names assigned by early explorers in recognition of the British Admiralty's participation in the 'Glorious First of June' defeat of the French navy in 1794 (Walbran 1971; Fig. 1). The current First Nations are the Sechelt (Shíshálh), Squamish (Sḵw̓x̓wú7mesh), Tsleil-Waututh (səlilwətaʔt) and the Musqueam (xʷməθkʷəy̓əm).

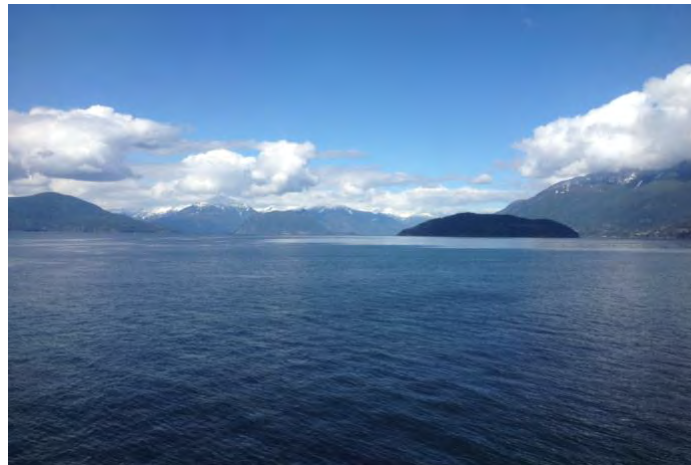


Figure 1. Howe Sound with Bowyer Island (foreground), Anvil Island (distant centre) and Gambier Island (left). The snow peaked Tantalus Range can be seen in distance behind Bowyer Island, 19 March 2017.

Howe Sound was industrialized in the early to late 20th century with concomitant environmental degradation (Levings et al 1979) followed by restoration efforts, continuing to the present day (Mulder 2013).

The islands, rocks and reefs provide a foothold for a carpet of mussels and barnacles that is an important food source for the sea ducks and shorebirds that assemble in the Sound each autumn, winter and spring. The labyrinth of islands also attract large schools of fish, in particular Pacific herring (*Clupea pallasii*) and northern anchovy (*Engraulis mordax*), Pacific sandlance (*Ammodytes hexapterus*) and surf smelt (*Hypomesus pretiosus*) that are important food for

seabirds and marine mammals. The distribution of the marine birds and mammals mirrors this ocean biological productivity.

Howe Sound is an extension of the Georgia Strait ecosystem, more recently known as the Salish Sea ecosystem that holds several globally and internationally important numbers of birds (Butler and Vermeer 1989, Butler 2009). Christie Islet in Howe Sound has been a federal Migratory Bird Sanctuary since 1962.

Despite an abundance of birds in Howe Sound, several studies report the Salish Sea region has experienced a significant decline in some species (Bower 2009, Anderson et al. 2009, Crewe et al. 2012). Vilchis et al. (2015) found long term declines most pronounced among some seabirds (alcids) and grebes that specialized on small fish for prey. They posited that the changes in bird numbers might signal large ecological changes to the food web. Brown and Gaydos's (2007) review of the potential threats to wildlife in the Salish Sea included human disturbance, underwater acoustics and oil spills from increased shipping to and from ports in Vancouver and Washington, and a variety of ecological changes.

The purpose of this report is to present results of a weekly year-round census from 2014-15, and compare with historical information on the distribution and abundance of marine birds and mammals in Howe Sound, and the broader Salish Sea. The project builds on similar work conducted within the Southern Gulf Islands of British Columbia (Davidson et al. 2010), and Burrard Inlet and Indian Arm (Butler et al. 2015).

1.2 Previous studies

Captain George Vancouver entered Howe Sound in mid-June 1792 remarking that “not a bird nor living creature was to be seen” (Vancouver 1798). Despite Vancouver's glum assessment, Archibald Menzies, accompanying naturalist on Vancouver's voyage wrote:

“Near the entrance they passed some Rocky Islands on which they shot a few Sea Pies [oystercatchers]” (Newcombe 1923).

His brief note was the first written account of a marine bird (or lack thereof) in Howe Sound. Nearly a century and a half later, Cummings (1932) wrote an annotated list of birds around Vancouver including Howe Sound, followed by Campbell (1972), and the Vancouver Natural History Society (1995). Vermeer (1981) provided in 1977-78 an early estimate of the number of waterfowl in Howe Sound and examined their diet there in 1982. Breault and Watts (1996) reported on birds in Howe Sound between September and June and Lacroix (2001) surveyed birds in southern Howe Sound between October and May 1998-1999 and September to May 1999-2000. Boyd and Esler (2011) tracked movements of Barrow's Goldeneye fitted with satellite transmitters within the Sound and nearby waters. Information on the trends of various species in the adjacent regions include waterbirds in Padilla Bay, Washington (Anderson et al. 2009), the Salish Sea (Vilchis et al. 2015), the Strait of Georgia (Crewe et al. 2012), and Puget Sound (Nysewander et al. 2001, Bower 2009).

2. Study Area and Methods

2.1 Study Area

The study area includes the tidal waters of southern Howe Sound from Point Atkinson to Anvil Island. A sound is a large sea or ocean inlet, larger than a bay, deeper than a bight and wider than a fjord (Wikipedia). Therefore, the steep walls and a deep seabed about 200 m deep carved by receding glaciers at the northern end of Howe Sound is more a fjord than a Sound. A moraine north of Anvil Island and southeast of the Defence Islands creates a sill that rises to within 30 m of the sea surface south of which the seabed plunges once more to a depth of 150-200m. South of the sill, the shore margins become further apart, creating a true sound.

Howe Sound is rimmed with residential and industrial development interspersed with unpopulated forested areas. Houses line much of the waterfront in West Vancouver, Gibsons, Langdale and Lions Bay, as well as on Bowen and Keats islands. The rest of the shoreline is uninhabited or sparsely inhabited, and comprised of Native Reserve, private and public lands. Christie Islet off the south end of Anvil Island is a federal Migratory Bird Sanctuary.

2.2 Transect Route and Field Protocol

Survey methods designed to estimate population size and distribution of seabirds in large open waters use a sampling method based on a fixed transect width (Tasker et al. 1984). The aim of our study was to derive an estimate of the total number of birds present and record their distribution in mostly narrow waterways, which required us to widen the transect.

We surveyed the southern portion of Howe Sound approximately once each month from June 2014 to May 2015 except September 2014. One survey in September 2015 was added to provide a full complement of survey months. Counts of birds and marine mammals were made from either a 5.2 m long rigid hull boat or a 7-m long aluminum boat moving at 12 knots within a 750 m wide transect either side of the boat paralleling the shoreline, and well within the 1800 m maximum distance that we were able to see sea ducks from the boat on calm days. Most of the birds and mammals were within the transect so our estimates closely approximated the total number of birds present in the waters sampled by our survey. However, many kilometers of Howe Sound were not surveyed such as much of the shore of Gambier Island and the eastern shore of Bowen Island.

Two observers scanned for birds and mammals on either side of the boat. One observer called out waypoints approximately every 500 meters while the other observer recorded the data. Binoculars were used to assist in counting and identifying distant birds and mammals. In most situations, birds and mammals were counted individually. Flocks of more than about 1000 individual birds were estimated by summing the number by groups of 10s or 100s of individuals. Previously, we compared our field estimates against the number counted from a photograph of the same flock and found our precision ($\pm 15\%$) to be similar to other studies (Prater 1979).

Rappolt et al (1984) concluded that over and underestimates canceled each other out.

2.3 Kernel and Cluster Mapping Techniques

Kernel analysis is used to estimate population density and is also used to visualize distribution patterns. Kernel applications are widely used in wildlife research. Kernel analysis creates a smooth surface in which the estimated surface value is highest at the location of the known data points and diminishes with increasing distance from the point, reaching zero at the predefined search radius distance from this point (ArcGIS 9.3, ESRI 2009).

2.3.1 Kernel Analysis

We applied a kernel estimator to determine the spatial distribution pattern of each species of interest using effort-corrected counts. A cell size of 50 metres (resolution) and a search radius of 1,500 metres were used to define the kernel settings. Next, we normalized each raster layer into groups using a “natural breaks” classification method. This method creates classes by identifying naturally occurring breaks in the distribution of data values. It attempts to reduce variance within groups and maximize the variance among groups. To allow comparison among species, we labeled highest values as primary area, the second highest values as secondary area, and the third highest as tertiary area. One further tier of (lowest) values was excluded from visual representation on the species maps to minimize distraction from areas of higher importance.

2.3.2 Clustering Analysis

In order to determine the distribution of groups of interest (e.g. SARA-COSEWIC species), the respective species rasters needed to be combined. In order to make the rasters comparable, it was important to use a common measurement scale and weights that allow us to make calculations of standardized criteria among several kernel rasters. To do this, we assigned numerical weights to the categories described above. Primary areas, secondary areas, and tertiary areas were assigned weights of 10, 6 and 2 respectively. After scaling the kernel raster datasets, the selected species were overlapped and summed together. The resulting rasters were displayed using "equal interval" classification which divides a dataset into groups at regular intervals containing equal ranges of values. In this way, a clustering degree was identified where primary, secondary and tertiary areas represent the species abundance and spatial distribution (and the lowest tier of values was excluded as before).

It is important to note that the maps in this report show the results of applying kernel analysis within 1,500 m of the waypoints along the survey transect route only; the analysis does not extrapolate beyond 1,500 m either side of the transect line. There are shortcomings of applying this technique to waypoints along a transect line, including spatial autocorrelation not being accounted for. The maps represent only the data collected during this survey, and do not reflect an absence of birds or mammals greater than 1500m from the transect line.

2.4 Other Observations

We included observations of birds and marine mammals seen in the inlet within a few years of our surveys but missed by us. The observations of these species listed in the Discussion, help to fill out the species list for the region.

3. Results

3.1 Summary of Records

Twelve surveys were conducted between 19 June 2014 and 12 September 2015, tallying approximately 1353 records (waypoint-encounters) of 36,191 individuals of 44 marine bird and 6 marine mammal species (Table 1). A total of 35,248 birds and 943 marine mammals were recorded on the surveys. Nearly 60% of the birds were Surf Scoters, followed by Barrow’s Goldeneyes and Glaucous-winged Gulls (~15% each). Harbour Seals were the most numerous of the marine mammals (96%). Birds were most numerous in November (8653 birds, mostly sea ducks) and least numerous in June (368 birds). Mammals were most numerous in September (269 mostly seals) and least numerous in December (4 seals). We tallied 13 regularly occurring species of conservation concern (Table 2). Marbled Murrelet and Pacific Great Blue Heron were the most abundant and most frequently-sighted federally-listed Species at Risk.

Table 1. Number of marine birds and mammals counted during 12 line-transect surveys (within 750 meters either side of survey vessel) in Howe Sound, British Columbia, 2014-2015. (September survey was completed in 2015 but shown here in 2014 to complete a year).

Species	2014							2015					Total
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
	(129)	(129)	(129)	(129)	(129)	(129)	(129)	(129)	(129)	(129)	(129)	(129)	
Red-throated Loon	0	0	0	1	0	0	0	0	0	0	0	0	1
Common Loon	0	0	0	0	1	5	3	3	0	0	1	1	14
Red-necked Grebe	0	0	0	0	0	0	1	0	0	0	0	1	2
Horned Grebe	0	0	0	0	1	0	2	2	7	4	0	0	16
Western Grebe	0	0	0	0	1	0	0	0	0	0	25	0	26
Double-crested Cormorant	0	1	4	45	132	15	16	36	62	76	6	0	393
Brandt's Cormorant	0	0	0	0	1	1	0	3	2	1	0	0	8
Pelagic Cormorant	25	20	68	37	69	28	12	28	19	28	57	35	426
Great Blue Heron	1	2	7	1	0	3	2	0	0	0	0	3	19
Canada Goose	69	19	0	0	0	3	0	8	3	42	10	3	157
Trumpeter Swan	0	0	0	0	0	0	0	0	0	38	0	0	38
Mallard	0	0	0	0	0	0	0	0	0	0	0	4	4
Northern Pintail	0	0	0	0	0	0	0	0	0	0	0	1	1
Harlequin Duck	5	3	8	10	71	5	2	14	8	14	20	27	187
Surf Scoter	40	40	120	207	5340	6753	3060	31	348	528	3023	1532	21022
White-winged Scoter	0	0	0	0	3	2	0	0	0	3	0	0	8
Long-tailed Duck	0	0	0	0	0	1	0	0	0	0	0	0	1
Bufflehead	0	0	0	0	0	6	3	7	7	2	2	0	27
Common Goldeneye	0	0	0	0	0	1	6	21	3	11	0	0	42

Barrow's Goldeneye	1	0	0	0	0	1320	812	1465	1359	469	10	0	5436
Hooded Merganser	0	0	0	0	0	0	4	0	0	0	0	0	4
Common Merganser	10	5	8	59	2	2	4	4	15	14	64	12	199
Bald Eagle	11	4	9	0	4	4	209	12	36	20	7	7	323
Golden Eagle	0	0	0	0	0	0	0	0	0	1	0	0	1
Osprey	0	0	0	1	0	0	0	0	0	0	0	0	1
Red-tailed Hawk	0	0	0	0	1	0	1	0	0	0	0	1	3
Turkey Vulture	1	2	1	0	0	0	0	0	0	0	0	0	4
Peregrine Falcon	0	0	0	0	0	0	0	0	0	0	0	1	1
Black Oystercatcher	9	10	7	29	59	2	1	23	3	9	16	6	174
Black Turnstone	0	3	19	23	0	21	0	21	13	2	7	0	109
Surfbird	0	0	0	0	0	320	70	23	6	0	0	0	419
Rhinoceros Auklet	0	0	0	1	0	2	0	0	0	0	0	0	3
Spotted Sandpiper	0	0	2	0	0	0	0	0	0	0	0	0	2
Least Sandpiper	0	0	1	0	0	0	0	0	0	0	0	0	1
Mew Gull	0	0	3	18	30	9	20	41	160	9	27	0	317
California Gull	0	4	10	5	1	6	0	0	0	0	0	0	26
Glaucous-winged Gull	177	386	490	459	1318	115	133	80	126	416	1010	568	5278
Thayer's Gull	0	0	1	0	2	0	1	1	0	0	0	0	5
Unidentified Gull	0	0	0	0	0	0	0	0	0	12	0	0	12
Common Murre	0	0	0	0	0	0	3	1	0	0	0	0	4
Pigeon Guillemot	15	22	34	0	1	0	0	0	19	4	4	53	152
Marbled Murrelet	4	0	4	2	2	29	248	30	16	12	5	2	354
Belted Kingfisher	0	1	0	4	0	0	0	0	0	0	0	0	5
Common Raven	0	0	0	0	0	0	0	0	0	2	0	0	2
California Sea Lion	0	0	0	0	0	0	1	0	0	0	0	0	1
Harbour Porpoise	0	0	0	0	0	1	0	2	4	2	0	0	9
Harbour Seal	67	128	116	269	96	14	3	17	14	7	72	103	906
Killer Whale	0	0	8	0	0	0	0	0	0	14	0	0	22
Mink	0	0	0	0	0	0	0	0	0	0	1	1	2
River Otter	0	0	0	0	0	0	0	0	1	0	2	0	3
All Birds	368	522	796	923	7039	8653	4613	1854	2212	1717	4294	2257	35248
All Mammals	67	128	124	269	96	15	4	19	19	23	75	104	943
All Species	435	650	920	1192	7135	8668	4617	1873	2231	1740	4369	2361	36191

Table 2. Regularly-occurring marine bird and mammal species of conservation priority in Howe Sound. We assumed that the Killer Whales were ‘transients’.

Scientific Name	Common Name	COSEWIC	BC CDC	SARA
<i>Podiceps auritus</i>	Horned Grebe	SC	Yellow	No status
<i>Aechmophorus occidentalis</i>	Western Grebe	SC	Red	SC
<i>Phalacrocorax auritus</i>	Double-crested Cormorant – Pacific Coast subspecies	Not at risk	Blue	No status
<i>Phalacrocorax penicillatus</i>	Brandt's Cormorant	N	Red	
<i>Ardea herodias fannini</i>	Great Blue Heron – Pacific Coast subspecies	SC	Blue	SC
<i>Clangula hyemalis</i>	Long - tailed Duck	N	Blue	
<i>Melanitta perspicillata</i>	Surf Scoter	N	Blue	
<i>Falco peregrinus pealei</i>	Peregrine Falcon – Pacific subspecies	SC	Blue	SC
<i>Larus californicus</i>	California Gull	N	Blue	
<i>Uria aalge</i>	Common Murre	N	Red	
<i>Brachyramphus marmoratus</i>	Marbled Murrelet	T	Blue	T
<i>Orcinus orca</i> Pop. 3	Killer Whale – Transient Population	T	Red	T
<i>Phocoena phocoena</i>	Harbour Porpoise	SC	Blue	SC

1 Committee on Species of Endangered Wildlife in Canada listing (www.cosewic.gc.ca): E =Endangered; T = Threatened; SC = Special Concern; N = not assessed

2 BC Conservation Data Centre listing (www.env.gov.bc.ca/cdc/): Red is the provincial equivalent of the federal Endangered and Threatened categories; Blue is equivalent to Special Concern; Yellow indicates not at risk.

3 Species at Risk Act assessment (http://www.registrelep-sararegistry.gc.ca/species/schedules_e.cfm?id=1)

3.2 Historical Comparisons in abundance and distribution

Vermeer (1981) counted 5,342 Surf Scoters and 2,934 Barrow’s Goldeneyes during a boat-based survey of Howe Sound in November 1977. An average of 6,173 gulls, 3,453 Surf Scoters and 1,030 Barrow’s Goldeneyes were tallied during 27 surveys in southern Howe Sound in 1998-2000 (Appendix 2 in LaCroix 2001). Vermeer (1981) and LaCroix (2001) used different methods and slightly different routes to our survey but all three studies support our conclusion that Howe Sound has had a long history of high use by sea ducks.

A few species showing increasing trends in the region include Canada Goose, Trumpeter Swan, Bald Eagle, Pigeon Guillemot and Harbour Seal. Trumpeter Swans have likely increased following

a ban on hunting and provision of foraging habitat in local agricultural areas. The widespread resident Canada Goose are offspring from flocks intentionally introduced to the Salish Sea about 40 years ago that have taken to local fields and estuaries (Dawe et al. 2010).

Bald Eagles are recovering regionally and beyond following a ban on industrial contaminants and persecution (Bednarz et al. 1990). It is not known why Pigeon Guillemots are increasing. A strong upward trend and large flocks have been seen in surveys in the southern Gulf Islands (Crewe et al. 2012, Davidson et al. 2010). Harbour Seal numbers have rebounded to approximate historical levels after discontinuation of a prior bounty program which was in place between 1913-1964 (Trites 2014).

3.3 General finding for SARA species and conservation concerns

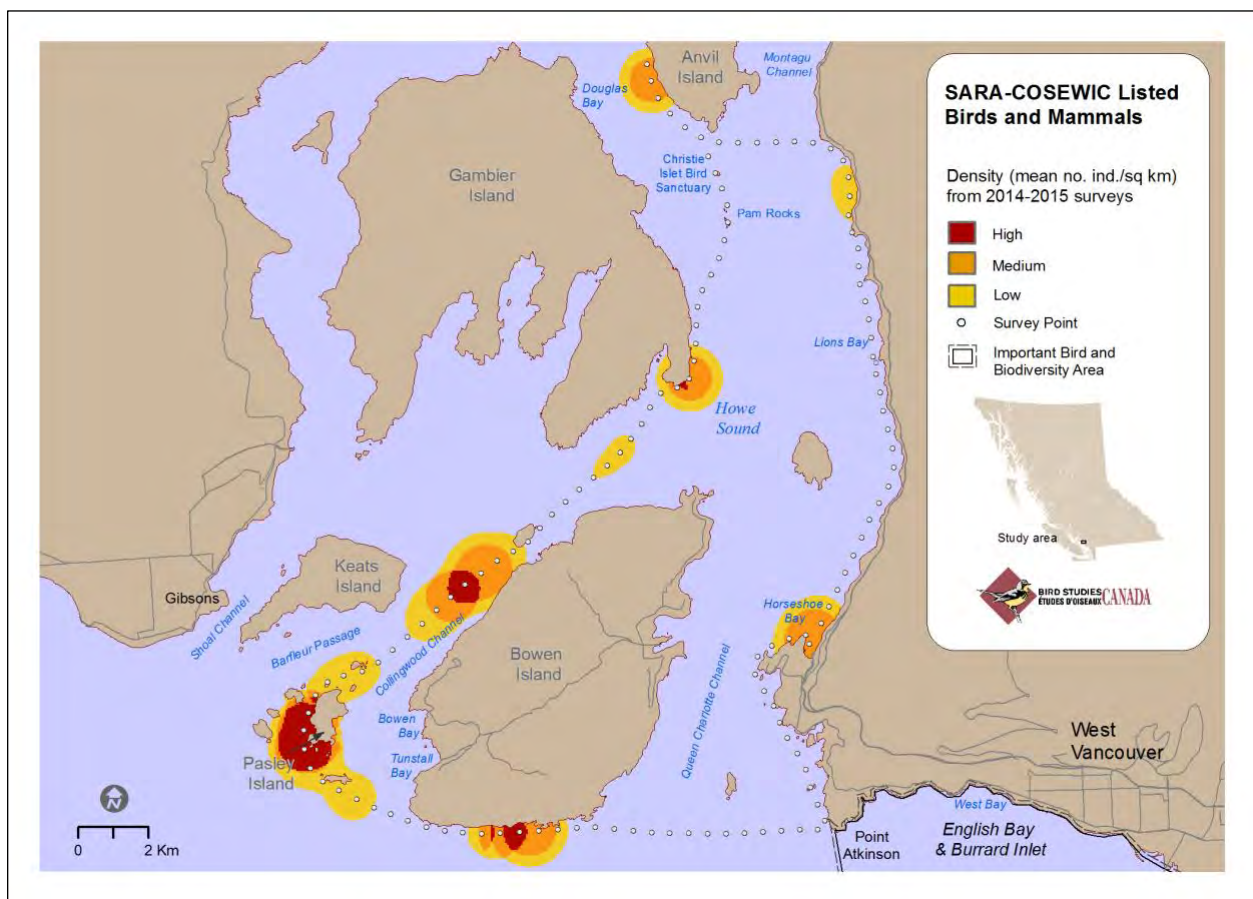


Figure 2 Primary, secondary and tertiary areas for all federal Species at Risk along the transect route in Howe Sound, based on spatial clustering analysis of all survey records of SARA-COSEWIC listed marine bird and mammal species.

Thirteen species listed either by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the Federal Species at Risk Act (SARA) or Provincially (Red or Blue-listed) were observed (Table 2). The causes of decline are not always known and warrant specific studies to develop appropriate targeted conservation actions. Among the 13 listed species, the Marbled

Murrelet was most numerous and most frequently sighted on our surveys despite declines in adjacent Burrard Inlet (Butler et al. 2015). Terrestrial critical habitat for the species has been identified in the Burrard Inlet watershed (Environment Canada 2014). Pacific Great Blue Heron was frequently sighted often as single or a few birds. The heron is designated as Species of Special Concern and identified in the Important Bird and Biodiversity Area designation for adjacent Burrard Inlet. Up to 14 herons have nested on Bowen Island in Snug Cove, Galbraith Bay and Tunstall Bay since at least by 1998 (Gowans 2016). Surf Scoters were the most abundant and frequently sighted provincially blue-listed marine bird. The region is an important wintering and staging area for that species. Potential threats to the listed species in Howe Sound include oil spills, loss of forage fish populations, human disturbance at nesting, roosting and foraging areas, predation by raptors, underwater noise and shipping disturbance. Killer Whales were sighted twice on the surveys although we do not know if they were transient and resident populations both of which periodically enter Howe Sound. A few Harbour Porpoises were seen at the entrance to English Bay and the southern shore of Bowen Island.

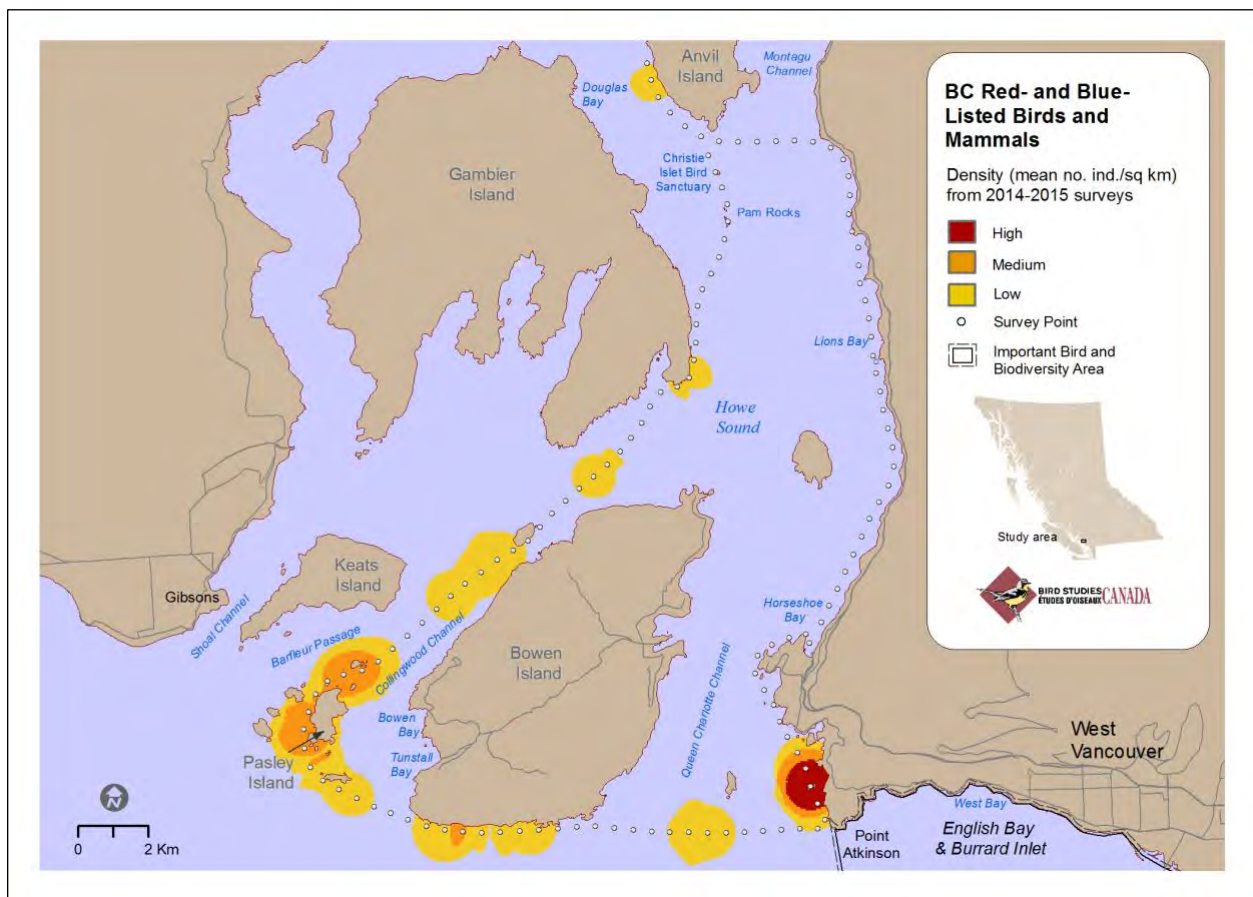


Figure 3 Primary, secondary and tertiary areas for all provincial marine bird and mammal Species at Risk along the transect route in Howe Sound, based on spatial clustering analysis of all survey records of Ministry of Environment Red- and Blue-listed marine bird and mammal species.

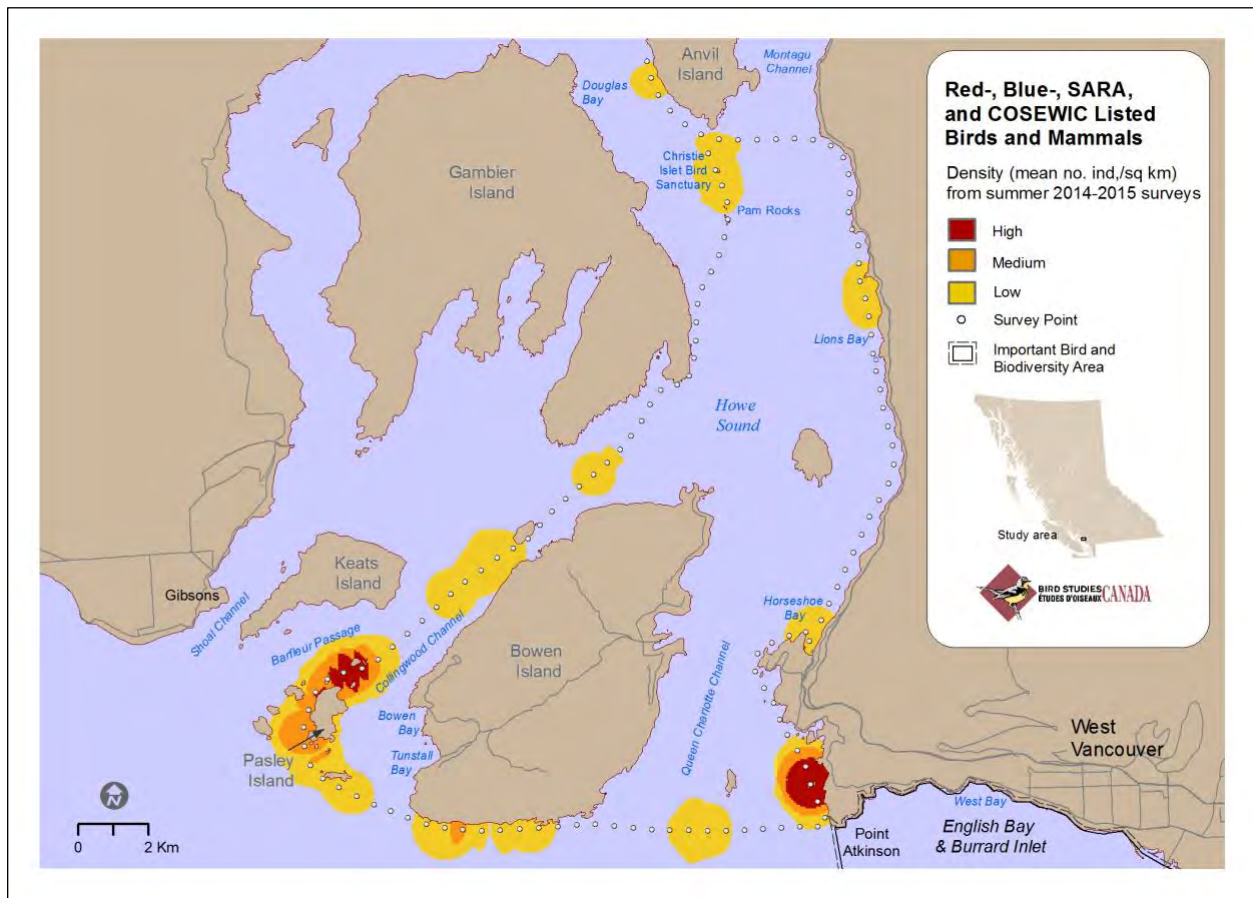


Figure 4 Primary, secondary and tertiary areas for all federal and provincial marine bird and mammal Species at Risk along the transect route in Howe Sound, based on spatial clustering analysis of all survey records of SARA-COSEWIC and BC Ministry of Environment Red- and Blue-listed marine bird and mammal species.

3.4 Specialist Foragers

A goal to sustain birds and mammals regardless of their designations requires a functioning ecosystem that can supply them with food, shelter, nest sites and safe resting locations. Restoring and sustaining habitats while minimizing pollution and disturbance are key actions.

Important food sources for many species of birds in Howe Sound are small schooling and inshore fish and marine invertebrates. Locating, maintaining and restoring eelgrass beds, estuaries, salt marshes, mudflats and fish bearing streams are important conservation measures. Birds that eat forage fish include Brandt's and Pelagic and Double-crested Cormorants, Common Murre, California Gull, Great Blue Heron, Harbour Porpoise, not a bird Horned and Western Grebe, Marbled Murrelet, and Pigeon Guillemot. Most of these species are also listed federally or provincially. Among the marine invertebrate foragers were large flocks that frequent mussel and barnacle encrusted beaches including Barrow's Goldeneye, Black Oystercatcher, Black Turnstone, Glaucous-winged Gull, Harlequin Duck and Surf Scoter. Sometimes flocks of large numbers of birds assemble to forage where an oil spill could result in large scale damage. For

example, the sighting of large flocks of 2,000-3,000 Surf Scoters, as seen off Cowans Point, Bowen Island in April 2015, is not an unusual event in Howe Sound between November and April.

4. Discussion

4.1 Precision of Estimates

We assumed a high ability to detect and count most birds present on the water during our surveys. The intertidal areas are included in the BC Coastal Waterbird Survey in which observers on land tally all the birds within one kilometer of shore.

We also assumed that a single survey each month would represent the abundance of waterbirds. This assumption is likely valid for the majority of species that remain for the winter but less so for passage migrants like the Bonaparte's Gull that likely move through in a short period of time. Our assumption that a monthly snapshot would represent the distribution of birds likely under represented the overall distribution and abundance. For example, satellite tracking of Barrow's Goldeneye captured in Indian Arm indicated that the birds moved regularly throughout the inlet.

There were several species of birds likely present but not seen by us. For example, between 16 and 300 Pacific Loons (*Gavia pacifica*) were present in Collingwood Channel in May 2016 (PB), and Eared Grebe (*Podiceps nigricollis*) and Western Gull (*Larus occidentalis*) were present in Bowen Bay (PB eBird data).

Rock Sandpipers (*Calidris ptilocnemis*) were not seen on our surveys despite them being present on December 7, 2014 on the Grebe Islets (M. Klotz and R. Lyske, pers. comm.). eBird records show that one or a few birds use Point Atkinson, Whytecliffe Park and nearby locations. Similarly, we saw no Wandering Tattlers (*Tringa incana*) although one was present on Pam Rocks on 18 August 2015 (L. Crowe-Hutchinson pers. comm.). A Snow Goose (*Chen caerulescens*) was photographed on the beach in Horseshoe Bay on 21 October 2014 was an unusual sighting (E. Sewell, pers. comm.). Sea Safari guide Julian Heavyside at Sewell's Marina reported in 2016 Surf Bird and Western Sandpiper (*Calidris mauri*) on Pam Rocks on 26 July. On 3 August, he saw an Ancient Murrelet (*Synthliboramphus antiquus*) off Lions Bay and a Wandering Tattler on Pam Rocks. All but the Ancient Murrelet record are expected to occur in the Sound. The murrelet seen off Lions Bay was unusual and questionable in that it was seen deep in the Sound, in summer and 500 m from the observer. The many eBird records of Ancient Murrelets in Howe Sound cluster at its entrance and fall mostly in winter.

A few species of marine mammals present in the Sound from time to time but not seen by us included a Humpback Whale (*Megaptera novaeangliae*) present on 4 August 2015 off Bowyer Island and a female with a calf off Whytecliffe on 8 days later, and Pacific White-sided Dolphins (*Lagenorhynchus obliquidens*) off Bowen Island in March 2014 and February 2015 (M. Sewell pers. comm.). The humpback occurred in the Sound historically (Sandilands 2008). Pacific White-sided Dolphins were first seen in Howe Sound about 2010. On 8 April 2016, 4 Dall's Porpoises (*Phocoenoides dalli*) were seen off Whytecliffe Park. Their presence is uncommon but not unexpected.

4.2 Historical Changes

The 43 marine bird species and 7 marine mammal species we reported on in Howe Sound are part of a complex ecological community dependent on the interaction of ocean currents and tides, freshwater runoff, marine and terrestrial plants and marine life to provide them with food, water, nest sites and safe places to rest. Our understanding of the distribution and abundance of many species and their ecological interactions is nonexistent or in its infancy. Targeted research to fill these gaps would assist in efforts to restore and enhance existing habitats, and measure change to the Howe Sound ecosystem.

4.3 SARA-COSEWIC Species, Forage Fish Specialists and Rocky Shore Specialists Habitat Delineation

This compilation of rare and threatened species allow identification of priority areas for the ongoing maintenance of species in Howe Sound especially areas used by the Marbled Murrelet. The large numbers of murrelets in Howe Sound is a pleasant surprise and suggestive of an important role as non-breeding habitat for this species. The mobile nature of the thousands of scoters and goldeneye using Howe Sound make these flocks vulnerable to oil spills which can have serious long- term consequences for the viability of their populations (Day et al.1997, Peterson 2003). Our surveys were a snapshot of how these birds use the Sound. Mapping locations of mussel beds that these sea ducks depend on for food during the winter (LaCroix 2000) would be a good approximation of suitable habitat for the ducks.

4.4 Christie Islet Migratory Bird Sanctuary

Christie Islet Migratory Bird Sanctuary (MBS) is a 1.23 hectare uninhabited and treeless islet due south of Anvil Island. It is the only site in Howe Sound that supports substantial numbers of nesting seabirds. Marine species recorded nesting in the MBS include Pelagic and Double-crested Cormorants, Glaucous-winged Gulls, Pigeon Guillemots and Black Oystercatchers. The islet is also a haul out for Harbour Seals. Christie Islet has been inhabited by nesting seabirds for at least several decades and by oystercatchers over a century. Chatwin and Burger (2013) recommend a setback of 50 m when viewing nesting seabirds in the Salish Sea to minimize disturbance. They also point out that nesting birds habituate to boats near their nests so that closer viewing is possible that does not disturb the birds. The key responsibility is for boaters to avoid approaching too close to raise alarm among the birds.

4.5 Unprotected Sites

Howe Sound has a few small islands with no formal legislated protection that support nesting, migrating or wintering birds. Whereas Christie Islet Migratory Bird Sanctuary supports the largest number of nesting gulls and cormorants in the Sound, nearby Pam Rocks, with no formal protection, supports shorebirds, sea ducks and seals. Pam Rocks is complimentary to Christie

Islet Migratory Bird Sanctuary and thereby a suitable candidate for inclusion within the sanctuary.

The Grebe Islets near the entrance to Howe Sound are a cluster of two large islets and outlying rocks with no formal protection. The islets are used by the four northeast Pacific endemic shorebirds – Black Oystercatcher, Black Turnstone, Surf-bird and Rock Sandpiper – and by Harlequin Ducks, cormorants and as a haul out by Harbour Seals. The islet also has historical significance (Fig. 5). Alerting local property owners to the presence of birds using their islands and shoreline would be an important community awareness campaign.



Figure 5. Archibald Menzies, naturalist on Vancouver's *Voyage of Discovery* reported shooting two "sea pies" (oystercatchers) on the Grebe Islets in June 1792. The same islets' mussel beds provide an important food source for sea ducks, gulls and shorebirds, including oystercatchers. (Photo: 1 July 2007).

4.6 Habitat Recommendations

Our study has established a baseline against which change, including recovery, can be measured. We also identified species of conservation priority that will require specific management actions. At a broader level, the maintenance of the most abundant species will require sustaining their habitats. Specifically, mussel beds and barnacle encrusted shores that support the suite of rocky shores specialists need to be mapped, and spawning locations for forage fish such as herring, sandlance, smelt and anchovy need to be located and protected. Opportunities to consider are the enhancement of habitats for forage fish such as marshes, seagrass meadows, removal or wrapping of creosote pilings, restoration of riparian edges, and enhancement of hard surfaces for mussels and barnacle attachment. Nesting sites for cormorants, gulls, guillemots and oystercatchers are not generally widely known and only a few have legal protection. Local residents could assist those areas without formal protection through guardianship. A campaign to notify island owners of the presence of nesting birds would be a good start.

Once the distributions of birds, mussels, barnacles and forage fish are known, subsequent monitoring of the contaminant loads in the trophic level would provide information which could guide policy of ecosystem management. The proximity of industry and urban development as

sources of contaminants is real to mussels, barnacles and the birds that predate on them in Howe Sound. Tracking contaminant load via programs such as the Vancouver Aquarium's Pollution Tracker would add a quality measure to the quantity estimates from mussel bed mapping.

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References

Alaska Department of Fish and Game 2006. Our wealth maintained: a strategy for conserving Alaska's diverse wildlife and fish resources. Alaska Department of Fish and Game, Juneau, Alaska. xviii+824 p.

http://www.adfg.alaska.gov/static/species/wildlife_action_plan/appendix4_waterbirds.pdf

Anderson, E.M., J.L. Bower, D.R. Nysewander, J.R. Evenson and J.R. Lovvorn. 2009. Changes in avifaunal abundance in a heavily used wintering and migration site in Puget Sound, Washington, during 1966 - 2007. *Marine Ornithology* 37:19 - 27.

Barr, J. F., C. Eberl and J. W. McIntyre 2000. Red-throated Loon (*Gavia stellata*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Bednarz, J.C., D. Klem, Jr., L. J. Goodrich and S. E. Senner. 1990. Migration Counts of Raptors at Hawk Mountain, Pennsylvania, as Indicators of Population Trends, 1934-1986. *Auk* 107: 96-109.

Bertram, D. M. Drever, M. McAllister, B. Schroeder, D. Lindsay, and D. Faust. 2015. Estimation of coast-wide population trends of Marbled Murrelets in Canada using a Bayesian Hierarchical Model. *PLOS One* 10.

Best, R.J. and P. Arcese. 2009. Exotic herbivores directly facilitate the exotic grasses they graze: mechanisms for an unexpected positive feedback between invaders. *Oecologia* 159:139 – 150.

Binford, L. C. B.G. Elliot and S.W. Singer. 1975. Discovery of a nest and the downy young of the Marbled Murrelet. *Wilson Bull.* 87:303 - 319.

Bower, J. L. 2009. Changes in marine bird abundance in the Salish Sea: 1975 - 2007. *Marine Ornithology* 37:9

Boyd, W.S. and D. Esler . 2011. Barrows Goldeneye Migration. [On line](#).

Buckeley, JR 1977. The currents, winds and tides of northern Howe Sound. PhD thesis. Dept. Physics and Institute of Ocean Sciences, UBC.

Butler, R.W. and T. E. Golumbia. 2008. Status of Breeding Black Oystercatchers, *Haematopus bachmani*, in the Strait of Georgia, British Columbia. *Northwestern Naturalist* 89: 57-60

Butler, R.W., R. S. MacVicar and S. Hollick-Kenyon. 2017. Observation of A Super Pod of Pacific Harbor Porpoises (*Phocoena phocoena vomerina*) In the Salish Sea. *Northwestern Naturalist* 98(2):137-138.

Butler, R.W. 2015. Double-crested Cormorant *in* Davidson, P.J.A., R.J. Cannings, A.R. Couturier, D. Lepage, and C.M. Di Corrado (eds.). *The Atlas of the Breeding Birds of British Columbia, 2008-2012*. Bird Studies Canada. Delta, B.C. [On line](#).

Butler R. and R. Vennesland. 2015. Great Blue Heron *in* Davidson, P.J.A., R.J. Cannings, A.R. Couturier, D. Lepage, and C.M. Di Corrado (eds.). *The Atlas of the Breeding Birds of British Columbia, 2008-2012*. Bird Studies Canada. Delta, B.C. [On line](#).

Butler, R.W., A. Couturier and E. Dickson. 2015. Status and distribution of marine birds and mammals in Burrard Inlet and Indian Arm, 2011-13. Pacific Wildlife Foundation & Bird Studies Canada report.

Campbell, R.W. 1972. Birds of Vancouver area. Vancouver Natural History Society, Vancouver, B.C.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The Birds of British Columbia. Royal British Columbia Museum. Victoria.

Chatwin, T.A., M. H. Mather and T. Giesbrecht. 2001. Double-crested and Pelagic Cormorant Inventory in the Strait of Georgia in 2000. [BC Ministry of Environment Report](#).

Chatwin, T.A, M.H. Mather and T.D. Giesbrecht. 2002. Changes in Pelagic and Double - Crested Cormorant nesting populations in the Strait of Georgia, British Columbia. *Northwestern Naturalist* 83(3):109 - 117.

Chatwin, T. and A E. Burger. 2013. Set-Back Distances to Protect Nesting and Roosting Seabirds Off Vancouver Island from Boat Disturbance. *Waterbirds* 36:43-52.

Chesser, R.T, K. J. Burns, C. Cicero, J. L. Dunn, A.W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, D. F. Stotz, and K. Winker. 2017. Fifty-eighth supplement to the American Ornithological Society's Check-list of North American Birds. *Auk* 134: 751-773.

Corrigan, C. 2001. www.corrigan.com.

Cresswell, G., Walker, D. and Pusser, T. 2007. Whales and Dolphins of the North American Pacific including Seals and other Marine Mammals. Harbour Publishing, British Columbia, Canada.

Crewe, T., K. Barry, P. Davidson and D. Lepage. 2012. Coastal waterbird population trends in the Strait of Georgia 1999 – 2011: Results from the first 12 years of the British Columbia Coastal Waterbird Survey. *British Columbia Birds* 22:8

Cummings, R.A. 1932. Birds of the Vancouver District, British Columbia. *Murrelet* 13:2-15.

Davidson, P., R.W. Butler, A. Couturier, S. Marquez and D. Lepage. 2010. Status and Distribution of Birds and Mammals in the Southern Gulf Islands, British Columbia. Bird Studies Canada & Pacific Wildlife Foundation unpublished report to Parks Canada.

Davidson, P.J.A., R.J. Cannings, A.R. Couturier, D. Lepage, and C.M. Di Corrado. 2015. *The Atlas of the Breeding Birds of British Columbia, 2008-2012*. Bird Studies Canada. Delta, B.C. [On line](#).

Davidson, P.J.A. 2015. Osprey *in* Davidson, P.J.A., R.J. Cannings, A.R. Couturier, D. Lepage, and C.M. Di Corrado (eds.). *The Atlas of the Breeding Birds of British Columbia, 2008-2012*. Bird Studies Canada. Delta, B.C. [On line](#).

Dawe, N.K. and A.C. Stewart. 2010. The Canada Goose (*Branta canadensis*) on Vancouver Island, British Columbia. *British Columbia Birds* 20:24 - 40.

Dawe, N.K., W.S. Boyd, R. Buechert, A.C. Stewart. 20 11. Recent, significant changes to the native marsh vegetation of the Little Qualicum River estuary, British Columbia; a case of too many Canada Geese (*Branta canadensis*)? *British Columbia Birds* 21:11 - 31.

Dawe, N.K., W. S. Boyd, T. Martin, S. Anderson, M. Wright. 2015. Significant marsh primary production is being lost from the Campbell River estuary: another case of too many resident Canada Geese (*Branta canadensis*)? *British Columbia Birds* 25:2 – 12.

Di Corrado, C. 2015. Common Loon *in* Davidson, P.J.A., R.J. Cannings, A.R. Couturier, D. Lepage, and C.M. Di Corrado (eds.). *The Atlas of the Breeding Birds of British Columbia, 2008-2012*. Bird Studies Canada. Delta, B.C

del Hoya, J. and A. Elliott. 1996. *Handbook of the world's birds*. Volume 3. Lynx Edition, Spain.
Day, R.H., S.M. Murphy, J.A. Wiens, G.D. Hayward, E.J. Harner and L.N. Smith 1997. Effects of the Exxon Valdez oil spill on habitat use by birds in Prince William Sound, Alaska. *Ecological Applications* 7:593 – 613.

Gowans, B. 2016. Pacific Great Blue Heron (*Ardea herodias fannini*) nesting activities (1998-2015) Bowen Island, BC. Bowen Nature Club & Bowen Island Conservancy. [On line](#)

Elliott JE, Harris ML (2001/2002) An ecotoxicological assessment of chlorinated hydrocarbon effects on bald eagle populations. *Rev Toxicol* 1–60.

Emms, S.K. and K.H. Morgan. 1989. The breeding biology and distribution of the Pigeon Guillemot (*Cepphus columba*) in the Strait of Georgia. Pp. 100-106 in K. Vermeer and R.W. Butler (eds.). *The ecology and status of marine and shoreline birds in the Strait of Georgia*, British Columbia. Special Publication, CWS, Ottawa.

Environment Canada 2011. Status of birds in Canada. [On line](#).

Environment Canada. 2013. Bird Conservation Strategy for Bird Conservation Region 5: Northern Pacific Rainforest. ISBN 978-1-100-21057-5. [On line](#).

Environment Canada. 2014. Recovery Strategy for the Marbled Murrelet (*Brachyramphus marmoratus*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. 49 pp.

Fannin, J. 1891. Checklist of British Columbia birds. Richard Woolfenden. Queen's Printer, Victoria, B.C. [On line](#).

Ford, J. K. B., G. M. Ellis and K. C. Balcomb. 2000. Killer Whales. (2nd ed.) UBC Press.

Ford, J. 2014. Marine mammals of British Columbia. Royal BC Museum Handbook, Victoria, BC.
Golumbia, T.E., D. Nysewander, R., Butler, R. Milner, T. Cyra, and J. R. Evenson. 2009. Status of breeding Black Oystercatchers *Haematopus bachmani* in the Salish Sea. *Marine Ornithology* 37: 29–32.

Hipfner, M. 2015. Brandt's Cormorant *in* Davidson, P.J.A., R.J. Cannings, A.R. Couturier, D. Lepage, and C.M. Di Corrado (eds.). *The Atlas of the Breeding Birds of British Columbia, 2008-2012*. Bird Studies Canada. Delta, B.C. [On line](#).

Hipfner, M. 2015. Rhinoceros Auklet *in* Davidson, P.J.A., R.J. Cannings, A.R. Couturier, D. Lepage, and C.M. Di Corrado (eds.). *The Atlas of the Breeding Birds of British Columbia, 2008-2012*. Bird Studies Canada. Delta, B.C. [On line](#).

Howie, R. 2015. Horned Grebe *in* Davidson, P.J.A., R.J. Cannings, A.R. Couturier, D. Lepage, and C.M. Di Corrado (eds.). *The Atlas of the Breeding Birds of British Columbia, 2008-2012*. Bird Studies Canada. Delta, B.C. [On line](#).

Levings, C.D., RB Turner and B Ricketts (eds). 1979. Proceedings of Howe Sound science workshop. Can. Tech. Rep. Fish. Aquat. Sci., West Vancouver.

Lacroix, D. 2001. Foraging impacts and patterns of wintering Surf Scoters feeding on bay mussels in coastal Strait of Georgia, BC. MSc, Simon Fraser University, Burnaby, BC. 126 pp.
Lok, E., M. Kirk, D. Esler and W.S. Boyd. 2008 Movements of pre-migratory Surf and White-winged Scoters in response to Pacific Herring spawn. *Waterbirds* 31: 385-393.

Middleton, H.A., R.W. Butler and P. Davidson. 2018. Waterbirds alter their distribution and behavior in the presence of Bald Eagles (*Haliaeetus leucocephalus*). *Northwest Naturalist* (in press).

Mitchell, C.D. and M. W. Eichholz. 2010. Trumpeter Swan (*Cygnus buccinator*). *The Birds of North America* (P. G. Rodewald, ed.), Cornell Lab of Ornithology, Ithaca, New York, USA.

Moul, I., R. G. Vennesland, M. Harris and R. W. Butler. 2001. Standardizing and interpreting nesting records for Great Blue Herons in British Columbia. *Canadian Wildlife Service Progress Notes* No. 17: 1-31.

Mulder, R. 2013. Howe Sound; rebirth or regress? *Discovery* 42: 30-33.

Nature Vancouver. 2013. Seasonal checklist of birds of greater Vancouver, BC. Nature Vancouver, Vancouver.

Newcombe, C. F. 1923. Menzies' journal of Vancouver's voyage, April to October 1792. [W. Cullin, Victoria.](#)

Norris, D. R., P. Arcese, D. Preikshot, D.F. Bertram and T. K. Kyser. 2007. Diet reconstruction and historic population dynamics in a threatened seabird. *Journal of Applied Ecology* 44: 875 - 884. North American Waterfowl Management Plan. 2012. [On line.](#)

Olesiuk, P. 1999. An assessment of the status of harbour seals (*Phoca vitulina*) in British Columbia. Canadian Stock Assessment Secretariat Research Document 1999/33.

Peterson, C.H., S.D. Rice, J.W. Short, D. Esler, J. L. Bodkin, B. E. Ballachey, D. B. Irons. 2003. Long-term ecosystem response to the Exxon Valdez Oil Spill. *Science* 302: 2082

Prater, A.J. 1979. Trends in accuracy of counting birds. *Bird Study* 26: 198 – 200.

Rappoldt, C., Kersten, M. and Smit, C. 1985. Errors in large-scale shorebird counts. *Ardea* 73:13 – 24.

Reimer, R. 2012. The Mountains and Rocks are Forever: Lithics and Landscapes of Skwxwú7mesh Uxwumixw". PhD Thesis, McMaster University.

Robbins, C. S., D. Bystrak, and P. H. Geissler. 1986. The breeding bird survey: its first fifteen years 1965 - 1979. U.S. Fish Wildl. Serv. Resour. Publ. 157.

Sandilands, D. 2008. Humpbacks return to Georgia Strait. BC Cetacean Sightings Network ([March](#)).

Sauer, J. R., S. Schwartz and B. Hoover 1996. The Christmas Bird Count Home Page. Version 95.1. Patuxent Wildlife Research Centre, Laurel, Md. <http://www.mbr-pwrc.usgs.gov/bbs/bbs2010.html>

Savard, J.-P.L., D. Bordage, and A. Reed. 1998. Surf Scoter (*Melanitta perspicillata*). in A. Poole, and F. Gill, eds. The Birds of North America, No. 363. The Birds of North America, Inc., Philadelphia, PA

Smith, C.M. 2000. Survival and recruitment of juvenile Harlequin Ducks. MSc, Simon Fraser University, Burnaby, BC. 83 pp.

Sprot, G.D. 1937. Migratory Behavior of Some Glaucous-Winged Gulls in the Strait of Georgia, British Columbia. *Condor* 39: 238-242.

Stenson, G.B., G. Badgero and H. D. Fisher. 1984. Food habits of the river otter *Lutra canadensis* in the marine environment of British Columbia. *Canadian Journal of Zoology* 62: 88-91.

Stout, B. E. and G. L. Nuechterlein 1999. Red - necked Grebe (*Podiceps grisegena*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology

Sullivan, T.M., R.W. Butler and W.S. Boyd. 2002a. Seasonal distribution of waterbirds in relation to spawning Pacific Herring, *Clupea pallasii*, in the Strait of Georgia, British Columbia. Canadian Field-Naturalist 116: 366-370.

Sullivan, T.M., S. Hazlitt and M. Lemon. 2002b. Population trends of nesting Glaucous-winged Gulls, *Larus glaucescens*, in the southern Strait of Georgia, British Columbia. Canadian Field-Naturalist 116:603-606.

Tasker, M. L., P. Jones, T. Dixon and B.F. Blake. 1984. Counting seabirds at sea from ships: a review of methods employed and a suggestion for a standardized approach. Auk 101:567 - 577.

Taverner, P. A. 1926. Birds of Western Canada. Museum Bulletin 41, Canada Department of Mines, Ottawa.

Trites, A. 2014. The marine mammals. In Beamish, R. and G. McFarlane. The sea among us. Harbour Publishing. Madeira Park, BC. Pp. 183-210.

Vancouver, G. 1798. A Voyage of Discovery to the North Pacific Ocean, and round the World. 1. London: G.G. & J. Robinson, and J. Edwards.

Vermeer, K. 1981. Food and populations of surf scoter in British Columbia. Wildfowl 32:107-116.

Vermeer, K. 1982. Food and diet of three *Bucephala* species in British Columbia waters. Wildfowl 3: 32-30.

Vermeer, K. and K. Devito. 1989. Population trends of nesting Glaucous-winged Gulls in the Strait of Georgia. Pp. 88-106. In K. Vermeer and R.W. Butler. The ecology and status of marine and shoreline birds in the Strait of Georgia, British Columbia. Special Publication, Canadian Wildlife Service, Ottawa.

Vermeer, K., K. Morgan and G. E. J. Smith. 1989. Population and nesting habitat of American black oystercatchers in the Strait of Georgia. In K. Vermeer and R.W. Butler. The ecology and status of marine and shoreline birds in the Strait of Georgia, British Columbia. Special Publication, Canadian Wildlife Service, Ottawa.

Vilchis, L. I., C. K. Johnson, J. R. Evenson, S. F. Pearson, K. L. Barry, P. Davidson, M.G. Raphael and J. K. Gaydos. 2015. Assessing ecological correlates of marine bird declines to inform marine conservation. Conservation Biology 29: 154 - 163

Walbran, J.T. 1971. British Columbia place names. Douglas & McIntyre (reprint of 1909 original), Vancouver.

Watson, J.W., and D.J. Pierce. 2001. Skagit River Bald Eagles: movements, origins and breeding population status. Final report to Washington Department of Fish and Wildlife, Olympia, WA.

Wilson, LK, ML Harris, S Trudeau, MG Ikonomoru, and JE Elliott. 2010. Properties of Blood, Porphyrins, and Exposure to Legacy and Emerging Persistent Organic Pollutants in Surf Scoters (*Melanitta perspicillata*) Overwintering on the South Coast of British Columbia, Canada. Archives of Environmental Contamination and Toxicology 59: 322-333.

Wilson S, E. Anderson, A. Wilson, D. Bertram and P. Arcese. 2013. Citizen science reveals an extensive shift in the winter distribution of migratory Western Grebes. PLoS ONE 8: e65408. <https://doi.org/10.1371/journal.pone.0065408>

Appendix 1. Species Accounts

BIRDS

Canada Goose *Branta canadensis*

Conservation Status

Conservation Data Centre: BC Yellow List

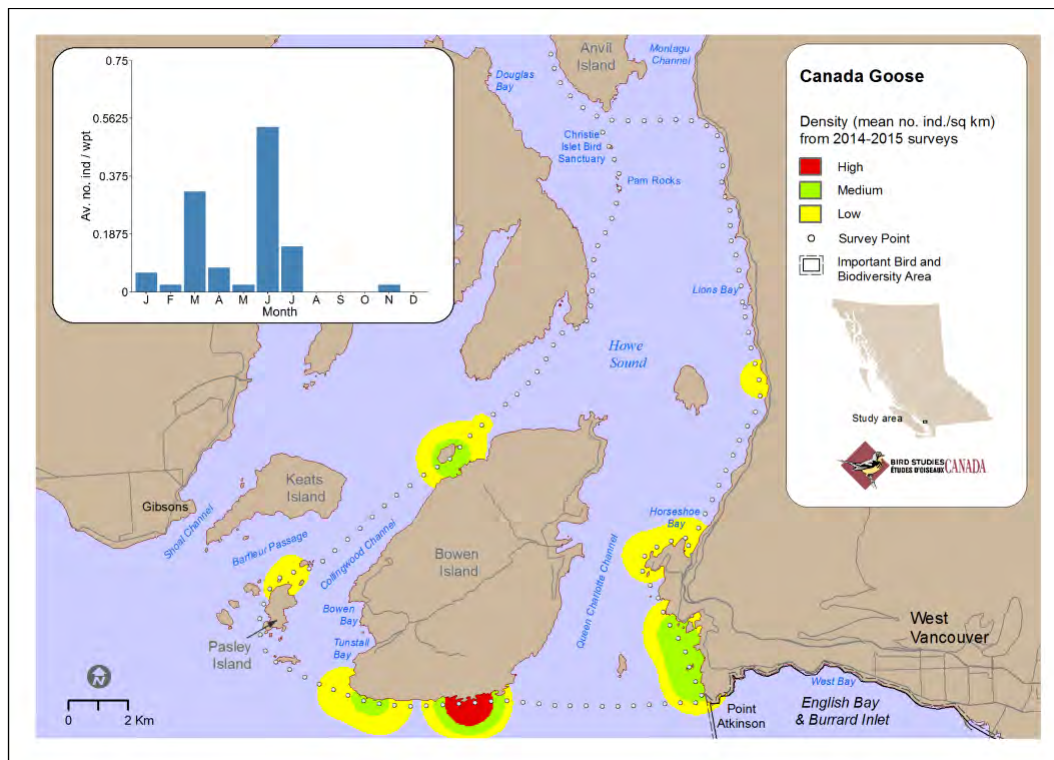


Fig. 6 Spatial distribution and seasonal abundance of Canada Goose in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The number of resident exotic Canada Geese tallied during the BC Coastal Waterbird Survey increased significantly averaging annually 3.8% between 1999 and 2011 (Crewe et al. 2012). This upward trend was mirrored in Puget Sound (Crewe et al. 2012). A native subspecies of Canada Geese, referred to as the Dusky Canada Goose (*B. c. occidentalis*), transits the region between winter quarters in the Willamette Valley, Oregon and breeding grounds in the Copper River, Alaska (Campbell et al. 1990).

Canada Geese in the lower mainland were largely migratory and a summer visitor until the 1970s (Campbell et al. 1990, Dawe and Stewart 2010, Martell 2015a). Small resident flocks were reported to breed in 1970 but most geese were in transit. The migratory native Canada Geese pass through the region in spring and autumn, often at high elevation. Starting in the 1970s, Canada Geese of several subspecies from other parts of Canada and the USA were shipped to the lower mainland by fish and game organizations from which arose the burgeoning resident exotic population in the Salish Sea, including Burrard Inlet and Indian Arm (Campbell et al. 1990). By the 1990s, the Canada Goose had become a regular fixture in Burrard Inlet and Indian Arm.

Survey Records

Detected largely from January to July. Numbers in Howe Sound peaked in March and again later in the summer when goslings were present. The highest density was found on the southern shore of Bowen Island and moderate densities at Point Atkinson and the northwest shore of Bowen Island.

Conservation Issues

The resident exotic Canada Goose has had a negative effect on vegetation in several estuaries on the eastern shore of Vancouver Island (Dawe et al 2011, 2015). Nesting exotic Canada Geese have also impacted floral vegetation on small islands (Best and Arcese 2009).

Recommendations

Estuarine vegetation is an important source of food energy for the ecosystem to function. Several creeks and rivers support naturally spawning salmon that might be impacted by the loss of vegetation. Dawe et al (2015) recommended actions to reduce the number of geese on Vancouver Island. A review of the impact of geese in Howe Sound should be undertaken.

Trumpeter Swan *Cygnus buccinator*

Conservation Status

COSEWIC (1996): Not at risk; Conservation Data Centre: BC Yellow List

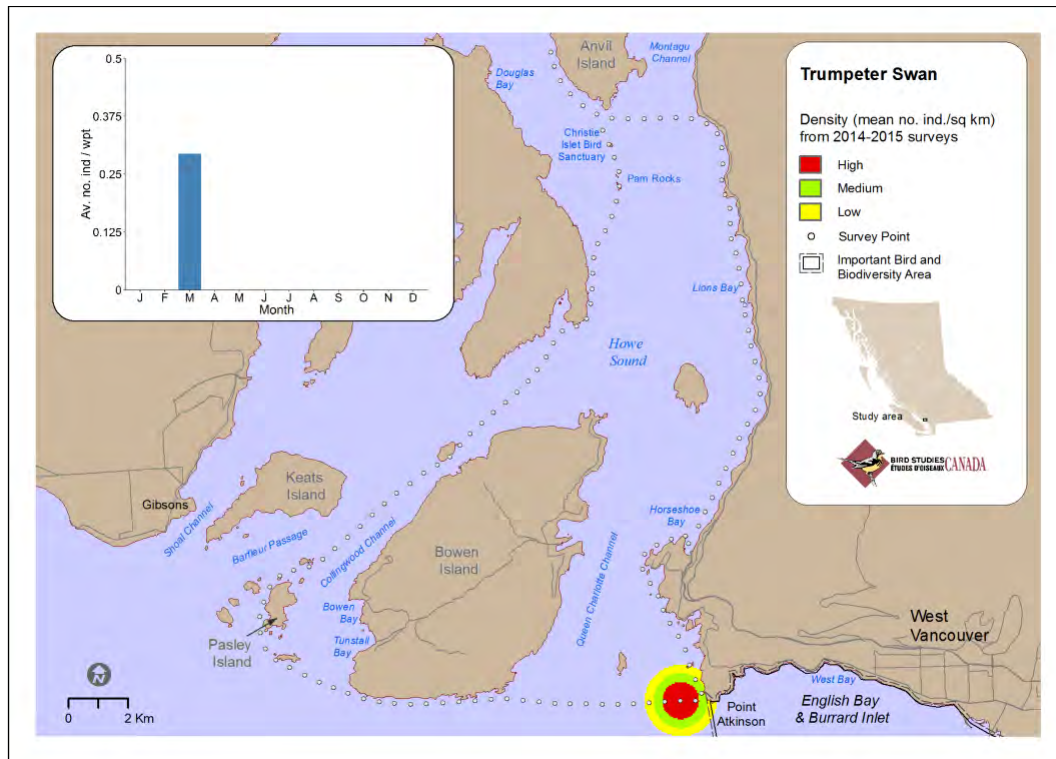


Fig. 7 Spatial distribution and seasonal abundance of Trumpeter Swan in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

In winter, Trumpeter Swans rely on freshwater and coastal estuarine wetlands and adjacent agricultural areas such as those found in the Comox Valley and lower Fraser River Valley. After reaching near-extinction from overhunting in the early twentieth century, Trumpeter Swan numbers increased steadily throughout their North American range (Taverner 1926, Mitchell and Eichholz. 2010). The BC breeding population, in the northern interior, is small but steadily increasing (BC Conservation Data Centre 2015). The winter population has rebounded and is now widespread. At the continental level, the species has reached its management goal (North American Waterfowl Management Plan 2012). No significant trend was detected in the Fraser delta using the BC Coastal Waterbird Survey data from 1999-2011 (Crewe et al. 2012).

Survey Records

A single observation of a flock of 38 birds alighting on the water near Point Atkinson in March was our only record for this species.

Conservation Issues and Recommendations

The major conservation issues facing the Trumpeter Swan in the Strait of Georgia are loss of winter farmland habitat to development, loss of suitable crop types to agricultural intensification, human disturbance, lead shot poisoning and losses of coastal marsh habitat due to climate change (Environment Canada 2013). No measures are proposed.

Mallard *Anas platyrhynchos*

Conservation Status

Conservation Data Centre: BC Yellow list

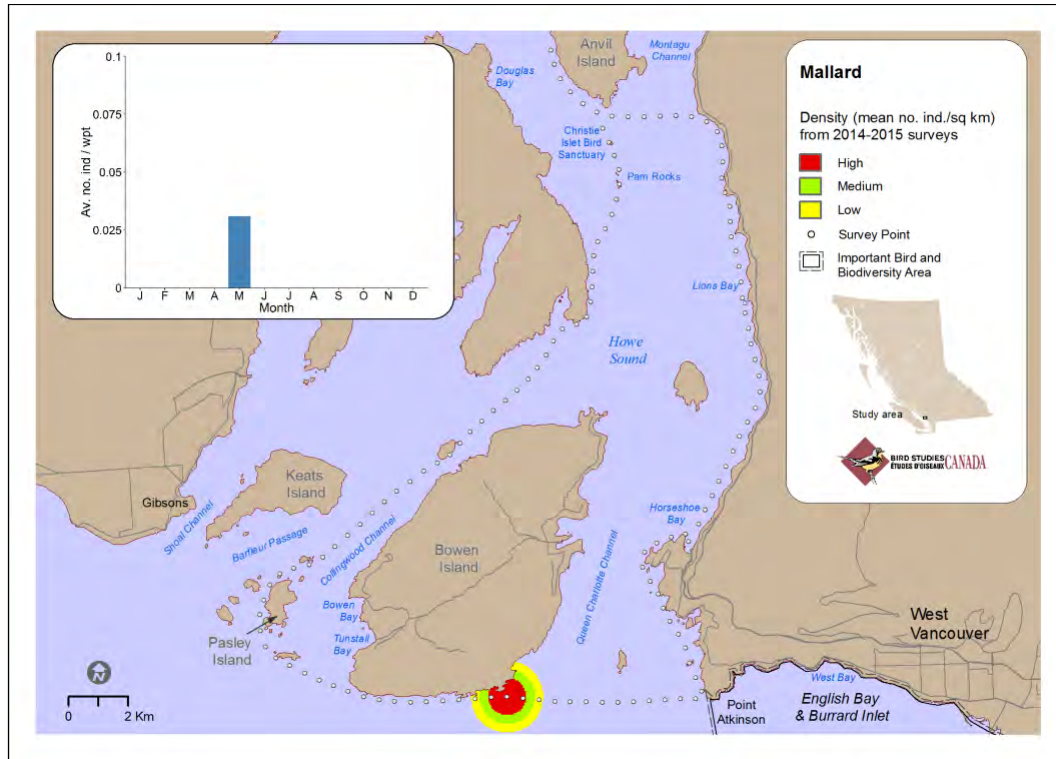


Fig. 8 Spatial distribution and seasonal abundance of Mallard in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Mallard is an herbivorous duck that forages on the blades, seeds and roots of grasses and sedges in marshes, agricultural fields and lawns. Mallard are widespread throughout the Salish Sea and have a clear centre of abundance in the Fraser delta where many thousands graze on farmland and rest in Boundary Bay in winter (Crewe et al. 2012, Middleton 2014).

No significant regional trend apparent in BC Coastal Waterbird Survey data from 1999-2011 (Crewe et al. 2012). No significant change in the wintering population in BC from Christmas Bird Count data from 1959-1988 (Sauer et al. 1996). Although there was no significant trend in winter numbers in Puget Sound from 1978-80 to 2003-06 (Bower 2009), Mallard numbers have been increasing in Padilla Bay, Washington, since the mid-1970s (Anderson et al. 2009).

Survey Records

Four ducks seen in May on the southeastern shore of Bowen Island was our only observation of this species.

Conservation Issues and Recommendations

Although the population is stable, steady losses of agricultural land to urban development and transportation corridors, and changes in agricultural land cover stand to threaten wintering habitat in the Fraser Estuary (Environment Canada 2013). No measures are proposed.

Northern Pintail *Anas acuta*

Conservation Status

Conservation Data Centre: BC Yellow list

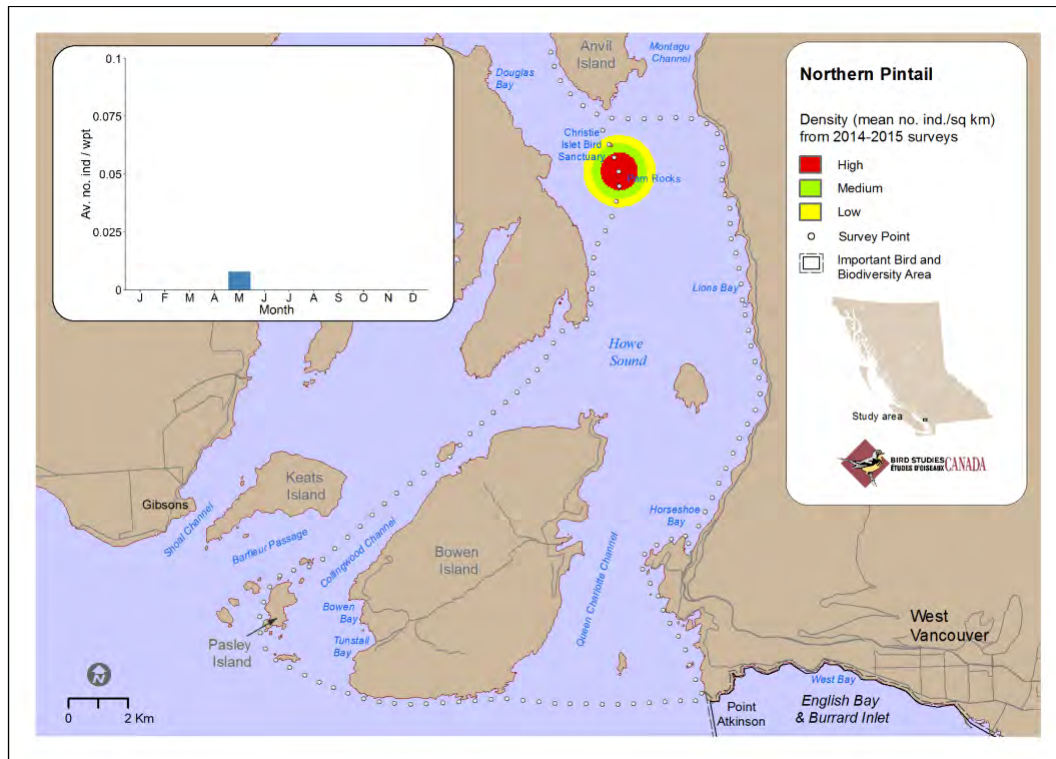


Fig. 9 Spatial distribution and seasonal abundance of Northern Pintail Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Northern Pintails are herbivorous ducks that eat blades, seeds and roots of grasses and sedges in estuarine marshes and agricultural fields. It is the third-most abundant of the duck species wintering in the region. Northern Pintail are common and widespread throughout the Strait of Georgia with a strong centre of abundance around the Fraser delta (Crewe et al. 2012). Flocks of many thousands graze on farmland and rest in Boundary Bay in winter (Crewe et al. 2012, Middleton 2014). Nationally and continentally, Northern

Pintails were declining until the mid-1990s (North American Bird Conservation Initiative 2014). The BC Coastal Waterbird Survey found no significant change in numbers from 1999-2011 (Crewe et al. 2012). Christmas Bird Count data from BC showed no significant change in numbers between 1959 and 1988 (Sauer et al. 1996). Anderson et al. (2009) found no significant change in Northern Pintail numbers in Padilla Bay, Washington, between the mid- 1970s and mid-2000s. No significant trend in Northern Pintail numbers was found in Puget Sound between 1978-80 and 2003- 06 (Bower 2009).

Survey Records

One bird was seen in May off the southern shore of Anvil Island.

Conservation Issues and Recommendations

Although the population is stable, losses of nearby agricultural land to developments and transportation corridors, and changes in agricultural land cover are considered important issues for maintenance of wintering habitat in the Fraser Estuary (Environment Canada 2013). Monitoring needs include the

development of a marsh monitoring program and targeted winter surveys (Environment Canada 2013.) No measures are proposed.

Harlequin Duck *Histrionicus histrionicus*

Conservation Status

Conservation Data Centre: BC Yellow list

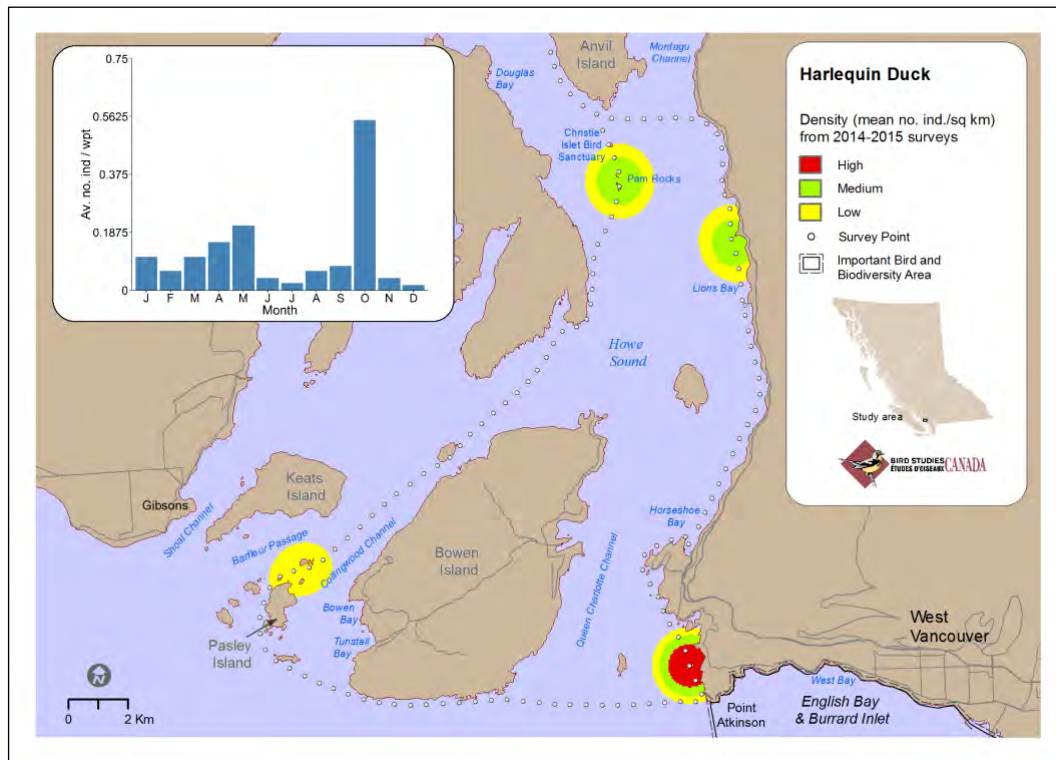


Fig. 10 Spatial distribution and seasonal abundance of Harlequin Duck in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Harlequin Duck nested in coastal streams of Howe Sound as far back as the late 19th century (Fannin 1891) and is a winter resident of rocky shoreline and gravel beaches. It nests along mountain streams and the males return to the coast soon after mating to moult feathers and overwinter. Small numbers occur along many rocky shores in the region until February or March when they move to the east coast of Vancouver Island to consume Pacific herring eggs (Sullivan et al. 2002a).

Surveys of this species in the region show conflicting trends (Crewe et al. 2001). Harlequin Duck numbers in the Strait of Georgia underwent a slow decline that might reflect natural fluctuations (Crewe et al. 2012). An estimated 11-15,000 Harlequin Ducks were present in the Strait in 2000 (Smith et al. 2000).

Survey Records

Detected year round and widespread in Howe Sound. Numbers were low in fall and early winter and began to rise in January when birds were preparing to move into breeding areas in the interior. Birds seen in June and July likely represented non-breeding individuals. Large numbers in October indicates that Howe Sound attracts this species after the moulting season. The lowest numbers fell during breeding season when mature adults were away from the coast. The highest density was at Point Atkinson with moderate density in Lions Bay on the mainland and off the eastern shore of Gambier Island. The species is fairly common around Vancouver from mid-September to May (Nature Vancouver 2013).

A banded hen carrying a transmitter (numberYg37) was seen on Christie Islet in October 2016. She was

banded in her hatch-year on 27 August 2015 in the headwaters of the Gregg River in the Canadian Rockies, where her mother was banded as Yg38 and her male sibling banded as Yg39. Despite her right wing having missing and broken secondary feathers, on September 4, 2016 she was captured in the McLeod River, the next watershed to the south and was flying well (B. MacCallum pers. comm.).

Conservation Issues and Recommendations

Post-breeding ducks begin to return in June to the coast where they undergo a feather moult that renders them flightless from late July through September (Robertson et al. 1997). Moulting ducks are especially vulnerable to disturbance and oiling at this time. Oil spill prevention should be a priority for this species in Howe Sound and neighbouring Burrard Inlet and Indian Arm.

White-winged Scoter *Melanitta deglandi*

Conservation Status

Conservation Data Centre: BC Yellow list

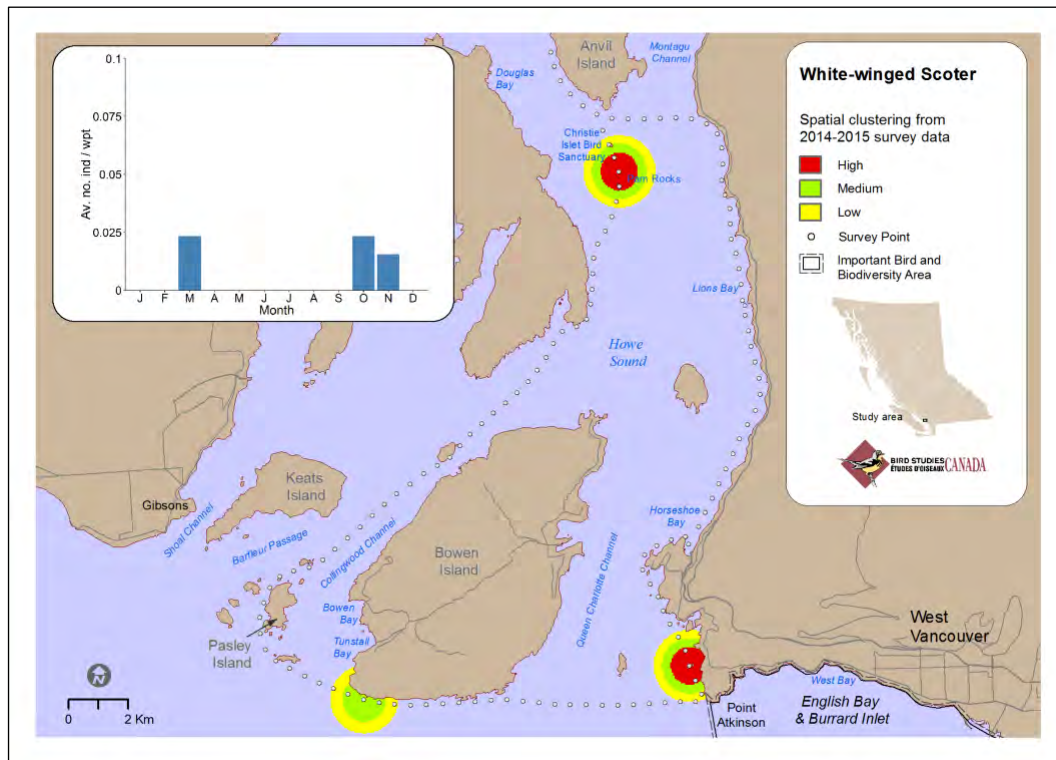


Fig. 11 Spatial distribution and seasonal abundance of White-winged Scoter in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

White-winged Scoters dive for mussels that they tear from rocks during shallow water dives (Lacroix 2001). They assemble in large numbers to eat herring spawn on the east coast of Vancouver Island in late winter and early spring (Sullivan et al. 2002a, Lok et al. 2008). Often seen in association with Surf and Black Scoters. The southern Strait of Georgia is one of two centres of winter distribution on the BC coast for the North American population (Campbell et al. 1990).

In all seasons, flocks of up to 500 birds are present on the south coast. Campbell et al. 1990) described White-winged Scoter occurrences as 'abundant to very abundant' in spring, 'very common to abundant' autumn migrant, 'abundant to very abundant' in winter and 'very common to abundant' summer visitant. The BC Coastal Waterbird Survey showed a declining trend of 7.6% per year from 1999-2011 (Crewe et al. 2012). There is evidence of declines in all species of scoters across North America (Savard et al 1998).

Survey Records

This species was not numerous in the Sound likely because of the shortage of sandy habitats where they like to forage. Sporadic, low density (2-3 birds) detections occurred in the fall (October and November) and spring (March). The highest densities were at Point Atkinson and off the southern shore of Anvil Island. Moderate densities were detected on the southwestern shore of Bowen Island. The species is common or fairly common around Vancouver year-round (Nature Vancouver 2013).

Conservation Issues and Recommendations

No recommendation proposed.

Long-tailed Duck *Clangula hyemalis*

Conservation Status

Conservation Data Centre: BC Blue list

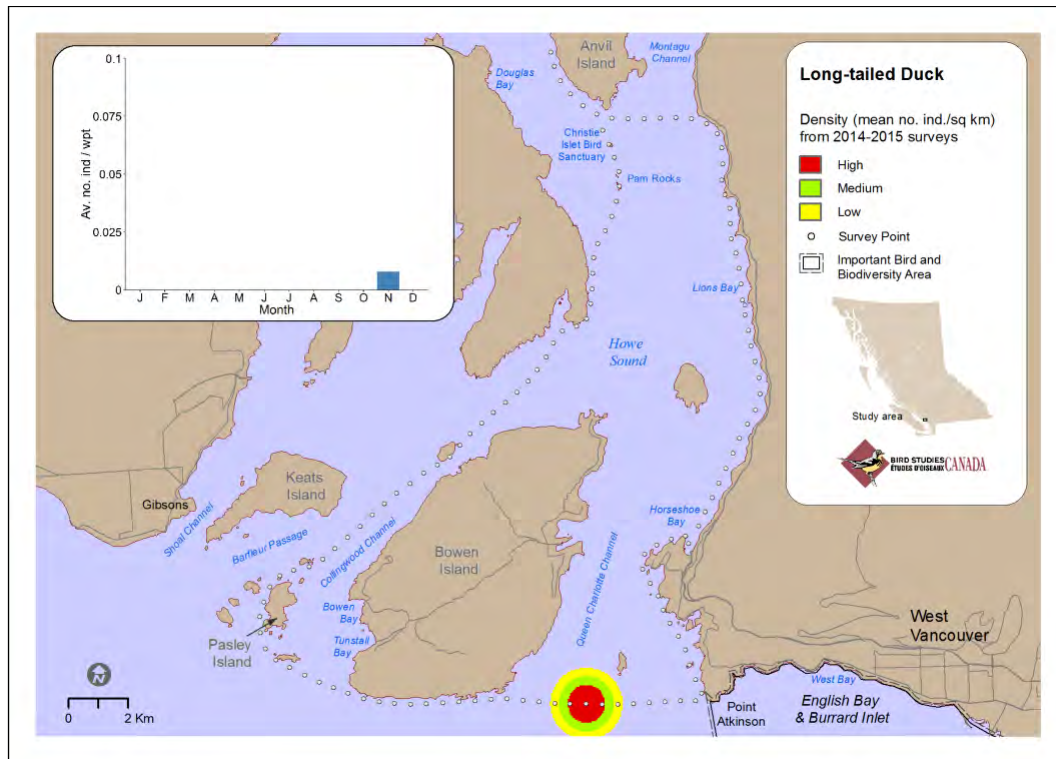


Fig. 12 Spatial distribution and seasonal abundance of Long-tailed Duck in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Long-tailed Duck is most often encountered far from shore in deep water where it dives for invertebrates. It spends the winter throughout the BC coast and breeds in the Arctic. The Long-tailed Duck has undergone declining trends on regional, continental and global surveys for unknown reasons (Crewe et al. 2012). The Coastal Waterbird Survey indicated a significant declining trend for the period 1999–2011 in the Strait of Georgia (Crewe et al. 2012), and in Puget Sound between the late 1970s and early 2000s (Nyeswander et al. 2001, Bower 2009). Campbell et al. (1972) reported the species to be frequent in winter. They noted that 20 were present off Stanley Park in March and 53 in November.

Survey Records

One bird sighted in November in the waters midway between Point Atkinson and the southern shore of Bowen Island. The species is fairly common around Vancouver from October to May (Nature Vancouver 2013).

Conservation Issues and Recommendations

None proposed.

Bufflehead *Bucephala albeola*

Conservation Status

Conservation Data Centre: BC Yellow list

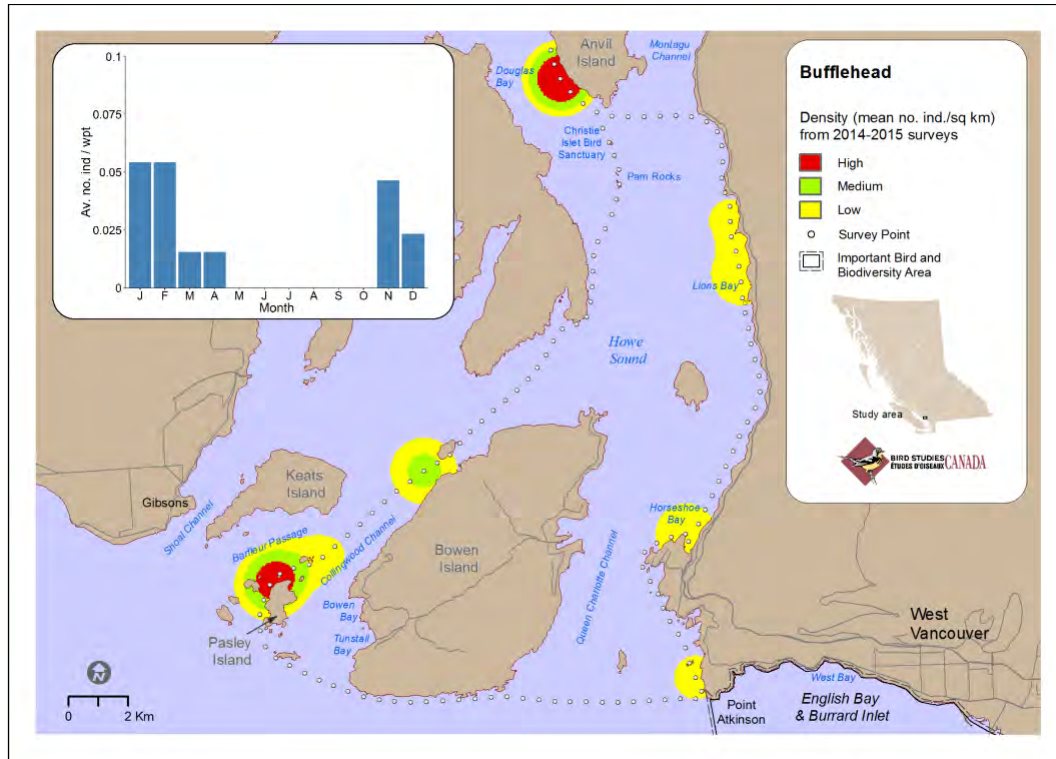


Fig. 13 Spatial distribution and seasonal abundance of Bufflehead in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Bufflehead is a widespread species in nearshore waters throughout the Salish Sea in winter. The Bufflehead nests in holes in trees in the British Columbia interior. They return to winter in sheltered bays, shallow coves, harbours and estuaries where they dive mostly for invertebrates. High numbers are found around Comox, Denman Island, and between Parksville and Qualicum, and Squamish Estuary (Crewe et al. 2012).

In BC, data from the Christmas Bird Count indicate stable numbers between 1959-1988 (Sauer et al. 1996). No trend was detected from the BC Coastal Waterbird Survey over the period 1999-2011 (Crewe et al. 2012). In Washington State, trends were less clear. Some surveys report declines (Anderson et al. 2009) while those in Puget Sound show increases (Bower 2009).

Survey Records

Only detected in winter and spring in Howe Sound. Numbers dropped in March and April. Widespread with highest density on the west coast of the southern end of Anvil Island and in Barfleure Passage. Moderate density off the northwest coast of Bowen Island. The species is common or fairly common around Vancouver from late September to late May (Nature Vancouver 2013).

Conservation Issues and Recommendations

Loss of breeding habitat in the aspen parkland of the BC interior due to logging is a concern (Environment Canada 2013). Mortality due to catastrophic and chronic oil spills on the BC coast is a developing threat

according to Environment Canada (2013). Bufflehead is a priority species under the North American Waterfowl Management Plan.

Improving comprehensive coastal monitoring of this widespread diving duck through increasing coverage of marine monitoring programs such as BC Coastal Waterbird Survey and estuarine surveys would be beneficial (Environment Canada (2013)).

Surf Scoter *Melanitta perspicillata*

Conservation Status

Conservation Data Centre: BC Blue list

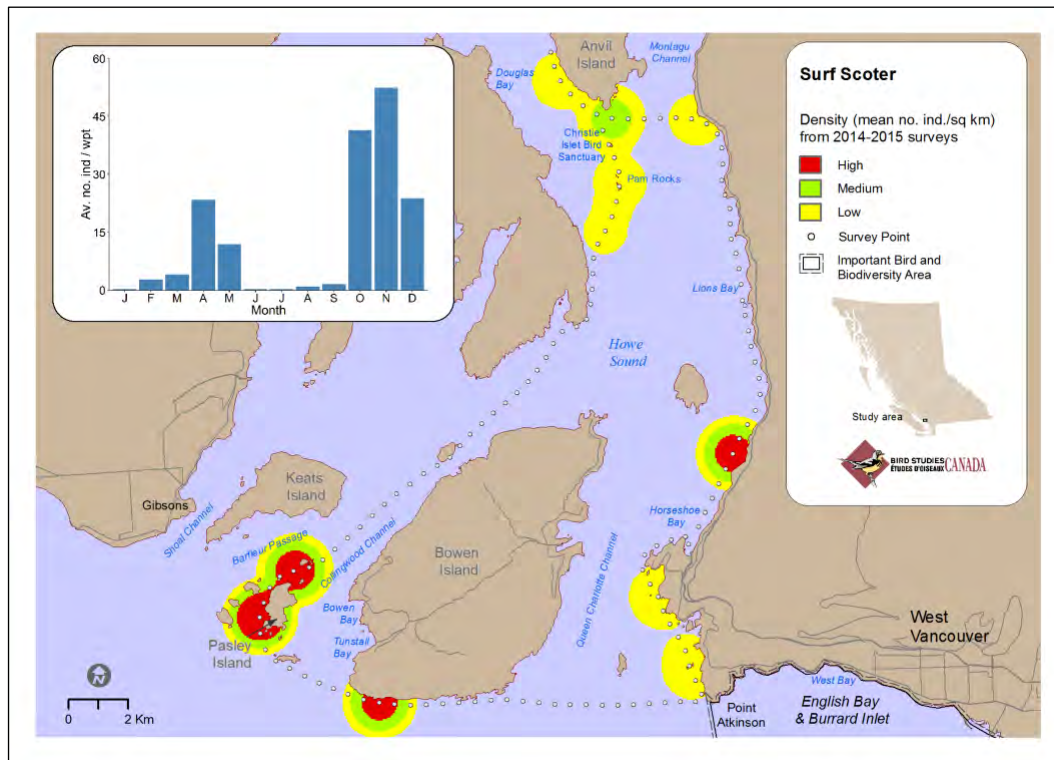


Fig. 14 Spatial distribution and seasonal abundance of Surf Scoter in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The coast of British Columbia is a significant winter destination for Surf Scoters and it is by far the most numerous waterfowl in Burrard Inlet, Indian Arm and Howe Sound. Globally important numbers in Burrard Inlet and Indian Arm contributed to its designation as an Important Bird and Biodiversity Area (Bird Studies Canada 2000-2015). The Surf Scoter spends its non-breeding season on the coast and migrates to the interior and arctic to breed. Small numbers of non-breeding scoters remain in the Salish Sea where they undergo a feather moult in summer. Surf Scoters can occur in flocks of several thousand birds through the autumn and winter near mussel beds and in late winter and early spring at herring spawning beaches (Sullivan et al. 2002a, Lok et al. 2009). Surf Scoters frequented mussel beds in the study area where they formed into large flocks to dive for mussels that they tear from rocks during dives in shallow water (Lacroix 2001, Worcester 2010). Thousands assemble to eat herring spawn on the east coast of Vancouver Island in late winter and early spring (Sullivan et al. 2002a, Lok et al. 2009). The Strait of Georgia is an important winter quarter for this species and where large flocks assemble to eat mussels and clams (Vermeer 1981).

Despite concerns about declines in North America (Anderson et al. 2015), the Strait of Georgia Surf Scoters did not show a significant change between 1999 and 2011 (Crewe et al. 2012).

Survey Records

Present year-round in Howe Sound with seasonal peaks numbers from October to December and April and

May. Widespread throughout Howe Sound with the high densities off Sunset Beach, throughout islands in Barfleur Passage and the southwestern shore of Bowen Island. Moderate density off the southern shore of Anvil Island. The species is common or fairly common around Vancouver in every month of the year (Nature Vancouver 2013).

Conservation Issues and Recommendations

Providing food, resting places and preventing pollution are key to the continued presence of this species in Howe Sound. Nearby Burrard Inlet and Indian Arm are a globally important winter habitat for this species. Surf Scoters are vulnerable to the immediate and longterm effects of oiled beaches (Day et al.1997, Peterson 2003) therefore spill prevention should be a priority in Howe Sound. Monthly tallies in the same bay reveal the mobility of the Surf Scoter. Despite large numbers being present in Howe Sound, the number at individual sites swings widely as the birds move around the Sound.

Barrow's Goldeneye *Bucephala islandica*

Conservation Status

Conservation Data Centre: BC Yellow list

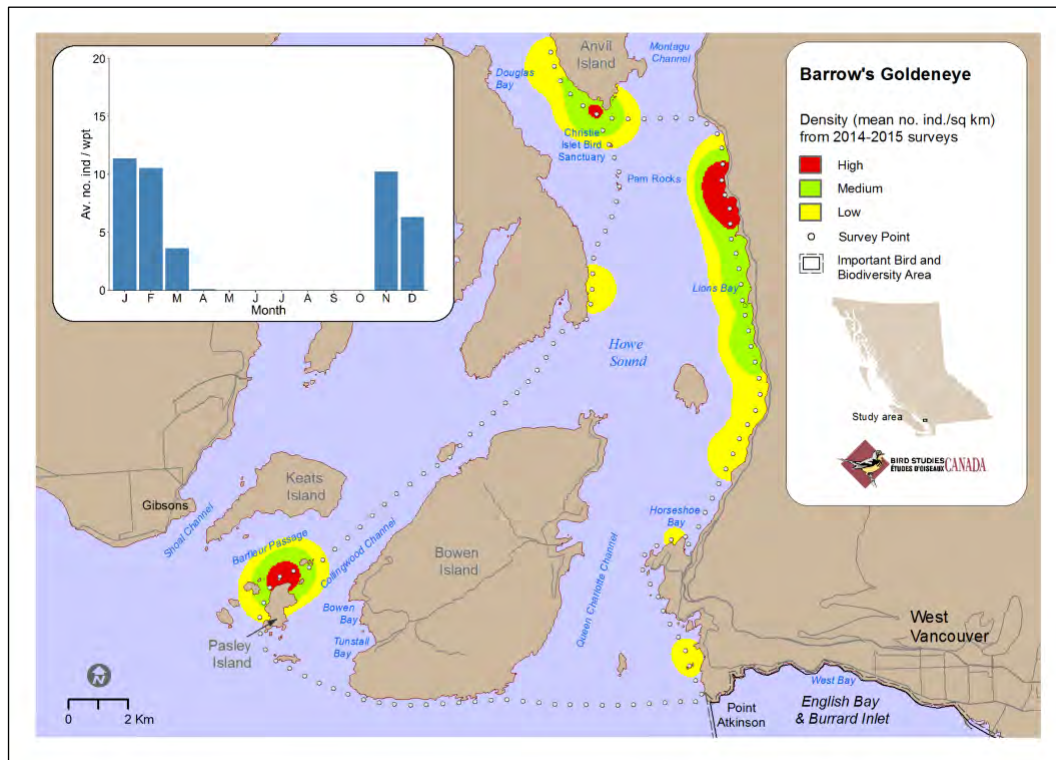


Fig. 15 Spatial distribution and seasonal abundance of Barrow's Goldeneye in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The south coast of British Columbia is an important wintering area for large numbers of the global population of Barrow's Goldeneye. The goldeneye is a west coast species especially sought by birdwatchers. Barrow's Goldeneye is restricted almost exclusively to sheltered rocky shorelines on its wintering grounds in the North Pacific. Its winter diet is mostly marine invertebrates such as snails, barnacles and mussels, and herring eggs in spring (Vermeer 1982). Pacific herring spawn can attract hundreds of goldeneye. Indian Arm and Howe Sound probably constitute a single population strongly associated with nest sites in the Cariboo, and Cardinal Lake in Alberta where they moult feathers after breeding (Boyd and Esler 2011). Adult male and female goldeneye with satellite tracking devices were located in Indian Arm and Howe Sound. Many goldeneye returned to the same wintering site between years with most females (71%) and some males (29%) relocating to within 5 km of the previous winter location in the subsequent year. Important coastal regions for this species are the southern Sunshine Coast, English Bay, Burrard Inlet and Howe Sound (Crewe et al. 2012).

The BC Coastal Waterbird Survey showed a significant decline of 4.3% annually between 1999– 2011 (Crewe et al. 2012). They identified Burrard Inlet where numbers had declined significantly over the past two decades. The species is common or fairly common around Vancouver from October to May (Nature Vancouver 2013). eBird records show the species is widespread in Howe Sound. Monthly tallies in the same

bay reveal the mobility of this species and the Surf Scoter. Despite large numbers being present in Howe Sound, the number at individual sites swings widely as the birds move around the Sound.

Table 3. Number of Barrow's Goldeneyes and Surf Scoters counted in Bowen Bay once each month from September 2016 to April 2017.

Date	Barrow's Goldeneye	Surf Scoter
September	0	250
October	0	353
November	85	6
December	6	5
January	0	2
February	78	0
March	14	5
April	91	0

Survey Records

Present in winter from November to March. Three centres of high density: Brunswick Beach, Barfleur Passage and the southern end of Anvil Island.

Conservation Issues

Globally important numbers of Barrow's Goldeneye in Burrard Inlet and Indian Arm contributed to its designation as an Important Bird and Biodiversity Area (Bird Studies Canada 2000-2015).

Data from satellite tags on goldeneyes marked in Indian Arm indicate interchange with Howe Sound. Two of 13 males marked in 2011 moved to Howe Sound in April for a few weeks prior to leaving for their breeding grounds (ID #s 11-40571 & 11-40582). Also, 2 of 18 females used Howe Sound for a few days (in 2007 and 2011; ID #s 07-65508 & 11-34724) (S. Boyd, unpubl. data).

Barrow's Goldeneye is one of the Sound's iconic birds. Oil spill prevention should be a priority for this species since it is vulnerable to the immediate and long-term effects of oiled beaches (Day et al.1997, Peterson 2003). The species' mobility makes it a potential candidate for oiling and a priority for response.

Recommendations

We recommend that the English Bay and Burrard Inlet Important Bird and Biodiversity Area boundaries be broadened to include southern Howe Sound.

Common Goldeneye *Bucephala clangula*

Conservation Status

Conservation Data Centre: BC Yellow list

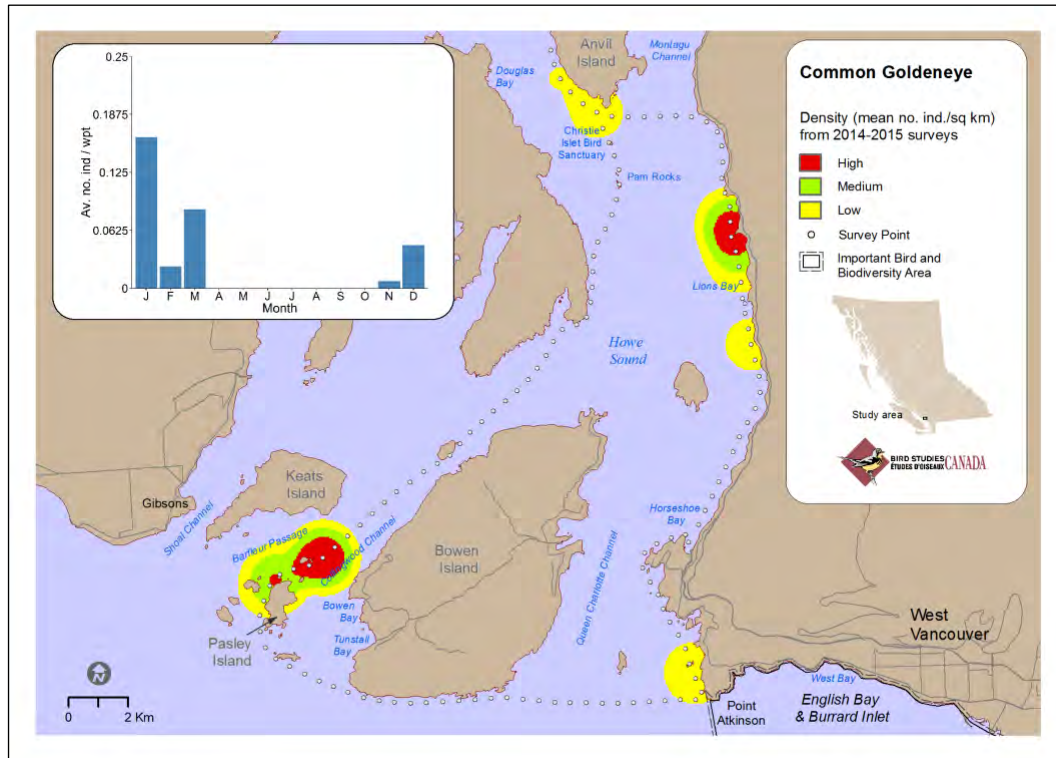


Fig. 16 Spatial distribution and seasonal abundance of Common Goldeneye in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Common Goldeneye are a widespread west coast species in winter. They are often found at soft-bottom estuaries and along shores (Campbell et al. 1990). They eat mostly marine invertebrates and assemble at herring spawning beaches on eastern Vancouver Island in late winter and early spring (Sullivan et al. 2002a). Crewe et al. (2012) found no significant change in abundance in the Canadian portion of the Salish Sea between 1999 and 2011 whereas both Bower (2009) and Anderson et al. (2009) found large declines on surveys in Puget Sound and Padilla Bay, Washington, respectively. Campbell et al. (1972) reported that the species was 'common' in winter.

Survey Records

Similar to Barrow's Goldeneye, Common Goldeneye were only present from November to March. Numbers rose steadily until January and then fluctuated. Widespread in Howe Sound with centres of distribution at Lions Bay and in Barfleur Passage. The species is common or fairly common around Vancouver from October to May (Nature Vancouver 2013).

Conservation Issues and Recommendations

No conservation issues are proposed. No recommendations are proposed.

Common Merganser *Mergus merganser*

Conservation Status

Conservation Data Centre: BC Yellow list

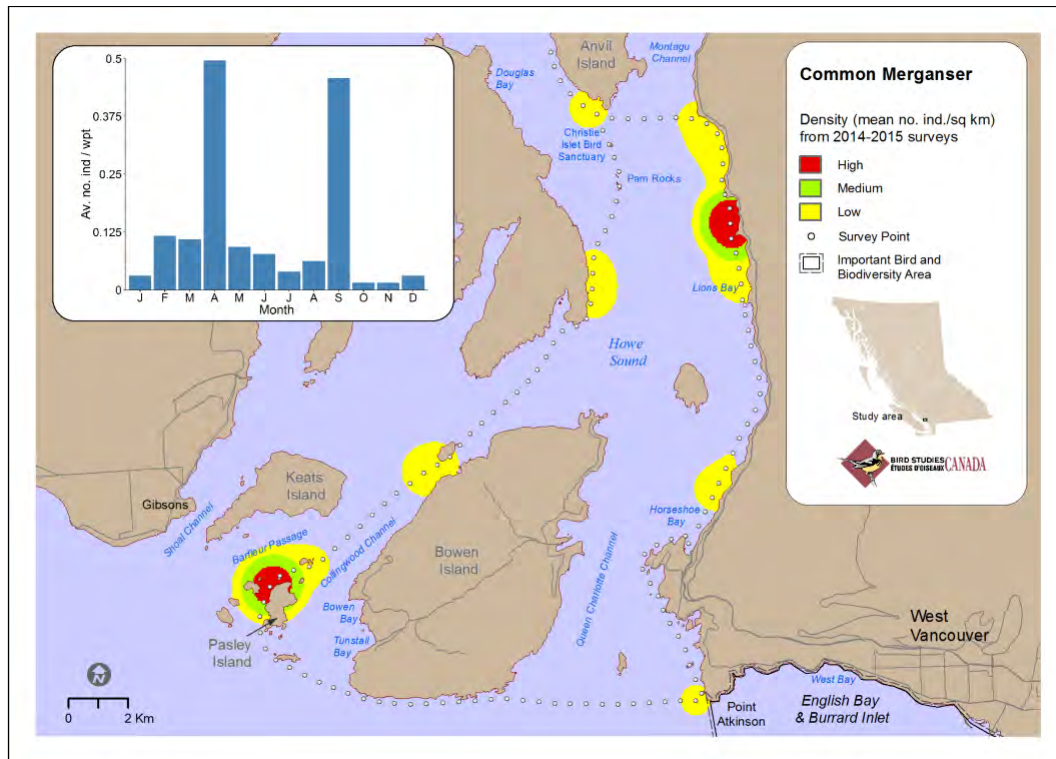


Fig. 17 Spatial distribution and seasonal abundance of Common Merganser in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Common Mergansers are a widespread species seen in small numbers throughout the region. They nest along the shores of local rivers and streams and bring their large broods to the sea. Mergansers eat mostly small fish.

Numbers appear to be stable in the Salish Sea (Bower 2009, Crewe et al. 2012). Common Mergansers were reported to nest along rivers and streams of the North Shore of Burrard Inlet in 1970 (Campbell et al. 1972).

Survey Records

Steady numbers year-round with peaks in April when pairs scout breeding streams and September when families return to the Sound. Widespread with highest densities in Lions Bay and in Barfleure Passage.

Conservation Issues and Recommendations

No issues are proposed. Documenting streams used by Common Mergansers would assist in ensuring the stability of local nesting populations.

Hooded Merganser *Lophodytes cucullatus*

Conservation Status

Conservation Data Centre: BC Yellow list

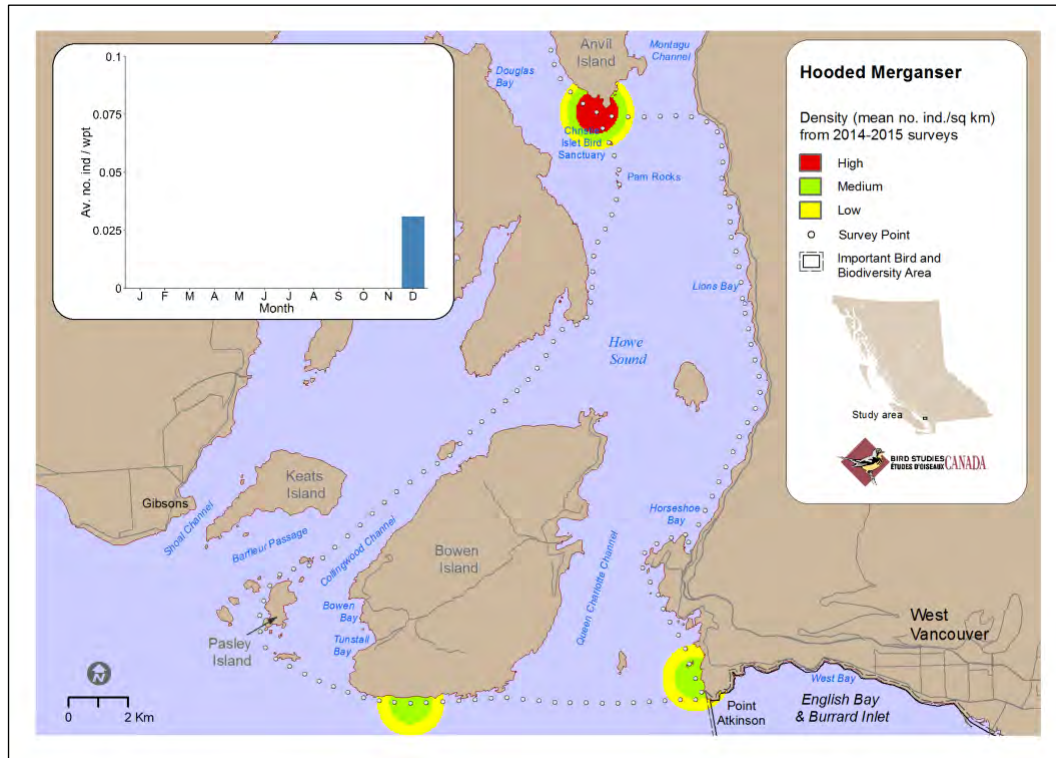


Fig. 18 Spatial distribution and seasonal abundance of Hooded Merganser in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Surveys in the region are not adequate to assess trends for Hooded Merganser (Anderson et al. 2009, Crewe et al 2012). Campbell et al. (1990) refer to the species as ‘common’ in spring, ‘locally very common’ in autumn, ‘rare to uncommon’ in summer, and ‘fairly common to locally very common’ in winter on the south coast of British Columbia. It is most often encountered in bays, inlets and estuaries on the south coast. Coastal and interior populations in British Columbia have more than doubled since 1970 (North American Bird Conservation Initiative 2012).

Hooded Mergansers nested in the Lower Mainland in 1970 (Campbell et al. 1972) and continue to do so. The species is widespread and mostly seen in small numbers or as individual birds. The scarcest of the three species of merganser, the Hooded Merganser was seen only in winter.

Survey Records

Only four Hooded Mergansers were recorded and all were in December. Two were found off the southern shore of Anvil Island and one each at Point Atkinson and the southern shore of Bowen Island.

Conservation Issues and Recommendations

No issues are proposed. No measures are proposed.

Common Loon *Gavia immer*

Conservation Status

COSEWIC: not at risk (1997); Conservation Data Centre: BC Yellow list

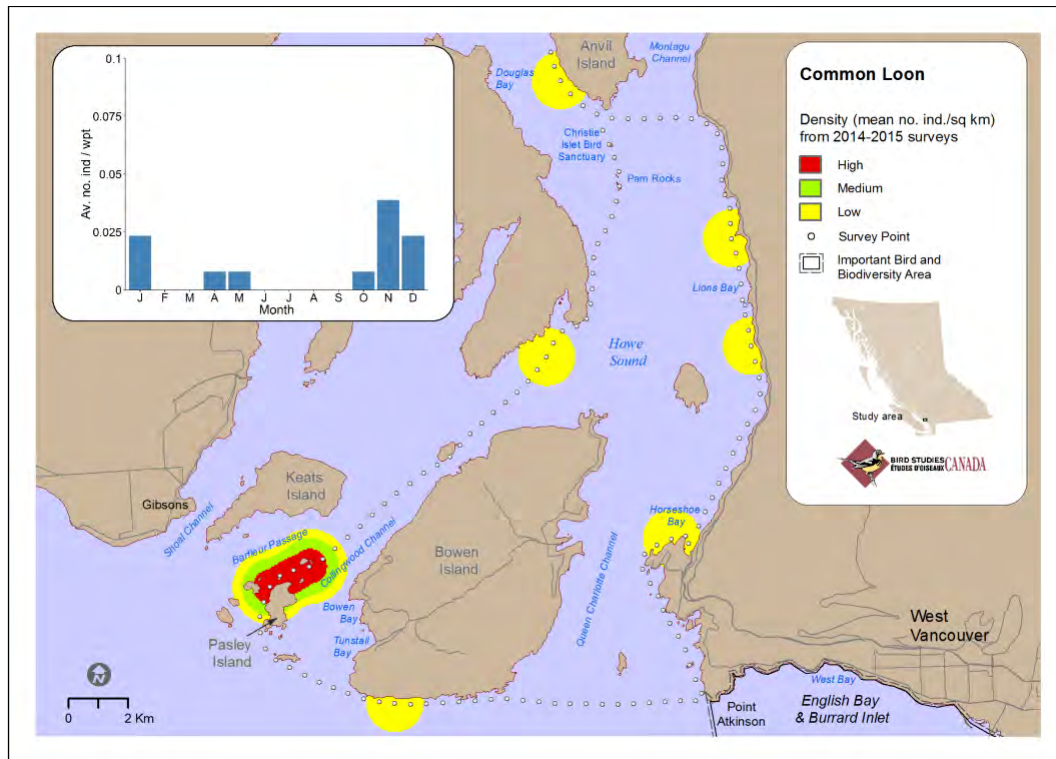


Fig. 19 Spatial distribution and seasonal abundance of Common Loon in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Common Loon is frequently seen in winter along the south coast of British Columbia. It departs for breeding lakes in April or May and returns in late August or September (Di Corrado et al. 2015). Small numbers remain on the coast through the summer.

The regional trend is confounded by reported increases in Puget Sound (Anderson et al. 2009, Bower 2009). Bower et al. (2009) reported a significant increase in 1978-79 and 2003-2006 whereas Crewe et al. (2012) reported a significant decline between 1998 and 2011. Campbell et al. (1972) described the status in the Vancouver region as 'common' in winter.

Survey Records

Detected in fall and winter from October to January and again in April and May. Widespread in Howe Sound with highest density in Barfleur Passage.

Conservation Issues and Recommendations

Conflicting trends in the Salish Sea possibly reflect their pursuit of mobile fish as prey. Loons are among a number of species in Burrard Inlet, Indian Arm and Howe Sound that eat small fish. Ensuring a supply of small fish as prey for loons and other piscivorous birds would help maintain their long-term presence in the Sound.

Red-throated Loon *Gavia stellata*

Conservation Status

Conservation Data Centre: BC Yellow list

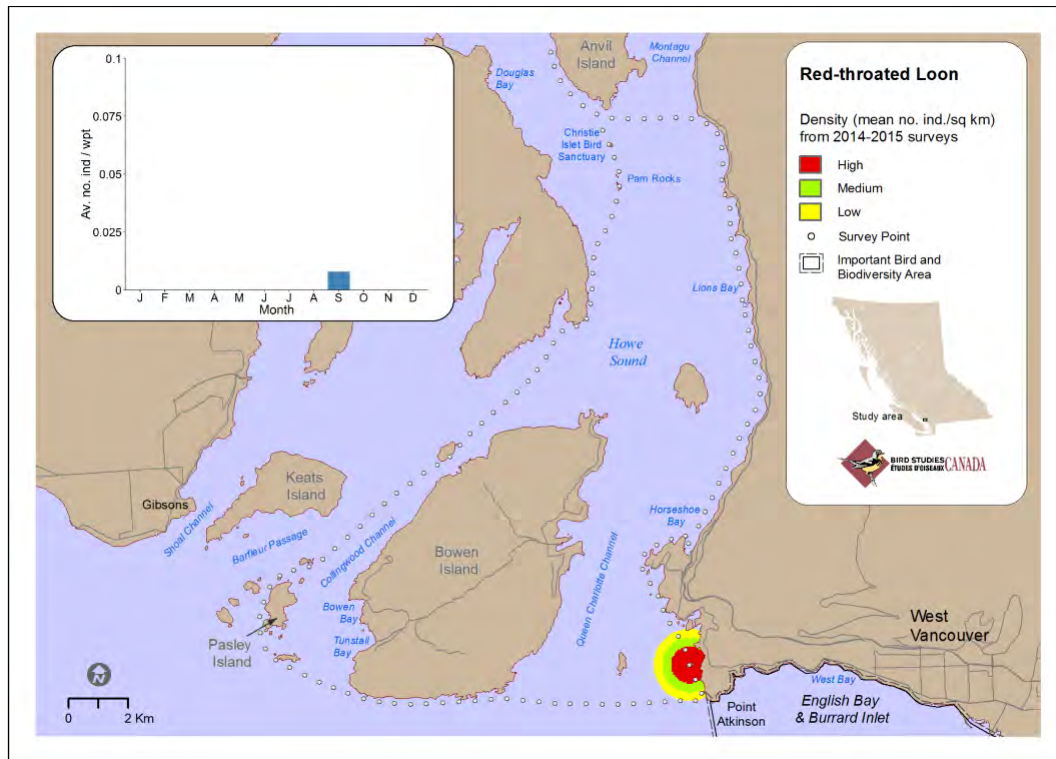


Fig. 20 Spatial distribution and seasonal abundance of Red-throated Loon in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Red-throated Loons nest on small freshwater lakes and ponds near the seashore where it feeds. The number of loons in a region is related to the number of lakes where they can nest but not the water chemistry or fish abundance on the lakes since most food is caught along the seashore (Campbell et al. 1990). Red-throated Loons winter in shallow, sheltered marine waters (Campbell et al 1990) with strong freshwater influence such as the Fraser Delta, Boundary Bay, Mayne Island and the area between Comox and Campbell River (Crewe et al. 2012).

In Alaska, a steep 53% population decline was detected between 1977-1993 (Barr et al. 2000). Campbell et al. (1972) reported that the species frequented the Vancouver region in winter but strong declines were apparent in the Salish Sea in recent years. A significant decline of 9.3% was reported by the BC Coastal Waterbird Survey between 1999-2011 (Crewe et al. 2012). Declines were also apparent in Washington with a 73.9% decline between 1978-80 and 2003-06 in Puget Sound (Bower 2009) and also significant declines in Padilla Bay (Anderson et al. 2009). Red-throated Loons were generally scarce in the study area (Table 2). The decline of this species is troubling especially since the Fraser River estuary historically held large numbers that likely extended into English Bay. The reasons for the declines are not known and might be related to changes in availability of prey. The species is common or fairly common around Vancouver from late October to April (Nature Vancouver 2013).

Survey Records

The Red-throated Loon does not appear to frequent Howe Sound despite it being fairly common near Vancouver. One seen in September at Point Atkinson was our only record.

Conservation Issues and Recommendations

Wintering Red-throated Loons are susceptible to catastrophic and chronic oil spills and being caught in fishing gear (Barr et al. 2000). None proposed.

Red-necked Grebe *Podiceps grisegena*

Conservation Status

COSEWIC: not at risk (1982); Conservation Data Centre: BC Yellow list

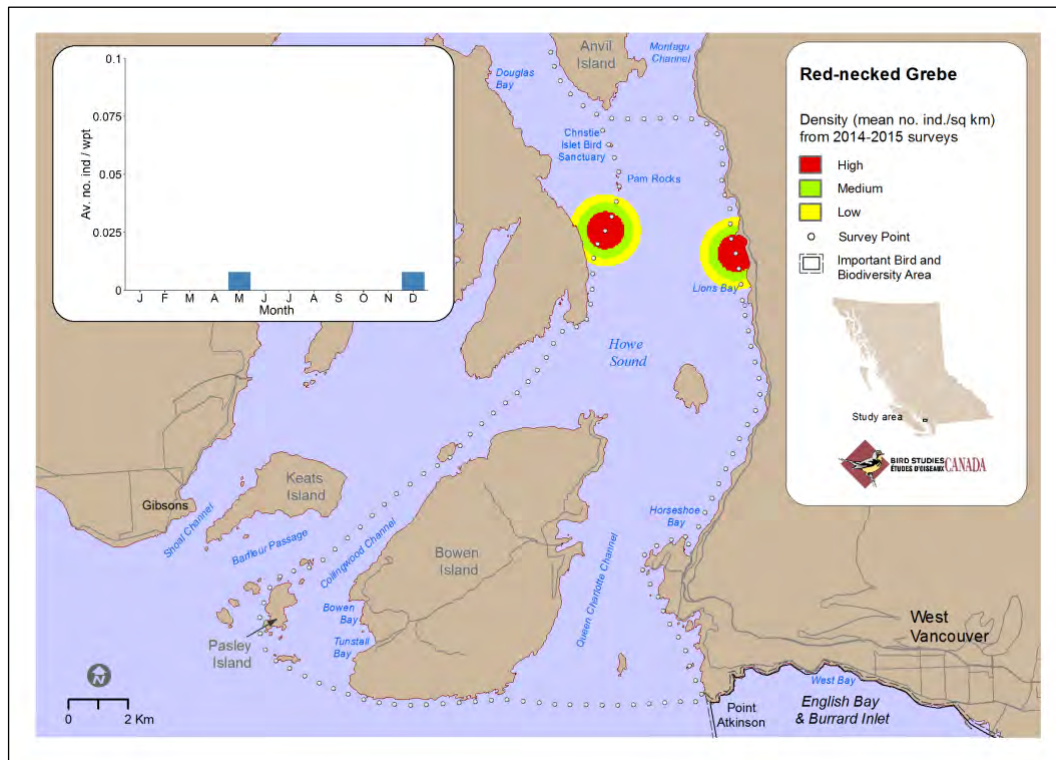


Fig. 21 Spatial distribution and seasonal abundance of Red-necked Grebe in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Red-necked Grebes winter throughout the BC coast with the highest numbers in fall (Crewe et al. 2012). They can be found in estuarine and coastal waters in shallow bays and inlets (Stout and Nuechterlein 1999).

Regional trend data are scarce (Stout and Nuechterlein 1999). No trend was found in the BC Christmas Bird Count between 1959-1988 (Sauer et al. 1996). Alaska aerial monitoring in Yukon National Wildlife Refuge showed a 10% decline from 1988-1998 (Alaska Department of Fish and Game 2006). In October 1971, 55 Red-necked Grebes were counted from Stanley Park where Campbell et al. (1972b) described it to be 'common'. No trend was detected in the BC Coastal Waterbird Survey between 1999-2011 (Crewe et al. 2012). In the US portion of the Salish Sea there was a decline of about 35% between 1975-1984 and 1998-2007 (Bower 2009). Aerial surveys in Puget Sound showed an 89% decline between 1978-79 and 1992-99 (Nysewander et al. 2001) and a 33% decline in Padilla Bay between 1978-79 and 2003-06 (Anderson et al. 2009). The species is common or fairly common around Vancouver from August to May (Nature Vancouver 2013).

Survey Records

Despite the abundance of Red-necked Grebes around Vancouver, we saw only a few in December and May off the eastern shore of Gambier Island and Lions Bay.

Conservation Issues and Recommendations

The species is neither a national nor regional conservation concern (Howie 2015a). No recommendations.

Horned Grebe *Podiceps auritus*

Conservation Status

COSEWIC (2009): Special Concern (Western population); Conservation Data Centre: BC Yellow list

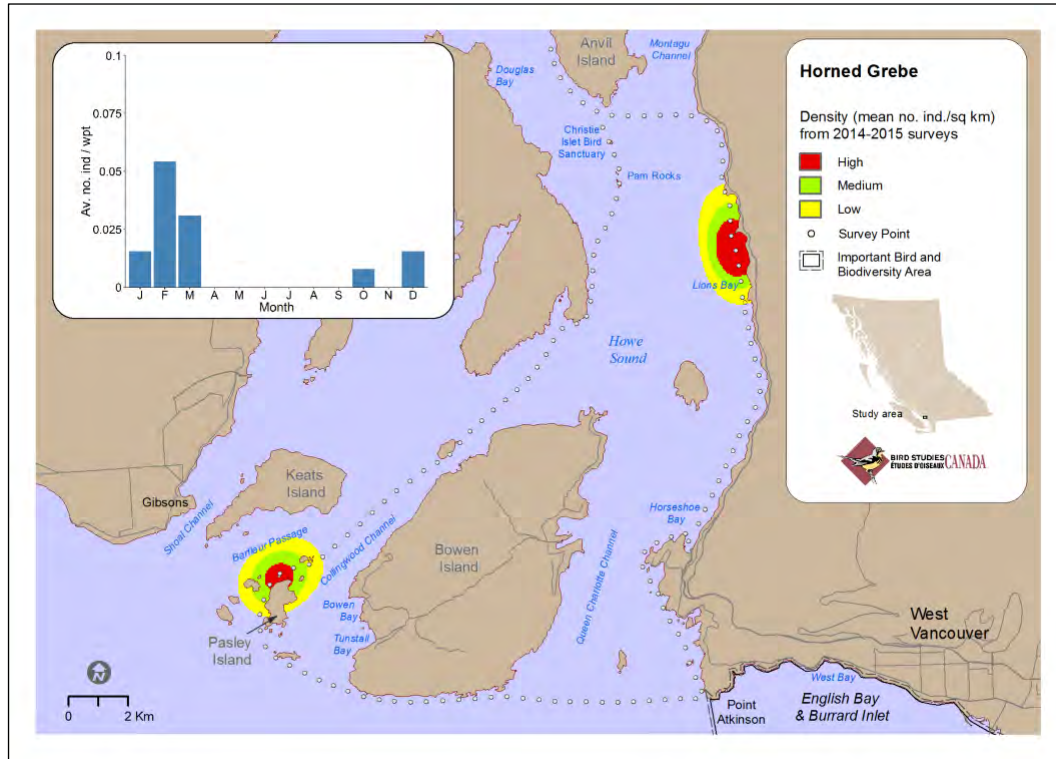


Fig. 22 Spatial distribution and seasonal abundance of Horned Grebe in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Horned Grebe is a frequent winter resident of coastal bays and estuaries in southern British Columbia. The grebe has undergone a population decline in numerous surveys in the Salish Sea for several years (Nysewander et al. 2001, Anderson et al. 2009, Bower 2009, Crewe et al. 2012). The cause of the declines is not known (COSEWIC 2009).

Survey Records

Between 1 and 7 grebes were detected primarily in Lions Bay and Barfleur Passage from October to March with a peak in February.

Conservation Issues and Recommendations

Research to understand the causes of the decline of this once widespread species is lacking. Several fish-eating species have undergone declines in recent decades suggesting changes in fish abundance as a possible cause.

Western Grebe *Aechmophorus occidentalis*

Conservation Status

COSEWIC (2014): Special Concern; SARA Status: Schedule 1;
Conservation Data Centre: BC Red list

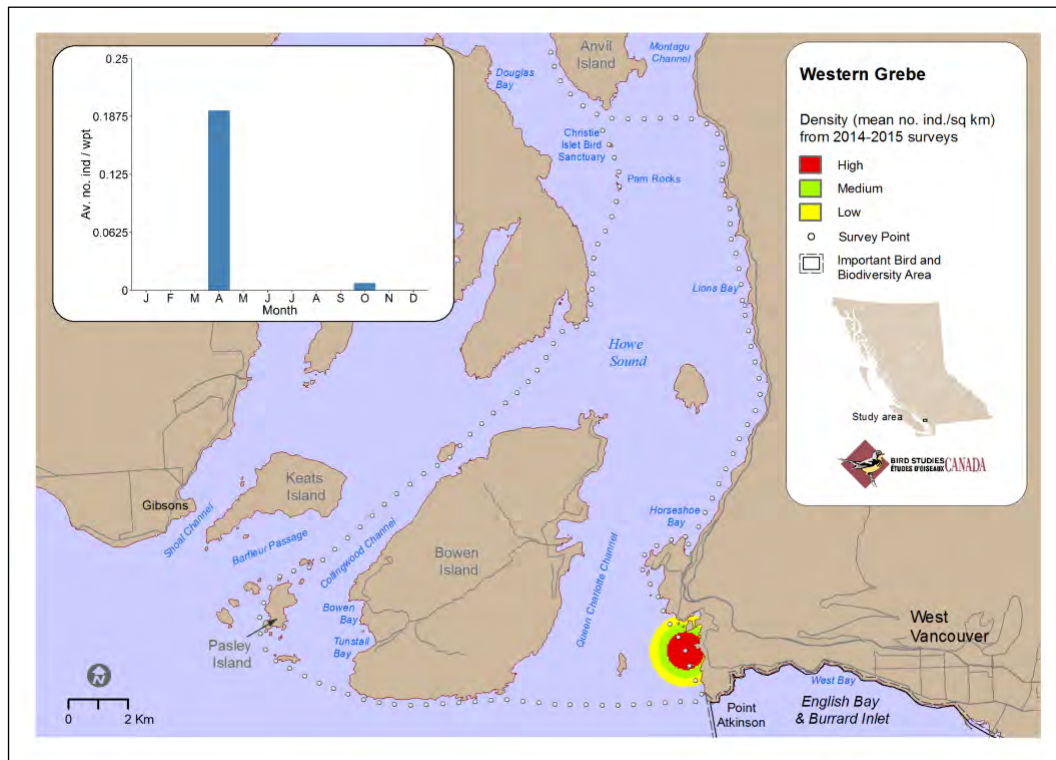


Fig. 23 Spatial distribution and seasonal abundance of Western Grebe in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Western Grebe breeds in western North America and spends the winter along the Pacific Coast (Howie 2015). Globally important numbers in Burrard Inlet and Indian Arm contributed to their designation as an Important Bird and Biodiversity Area (Bird Studies Canada 2000-2015). However, the species has undergone one of the largest and sharpest declines of waterbirds on Salish Sea surveys in recent years (Crewe et al. 2012).

John Fannin wrote in 1891 that the Western Grebe “appears in great numbers” in Howe Sound. Between 12,000 and 15,000 grebes historically used nearby English Bay and hundreds were present into the 1990s (Butler et al. 2015). These observations suggest there was local movement in the study area until the end of the 1990s. The number of Western Grebes in the Salish Sea declined by 95% in recent decades while increasing by 300% in California (Wilson et al. 2013). These authors posit that the shift in abundance of western grebes reflects a distributional shift in their small forage fish prey.

Survey Records

Western Grebes were only detected off Point Atkinson when a flock of 25 was sighted in April and one grebe was seen in October.

Conservation Issues and Recommendations

Ensuring an abundant supply of small fish, in particular Pacific herring would likely assist in the return of

Western Grebes to Howe Sound.

Brandt's Cormorant *Phalacrocorax penicillatus*

Conservation Status

Conservation Data Centre: BC Red list

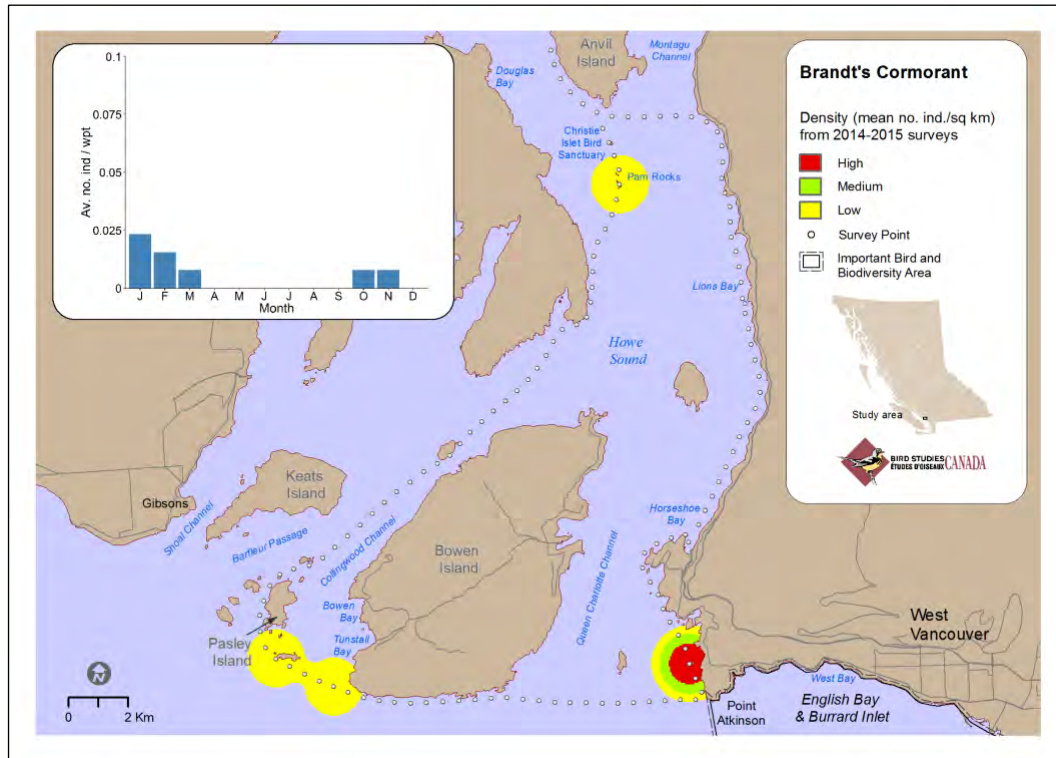


Fig. 24 Spatial distribution and seasonal abundance of Brandt's Cormorant in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Brandt's Cormorant is an endemic species in western North America where it frequents an oceanic, deeper water realm. Large numbers have been reported from Baynes Sound, the Sunshine coast, Victoria and the east coast of Vancouver Island (Crewe et al. 2012). Most Brandt's Cormorant breed outside the province (Hipfner 2015a).

Brandt's Cormorant numbers fluctuate over the years with no significant trend detected in the BC Coastal Waterbird Survey (Crewe et al. 2012). Campbell et al. (1972) considered the species to be 'rare' in the Vancouver area.

Survey Records

Steady but low numbers were seen October to March in Howe Sound with a peak in January. The highest density was off Point Atkinson.

Conservation Issues and Recommendations

No conservation issues are proposed. No measures are proposed.

Double-crested Cormorant *Phalacrocorax auritus auritus*

Conservation Status

COSEWIC (1978): Not at risk; Conservation Data Centre: BC Blue list

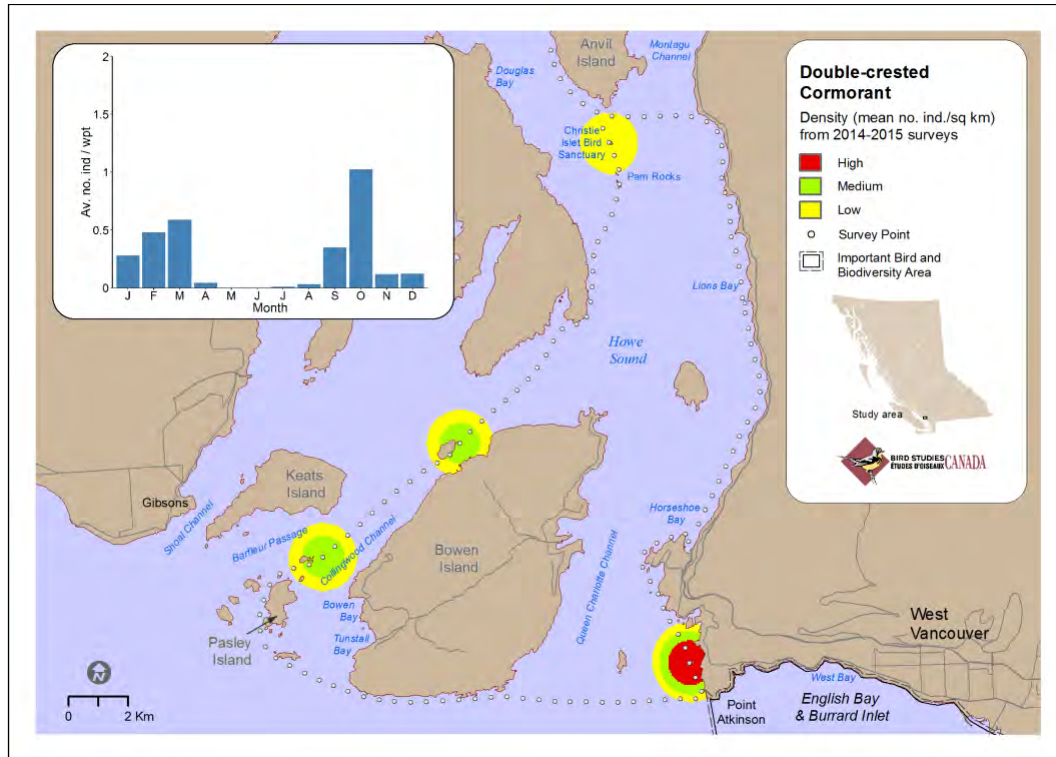


Fig. 25 Spatial distribution and seasonal abundance of Double-crested Cormorant in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Double-crested Cormorant is a year-round resident and is one of the area's iconic species. It resides year-round and is widespread where it is often seen diving for fish prey along many beaches or drying its wings on pilings. It breeds on local islands and human-made structures. The number of nesting cormorants at breeding colonies has fluctuated over the years in the region suggesting the region-wide distribution is dynamic, perhaps in response to local food resources.

Double-crested Cormorants have been reported as nesting in Howe Sound since monitoring began in the mid-1970s. Numbers of pairs at Christie Islet, Pam Rocks and Passage Island increased to a high in the mid-1980s and then began to decline (Vermeer and Butler 1989). Campbell et al. (1972) did not report breeding by the Double-crested Cormorant within Burrard Inlet and Indian Arm in 1970. That shifted at least a decade ago when they began to nest on towers and bridges. Distribution shifts appear to be a hallmark of this species in the Salish Sea. Chatwin et al. (2002) reported colony counts indicating large declines but the number of wintering double-crested cormorants did not change significantly in the Salish Sea (Crewe et al. 2012).

Survey Records

The Double-crested Cormorant was seen in Howe Sound on every month but January and May. The cormorant was largely absent during the breeding period from May to August. It was widely distributed with highest density around Point Atkinson and moderate density in Barfleur Passage and along the northwestern shore of Bowen Island.

Conservation Issues and Recommendations

Double-crested Cormorants frequently relocate colonies (Chatwin et al. 2001). Conservation of unoccupied but previously used colony sites would permit this dynamic to continue. The nearest nesting site was in the girders beneath the Granville Street Bridge and Iron Workers Memorial Bridge in Vancouver. In 1987, 119 pairs nested on Christie Islet and in 2000 there were 42 nesting pairs (Chatwin et al. 2002). A few pairs attempted to nest there sometime between 2007 and 2012. The decline of this species from Howe Sound as a nesting species is likely attributed to the increased presence of Bald Eagles. Eagles prey on seabirds and we saw one on Christie Islet on several occasions.

Pelagic Cormorant *Phalacrocorax pelagicus*

Conservation Status

Conservation Data Centre: BC Yellow list

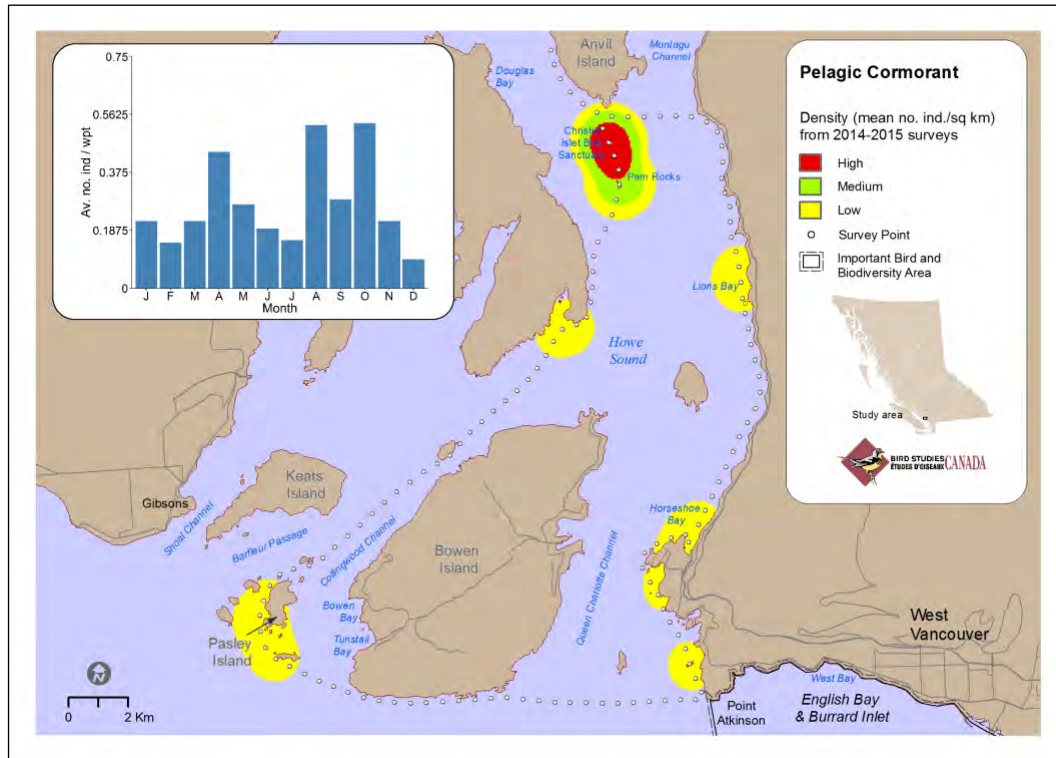


Fig. 26 Spatial distribution and seasonal abundance of Pelagic Cormorant in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Pelagic Cormorant is a resident species on the British Columbia coast where it forages for fish mostly over rocky substrates (Campbell et al. 1990).

Pelagic Cormorants have been reported nesting in Howe Sound since monitoring began in the mid-1970s. Numbers of pairs at Christie Islet, Pam Rocks and Passage Island increased to a high in the mid-1980s and then began to decline in concert with regional declines (Chatwin et al. 2002). The BC Coastal Waterbird Survey showed no significant change in winter populations in the Salish Sea (Crewe et al. 2012), whereas Bower (2009) reported a large increase for Puget Sound. Analysis of Christmas Bird Count from British Columbia revealed no significant change (Sauer et al. 1996). The apparent conflicting results between surveys are difficult to reconcile but possibly reflect the different time scales of surveys or difficulty locating colonies and tallying nesting pairs.

Survey Records

Widespread and numerous year-round resident characterizes the presence of the Pelagic Cormorant in Howe Sound. Christie Islet is the only known nesting location in the Sound where 12 nests were counted on 22 June 2015.

Conservation Issues and Recommendations

The Pelagic Cormorant joins the Double-crested Cormorant in being a widespread, and year-round species of the inlet. The decline of this species as a nesting species in the Salish Sea is possibly the outcome of the recovery of Bald Eagles that prey on birds (Chatwin et al. 2002). Access to nesting sites, especially those sheltered from Bald Eagle attacks, is an important step in sustaining local populations. The large numbers of cormorants inhabiting the Sound increases the importance of preventing oil spills.

Pacific Great Blue Heron *Ardea herodias fannini*

Conservation Status

COSEWIC (2008): Special Concern; SARA Status (2010): Schedule 1, Special Concern; Conservation Data Centre: BC Blue list

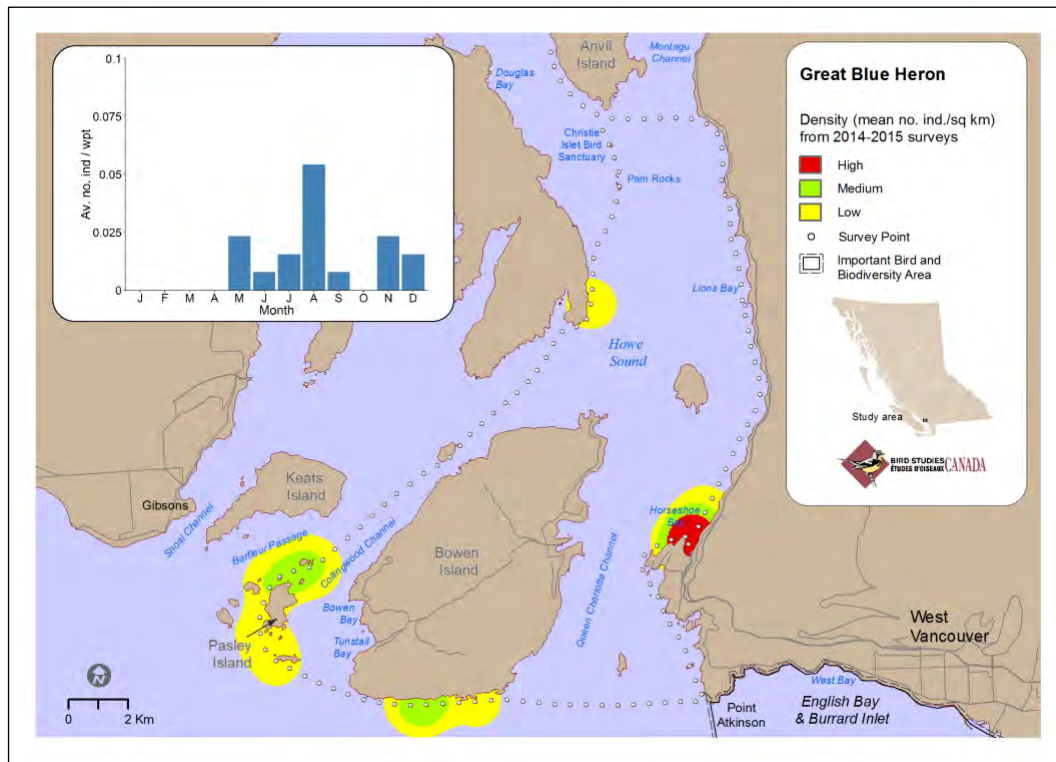


Fig. 27 Spatial distribution and seasonal abundance of Great Blue Heron in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Pacific Great Blue Heron is a resident subspecies found on the Pacific coast of Washington, British Columbia and southeastern Alaska (Butler and Vennesland 2015). They nest as single pairs and assemble into nesting colonies numbering from a few to many hundreds of pairs. Most breeding herons forage within about 10 kilometers of their nest. Their prey is mostly small fish caught on shallow beaches in spring and summer augmented with small mammals hunted in fields and ditches in autumn and winter (Butler 1997). Nationally-important numbers in nearby Burrard Inlet and Indian Arm contributed to its designation as an Important Bird and Biodiversity Area (Bird Studies Canada 2000-2015).

The Salish Sea, and particularly the lower mainland of British Columbia, is the centre of abundance of the *fannini* subspecies of Great Blue Herons in Canada (Butler 1997, Butler and Vennesland 2015). About 1,800 pairs of Great Blue Herons nested around the Strait of Georgia and Fraser River Valley in recent decades. Numbers of nesting pairs has been in slow decline for many years prompting its conservation designation both federally and provincially (Butler and Vennesland 2011).

Survey Records

Heron were seen in low numbers in Howe Sound from May to December. A peak in August likely represented the appearance of young of the year. Our boat-based surveys likely did not represent well the heron's distribution or abundance. For example, observations from kayak done outside the survey showed herons were evenly distributed along the shore of Bowen and Pasley islands.

Conservation Issues and Recommendations

Historical records for heron nesting in Howe Sound date to 1972 and 1974 when a single nest was found on Anvil Island (Moul et al. 2001). Four nests were located in Lions Bay in 1980. From 1-14 pairs of herons nested on Bowen Island between 1998 and 2015 (Gowans 2016). About 6 pairs nested in Horseshoe Bay from 1999 to about 2010. The number of herons using the Sound is small but given their uncertain future, deserve care to not disturb the nesting efforts. Eagle predation, habitat loss and human disturbance are the major causes of decline for this subspecies (Butler and Vennesland 2015). The long-term outlook for herons will depend on the level of disturbance at their nesting and foraging sites.

Peregrine Falcon *Falco peregrinus pealei*

Conservation Status

COSEWIC (2007): Special Concern; SARA Status (2003): Schedule 1, Special Concern; Conservation Data Centre: BC Blue list

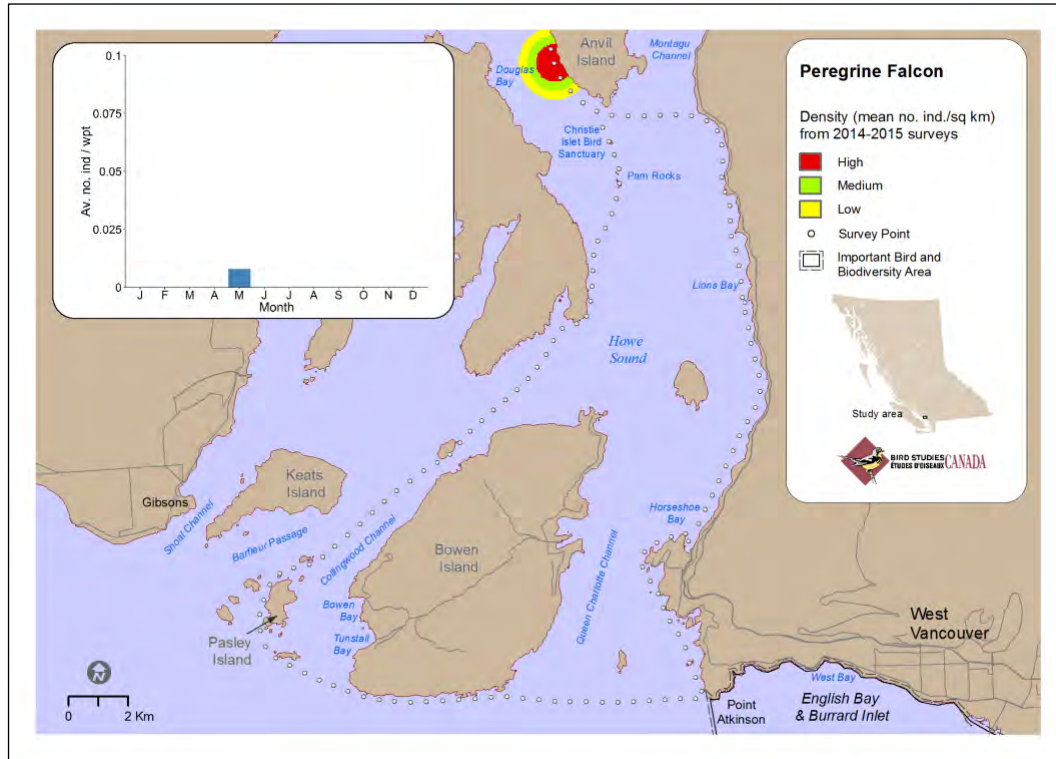


Fig. 28 Spatial distribution and seasonal abundance of Peregrine Falcon in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Three subspecies of Peregrine Falcon are reported to occur in British Columbia. The dark, resident coastal subspecies *F. p. pealei*, and the smaller, migratory, inland subspecies *F. p. anatum* breed within British Columbia, and the Arctic-breeding *F. p. tundrius* is a rare migrant (Campbell et al. 1990). The most likely subspecies inhabiting Howe Sound is the coastal form. The Peregrine Falcon spends the winter and migrates in open coastal habitats of British Columbia where there is an abundance of shorebird and waterfowl prey. A few falcons hunt pigeons around the city of Vancouver year-round.

Analyses of Christmas Bird Count data from British Columbia indicate a stable population from 1959–1988 (Sauer et al. 1996). The Peregrine Falcon was considered a frequent winter species in the Vancouver region in 1970 (Campbell et al. 1972), a situation that appears unchanged in recent years (Crewe et al. 2012).

Survey Records

We had one sighting on the western shore of Anvil Island in May. On 12 September 2015 we received a report of a Peregrine calling there (J. Whiting, pers. comm.).

Conservation Issues and Recommendations

In British Columbia, the coastal subspecies *P. f. pealei* is designated to the BC Blue list because of its small

population. It is not clear if the Peregrine Falcon in Howe Sound is present because of natural prey or introduced species such as Rock Pigeons (*Columba livia*). No measures are proposed.

Osprey *Pandion haliaetus*

Conservation Status

Conservation Data Centre: BC Yellow list

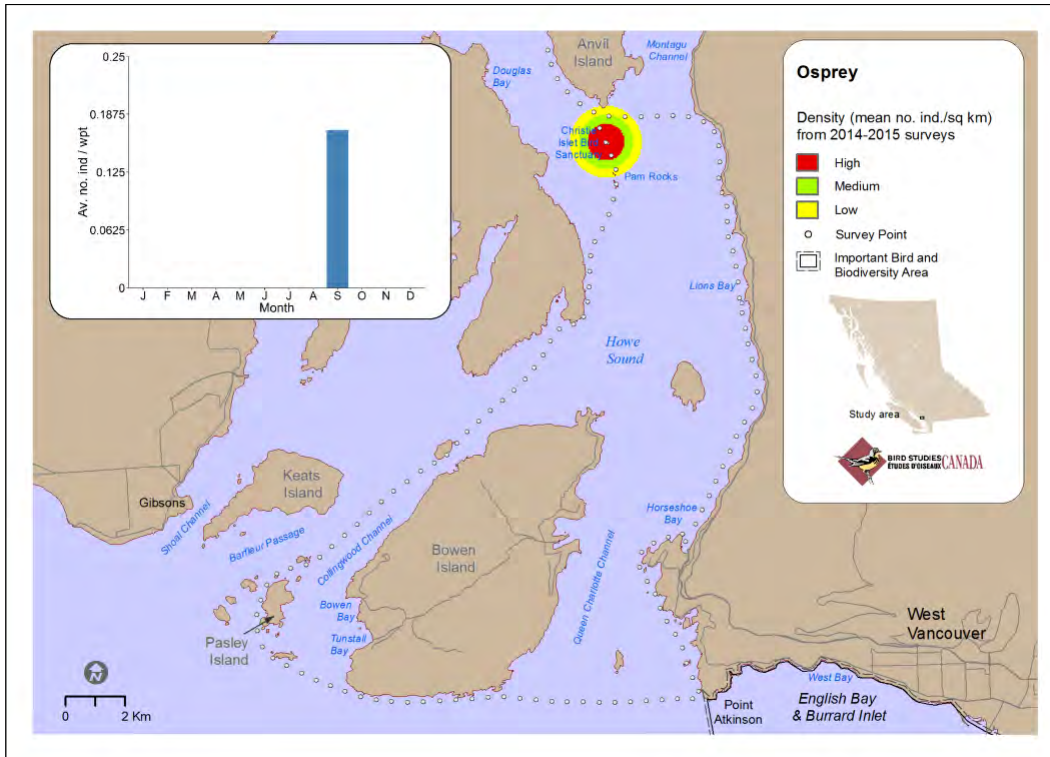


Fig. 29 Spatial distribution and seasonal abundance of Osprey in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Ospreys are a summer breeder in the region, including Howe Sound, where they eat fish caught during spectacular aerial dives. It is a widespread species throughout many parts of the world including southern British Columbia. There are several nesting pairs in the Lower Fraser River and a few in Burrard Inlet and Indian Arm (Butler et al. 2015) but not Howe Sound (Davidson 2015). Historically, Ospreys nested throughout the Salish Sea (Munro and Cowan 1947) but were considered 'rare' in summer in 1970 (Campbell et al 1972a). The first record of its return to nearby Burrard Inlet was a sighting by one of the authors (RWB) on May 23, 1970 (Campbell et al. 1972).

Survey Records

A single Osprey in September off the southern shore of Anvil Island was our only record.

Conservation Issues and Recommendations

No recommendations proposed.

Bald Eagle *Haliaeetus leucocephalus*

Conservation Status

COSEWIC (1984): Not at risk; Conservation Data Centre: BC Yellow list

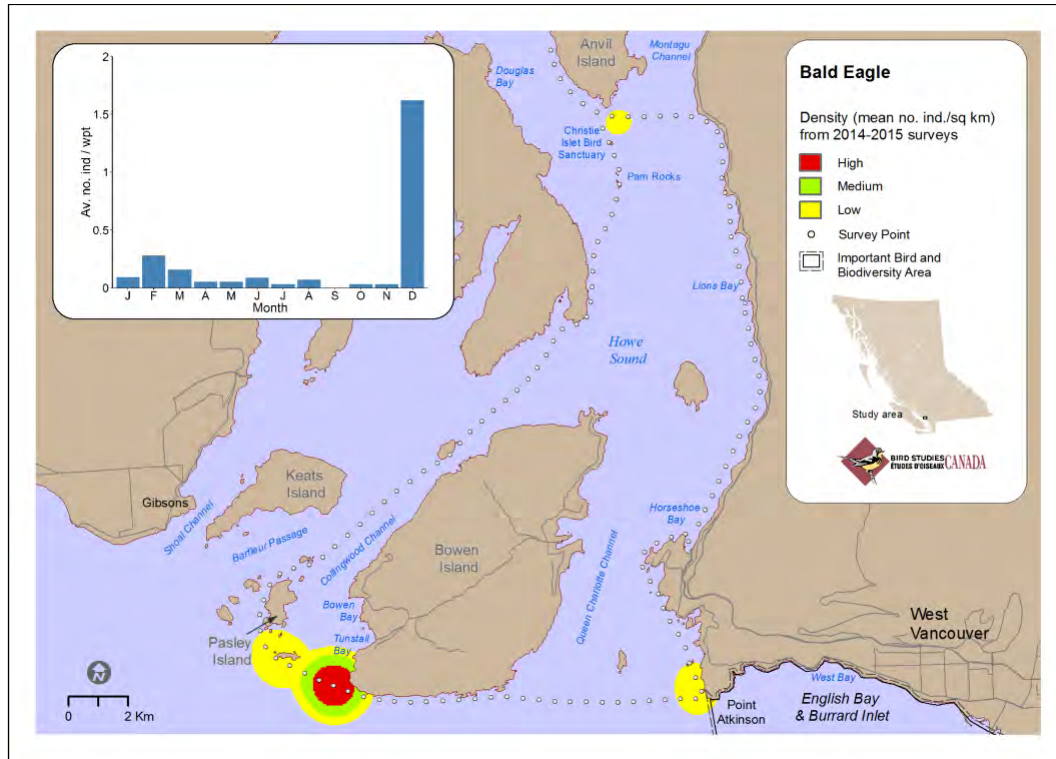


Fig. 30 Spatial distribution and seasonal abundance of Bald Eagle in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Bald Eagles historically was an abundant, resident raptor in the region (Fannin 1891) that underwent a substantial decline in the mid 20th century. Regionally, eagle numbers have rebounded in the past few decades so that many eagles now nest along the shores of English Bay and Indian Arm (Butler et al. 2015).

Highly mobile, they both scavenge and predate on birds, fish and mammals. Thousands gather annually near Squamish in northern Howe Sound to scavenge carcasses of spawned salmon. Nesting success of urban Bald Eagles in Vancouver is among the highest reported for North America (Goulet 2009). Their success is likely a result of an abundance of bird prey through the year including gulls, ducks, pigeons and crows (Goulet 2009) and the availability of nest sites. Eagles are important bird predators in the Howe Sound ecosystem and their recovery over the past few decades will likely redistribute seabirds and sea ducks (Middleton et al. 2018).

Bald Eagles move large distances in response to pulses of prey abundance, in particular salmon (Watson and Pierce 2001). Many leave the Salish Sea in late July and August to return in late fall or winter.

Survey Records

Eagles were present year-round in Howe Sound often as individuals or pairs. The greatest numbers were seen in December. Most eagles were seen at the entrance to Howe Sound especially off the southwestern coast of Bowen Island. This observation likely coincided with an influx of Pacific herring into Howe Sound. We know of 14 nests in the south Sound. These locations include Lighthouse Park, the eastern shore near the entrance to Horseshoe Bay, Worlcombe Island (2 nests), Hermit Island and Mickey Island, Cotton Point on

Keats Island, Bowen Island in Seymour Bay, end of Jason Road, Fairweather Road, and between Bowen and Tunstall Bays, near Halkett Bay on Gambier Island, the east shore of Anvil Island, and Defence Islands.

Conservation Issues and Recommendations

The high density of nesting eagles on the west side of Bowen Island is a good sign that marine life in the nearby waters is highly productive for marine life that draws an abundant supply of fish and birds. These prey animals are vital to successful nesting of eagles. A review of the state of suitable nest trees would assist in deciding what could be done to ensure future nest sites for eagles.

Black Oystercatcher *Haematopus bachmani*

Conservation Status

Conservation Data Centre: BC Yellow list

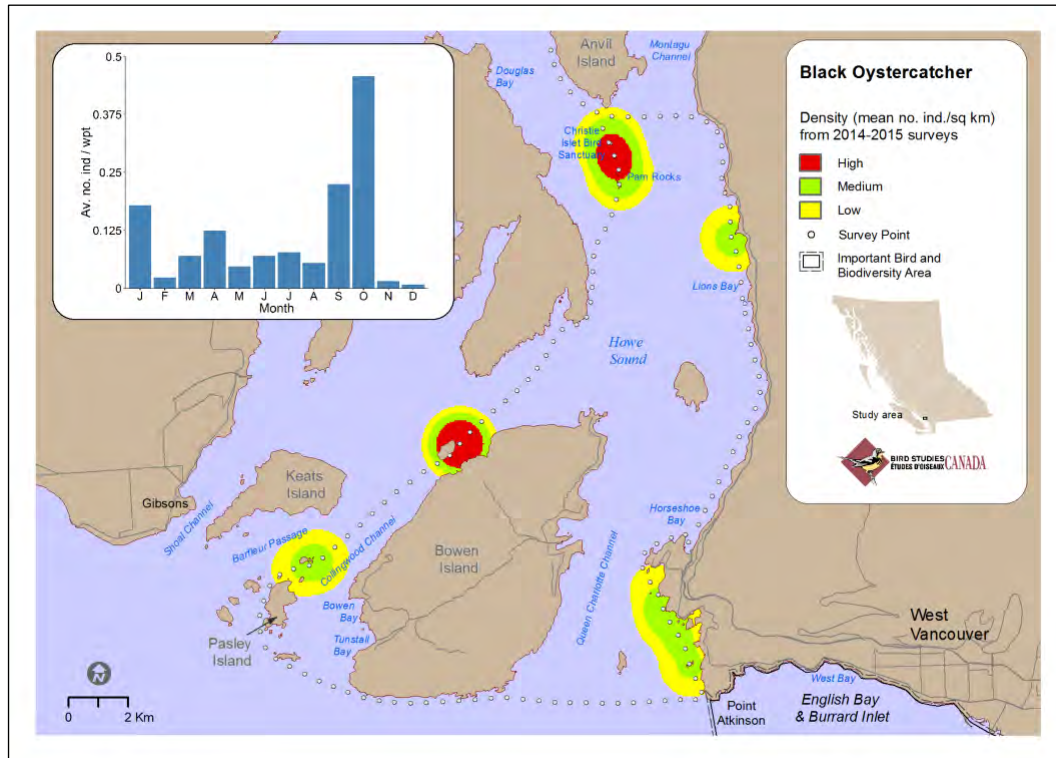


Fig. 31 Spatial distribution and seasonal abundance of Black Oystercatcher in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Black Oystercatcher is an endemic north Pacific species that frequents rocky shores to feed on limpets, mussels and other shellfish (Hipfner 2015b). It is a west coast species especially sought by birdwatchers.

British Columbia holds more than one-fifth of the global population of this species (Hipfner 2015). The winter and breeding populations in the Salish Sea do not appear to have changed in recent years (Golumbia et al. 2009, Crewe et al. 2012).

The earliest written record of oystercatchers in Howe Sound is Archibald Menzies, accompanying naturalist on Vancouver's voyage in 1792 who commented that "Near the entrance they passed some Rocky Islands on which they shot a few Sea Pies [oystercatchers]" (Newcombe 1923). The islands were likely the Grebe Islands that are occupied by oystercatchers to this day. There is a specimen in the Royal BC Provincial Museum collected in May 1889 (Munro and Cowan 1947). Cummins (1932) did not report the species in the Vancouver area including Howe Sound. However, oystercatchers were present on Passage Island in 1963 and two alarmed adults and 3 eggs were found on Christie Islet in 1964 (Campbell 1968). Vermeer and colleagues (1989) reported evidence of 2 breeding pairs on Christie Islet and Pam Rocks and not on Pasley Island in 1987. Butler and Golumbia (2008) reported evidence of 2 breeding pairs on Christie Islet and Pam Rocks in addition to a pair on Pasley Island.

Survey Records

Oystercatchers were present year around in Howe Sound with lowest numbers occurring in November and December, and greatest numbers in September and October. The Black Oystercatcher is widespread in Howe Sound.

The greatest number of oystercatchers on our surveys was 59 birds counted on 14 October 2014. A single flock of 43 birds roosted on a rock in Galbraith Bay, Bowen Island, and 15 more oystercatchers were seen on the Grebe Islets. A single oystercatcher was present along the east shore of Howe Sound bringing the total to 59 birds which probably approximated the entire nesting population and their young for Howe Sound. We tallied 16 oystercatchers at 11 sites during the 2015 nesting season (Table 4). Oystercatchers were absent from the Grebe Islets during our surveys although there is evidence from the last decade of them using Bird and Grebe islets, Pam and Christie Rock, Ragged and Pasley islands for nesting (RWB). Oystercatchers are also known to have nested at a few other locations outside our surveyed area such as along the western shore of Gambier and on Britannia Rock near Britannia Beach (BC Breeding Bird Atlas data files, Bird Studies Canada, Delta, BC). We estimate 15 - 20 pairs of oystercatcher nest in Howe Sound.

Table 4. Locations, number of adults, young, eggs and nests of black oystercatchers in south Howe Sound in 22 June 2015.

Place name	Location	Adults	Young	Eggs	Nests
Onion Island	49.21.38 N:123.25.45 W	4	0	3	2
Worlcombe Island	North side tombolo	0	0	0	0
Worlcombe Island	West islets	0	0	0	1
Pasley Channel	Mid-sized islet, south side	2 alarm calling	0	0	2
Pasley Channel	Small islet	0	0	0	1 old
Hermit Island	49.22.36N:123.28.20W	2	0	0	0
Pasley Rock	49.22.31N:123.27.52W	0	0	0	1 old
East Ragged Island	Southeast point	3 (2 alarm calling)	0	0	old nests on point
East Rugged Islet	49.22.70N:123.26.79W	0	0	0	3
Bowen Rock	49.24.16N:123.22.72W	1 on nest	0	?	1
Gambier Island islet	49.27.33N:123.18.89W	0	0	0	0
SE islet Pam Rock		1 alarm calling			
Pam Rock		3			
Christie Islet		(2 NW side;2 W side)	1	0	

Conservation Issues and Recommendations

The Black Oystercatcher joins the Black Turnstone, Barrow's Goldeneye, Harlequin Duck and Surf Scoter as rocky shore dependent species that rely on marine invertebrates for their prey. It is vulnerable to the immediate effects of oiled beaches (Andres 1999) but quickly recovers (Murphy and Mabee 2000). Most nesting sites in the Salish Sea have some form of protection (Golumbia et al. 2009). The number of nesting oystercatchers in Howe Sound appears to have greatly increased in the past 50 years from 1-2 pairs (Campbell 1968) to 15-20 in our survey. Campbell (1968) did not cover as much of the Sound as we did but he also noted only two birds on Christie Islet and Pam Rocks where we saw 8 oystercatchers.

No measures are proposed.

Spotted Sandpiper *Actitis macularius*

Conservation Status

Conservation Data Centre: BC Yellow list

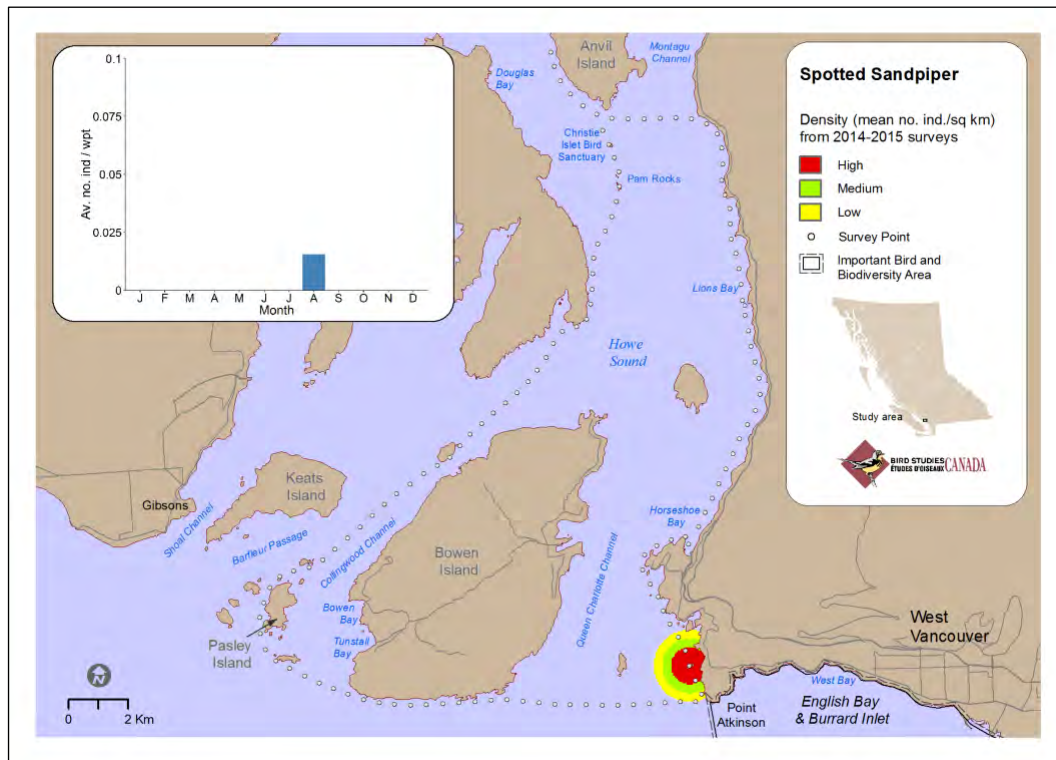


Fig. 32 Spatial distribution and seasonal abundance of Spotted Sandpiper in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Spotted Sandpipers are found across North America where water is present including marshes, estuaries and beaches (Reed et al. 2013). It is widespread along rivers and seashores of the Salish Sea and where it nests in summer. Campbell et al. (1972) referred to this species as 'frequent' in summer in the Vancouver region. Spotted Sandpiper was not included in coastal surveys reported by Crewe et al. (2012). Its presence in Howe Sound only in August suggest this is a passage migrant.

Nationally, surveys show declining trends in central and eastern Canada (Donaldson et al. 2000). Continentally, the trends are not well-defined (Andres et al. 2012). Breeding Bird Surveys show no significant changes (Sauer et al. 1996) suggesting that the species' abundance has not appreciably changed (Andres et al. 2012). Scattered records in eBird show the species is not abundant or widespread in the Sound.

Survey Records

One sighted in August at Point Atkinson.

Conservation Issues and Recommendations

Nationally, Spotted Sandpiper is considered a species of moderate concern because the population is stable but with moderate or unknown threats (Donaldson et al. 2000). No measures are proposed.

Black Turnstone *Arenaria melanocephala*

Conservation Status

Conservation Data Centre: BC Yellow list

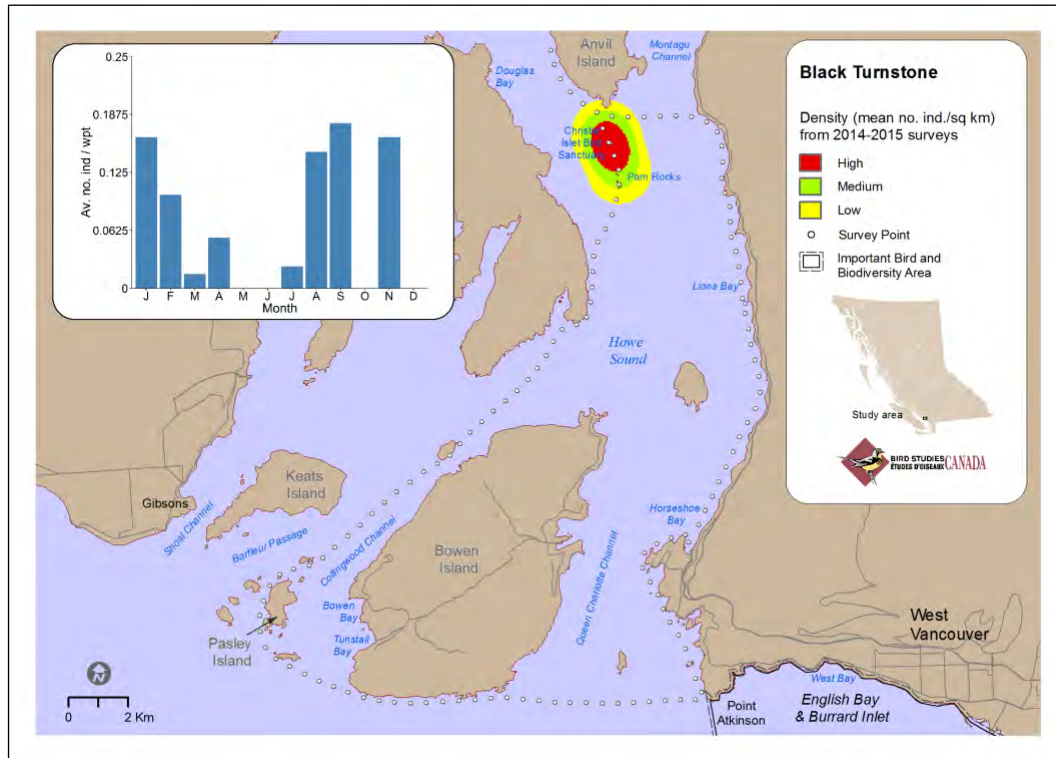


Fig. 33 Spatial distribution and seasonal abundance of Black Turnstone in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Black Turnstone is a north-Pacific endemic species that occurs in nearly year round in Howe Sound. It is especially sought by birdwatchers. Black Turnstones feed on marine organisms along rocky intertidal shores and beneath wharves.

The earliest record of turnstones in Howe Sound we could find was from Bowen Island in January 1934 (Munro and Cowan 1947). Turnstones were seen at Point Atkinson in 1971 (Campbell et al. 1972b). The species is common around Vancouver from August to April (Nature Vancouver 2013). eBird records show the species is widespread in Howe Sound.

Crewe et al (2012) reported no apparent trend from the Coastal Waterbird Survey between 1999 and 2011 for the Strait of Georgia. It should be noted that our boat-based surveys were too far from shore in many places to effectively census this species. Turnstones were seen on the Grebe Islets, Onion Island and western shore of Worlcombe Island outside the survey period.

Survey Records

Turnstones were detected every month but May and June year in Howe Sound. All observations were on Christie Islet and Pam Rocks.

Conservation Issues and Recommendations

There are no conservation issues for this species. No measures are proposed.

Surfbird *Aphriza virgata*

Conservation Status

Conservation Data Centre: BC Yellow list

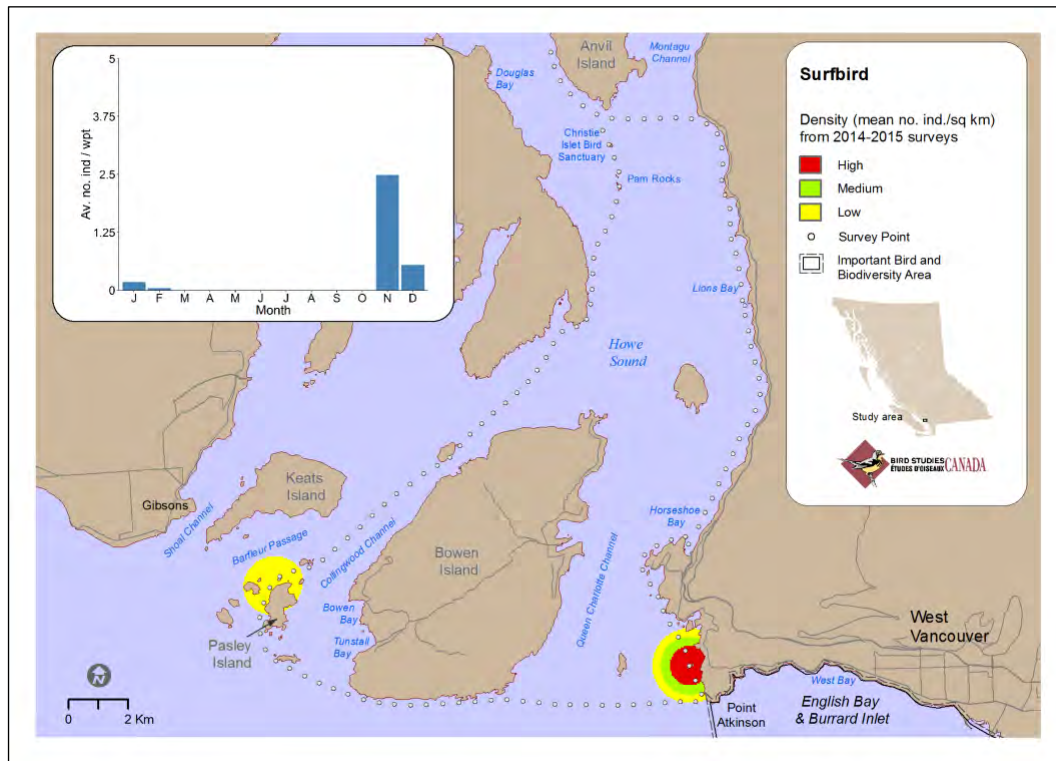


Fig. 34 Spatial distribution and seasonal abundance of Surfbird in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Surfbird is a narrow rocky-shore associated shorebird that winters along the Pacific coast often in association with Black Turnstones. Their main food is marine invertebrates along the upper intertidal zone. The earliest record of Surfbirds in Howe Sound is a specimen shot by R.V. Griffin (Fannin 1891).

The BC Coastal Waterbird Survey reported sharp declines at 18.1% per year from 1999-2011 (Crewe et al. 2012). eBird records are mostly from Point Atkinson with fewer from Pam and Christie Rock and the islands west of and including Bowen Island.

Survey Records

Surfbirds were present from November to February with the highest numbers in November at Point Atkinson.

Conservation Issues and Recommendations

No measures proposed.

Least Sandpiper *Calidris minutilla*

Conservation Status

Conservation Data Centre: BC Yellow list

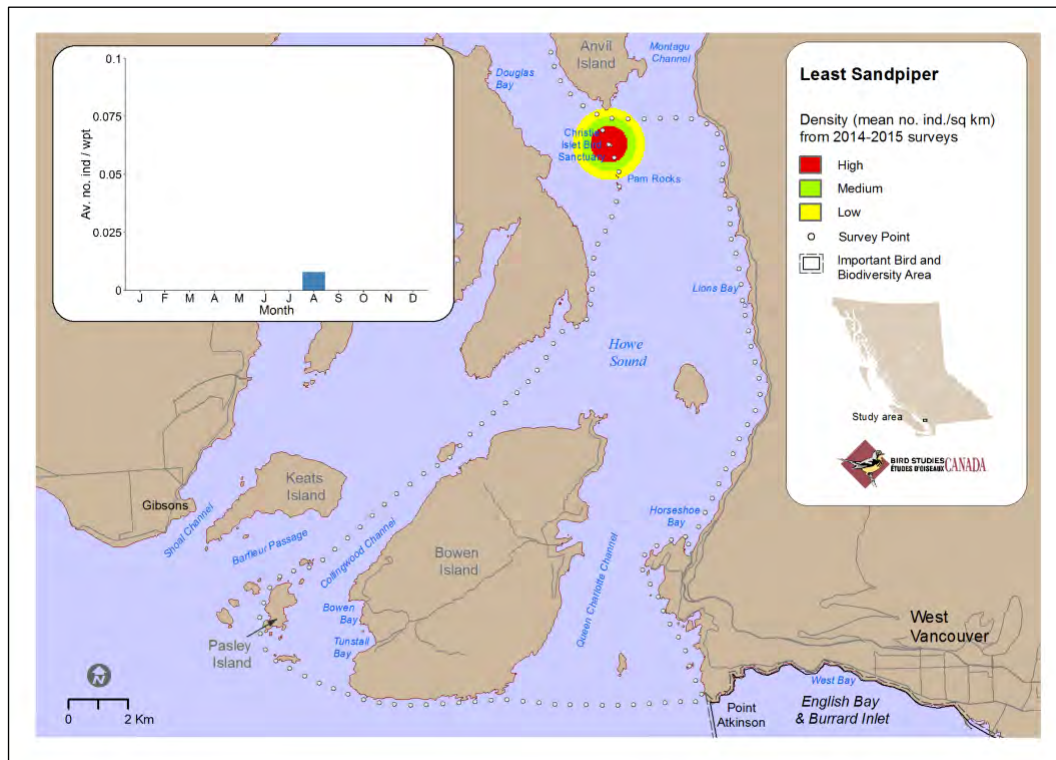


Fig. 35 Spatial distribution and seasonal abundance of Least Sandpiper in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends and Salish Sea Status

Least Sandpipers are passage migrants that move through the region during northward (April and May) and southward (July to October) migration. They are typically found on mudflats, muddy shores and sparsely vegetated estuarine areas, a habitat that is scarce in Howe Sound. The species is numerous with a portion of this population passing through the Pacific Flyway. From fall counts on the mudflats of the Fraser estuary there is a non-significant upward trend in numbers from 1998-2008 (Gratto-Trevor et al 2010). The low number of Least Sandpiper observed during our surveys reflects scarcity of suitable habitat.

Survey Records

One sighted in August on Christie Islet and Pam Rocks was our only record.

Conservation Issues and Recommendations

No recommendation proposed.

Mew Gull *Larus canus*

Conservation Status

Conservation Data Centre: BC Yellow list

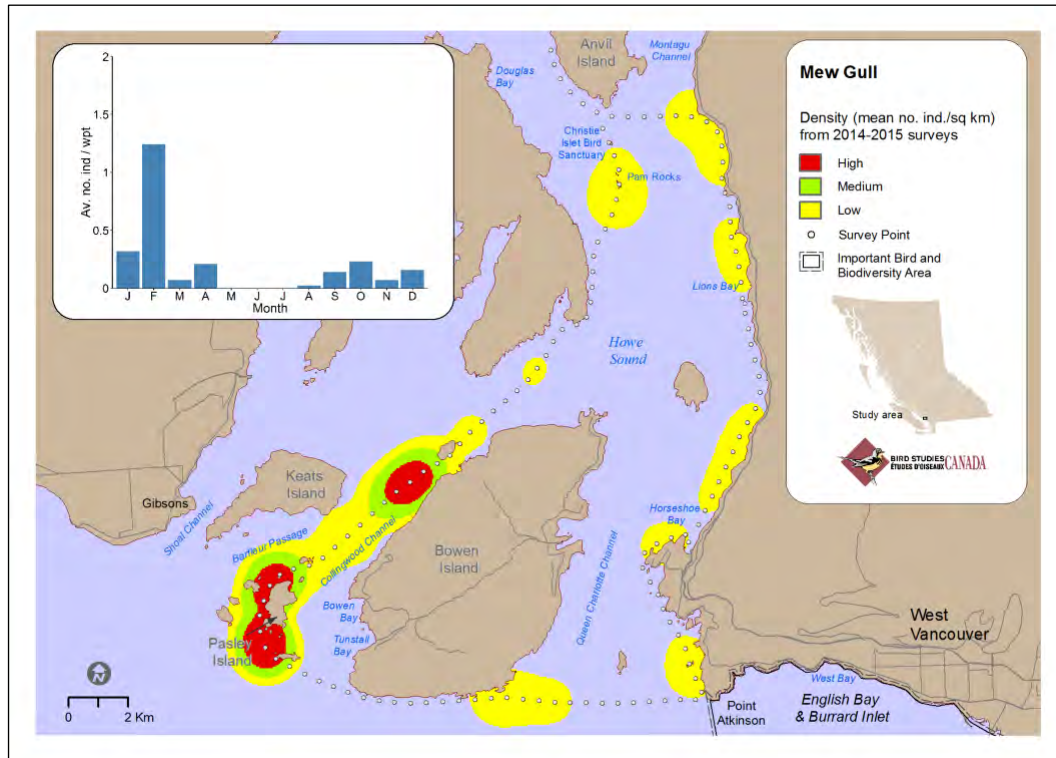


Fig. 36 Spatial distribution and seasonal abundance of Mew Gull in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Mew Gulls are found in nearshore coastal waters, estuaries, beaches, harbours and agricultural fields (Campbell et al. 1990, Moskoff and Bevier 2002). Large concentrations occur in March in response to herring spawning events (Crewe et al. 2012).

Nationally, Breeding Bird Survey data from coastal and northern BC showed a decline beginning in the 1970s that stabilized since the mid- 2000s (Environment Canada 2013). The BC Coastal Waterbird Survey reported no significant trend from 1999-2011 (Crewe et al. 2012). The Christmas Bird Count in British Columbia from 1959-1988 showed a 3% annual decline (Sauer et al. 1996) whereas a stable pattern was reported throughout the Salish Sea between 1975-84 and 1998-2007 (Bower 2009). Monitoring in Washington State from 1978-80 and 2003-05 showed a 25% decline (Anderson et al. 2009) yet numbers in Padilla Bay, Washington were stable during the same period (Anderson et al. 2009).

Survey Records

Mew Gulls were present in Howe Sound from August to April with a peak abundance occurring in February. The highest density occurred off the northwest shore of Bowen Island and Barfleure Passage.

Conservation Issues and Recommendations

No measures are proposed.

Thayer's Gull *Larus glaucoides thayeri*

Conservation Status

Conservation Data Centre: BC Yellow list

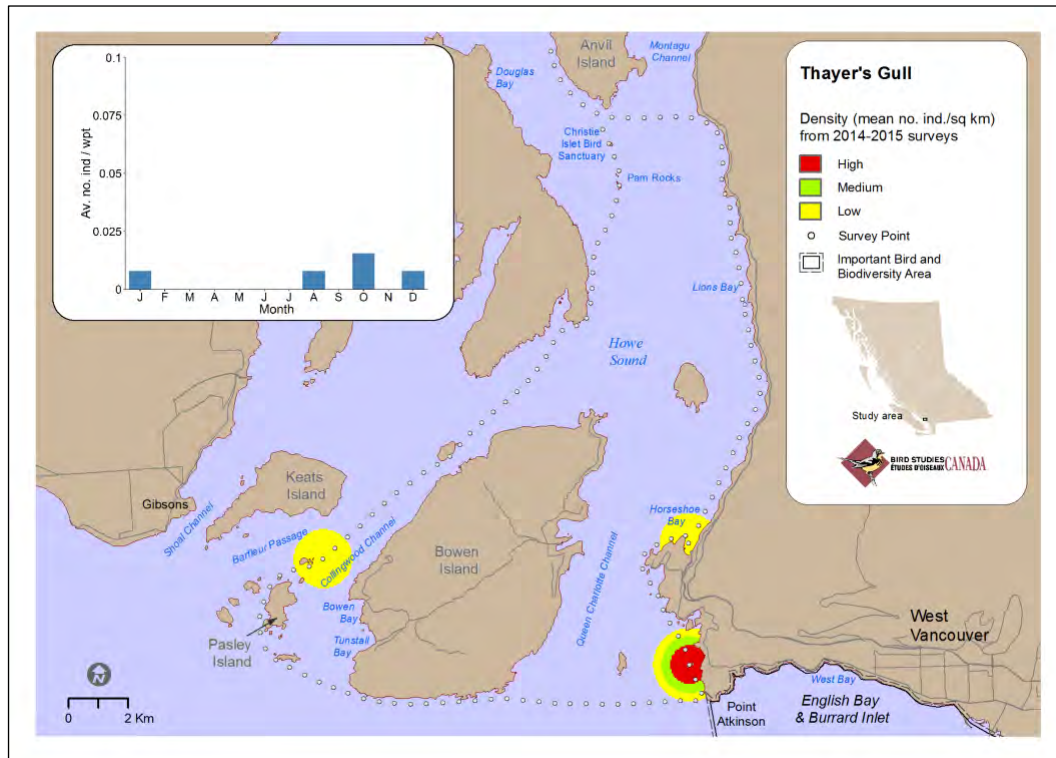


Fig. 37 Spatial distribution and seasonal abundance of Thayer's Gull in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Thayer's Gull was recently merged as a subspecies of the Iceland Gull (Chesser et al. 2017). Thayer's Gulls winter along the northern Pacific Coast in protected bays and estuaries where they eat fish and marine invertebrates. The BC Coastal Waterbird Survey reported Thayer's Gull to be declining at 4.1% per year from 1999-2011 (Crewe et al. 2012).

Survey Records

Thayer's Gulls were seen periodically in the fall and winter in the entrance to Howe Sound. eBird shows a similar distribution.

Conservation Issues and Recommendations

No recommendation proposed.

California Gull *Larus californicus*

Conservation Status

Conservation Data Centre: BC Blue list

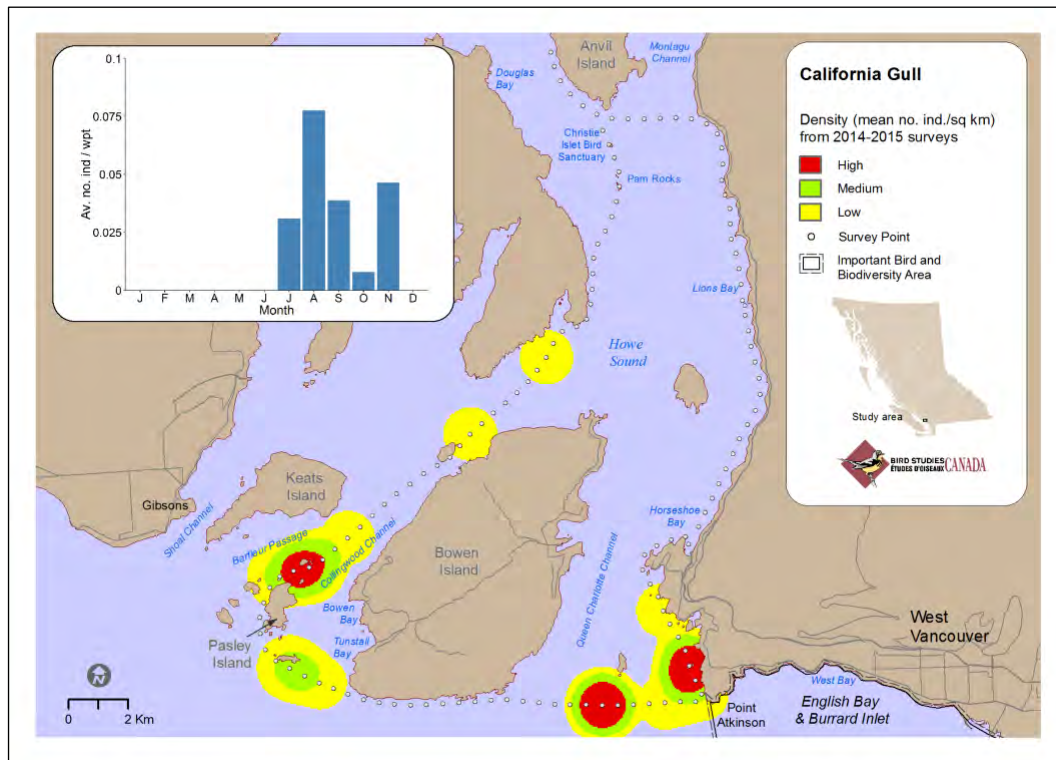


Fig. 38 Spatial distribution and seasonal abundance of California Gull in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

California Gulls use a wide variety of marine habitats from open ocean at the continental shelf to coastal estuaries, river deltas, beaches, mudflats and rocky coastlines (Winkler 1996). They winter in large numbers along the west coast of North America and migrate along the BC coast (Campbell et al. 1990). The California Gull is a frequent transient in the Vancouver region (Campbell et al. 1972).

In British Columbia, Christmas Bird Count numbers were stable over the long term (Sauer et al. 1996). No trend was apparent in the BC Coastal Waterbird Survey dataset over the period 1999-2011 (Crewe et al. 2012). Numbers in Puget Sound, Washington were stable over the same period (Anderson et al. 2009).

Survey Records

Detected from July to November with numbers fluctuating between months, the California Gull was seen mostly at the entrance to Howe Sound with highest densities in Barfleur Passage, Point Atkinson and the waters between Point Atkinson and Bowen Island.

Conservation Issues and Recommendations

California Gulls are Blue-listed in BC because their small breeding population is susceptible to human disturbance and random environmental fluctuations (BC Conservation Data Centre 2015). They are listed as a regional stewardship species in the Bird Conservation Region Strategy for Region 5 (Environment Canada

2013). Threats to the wintering population include entanglement in gill nets and longlines, ingestion or entanglement in plastic waste in both marine and terrestrial environments and chronic and catastrophic oil spills (Environment Canada 2013.).

Glaucous-winged Gull *Larus glaucescens*

Conservation Status

Conservation Data Centre: BC Yellow list

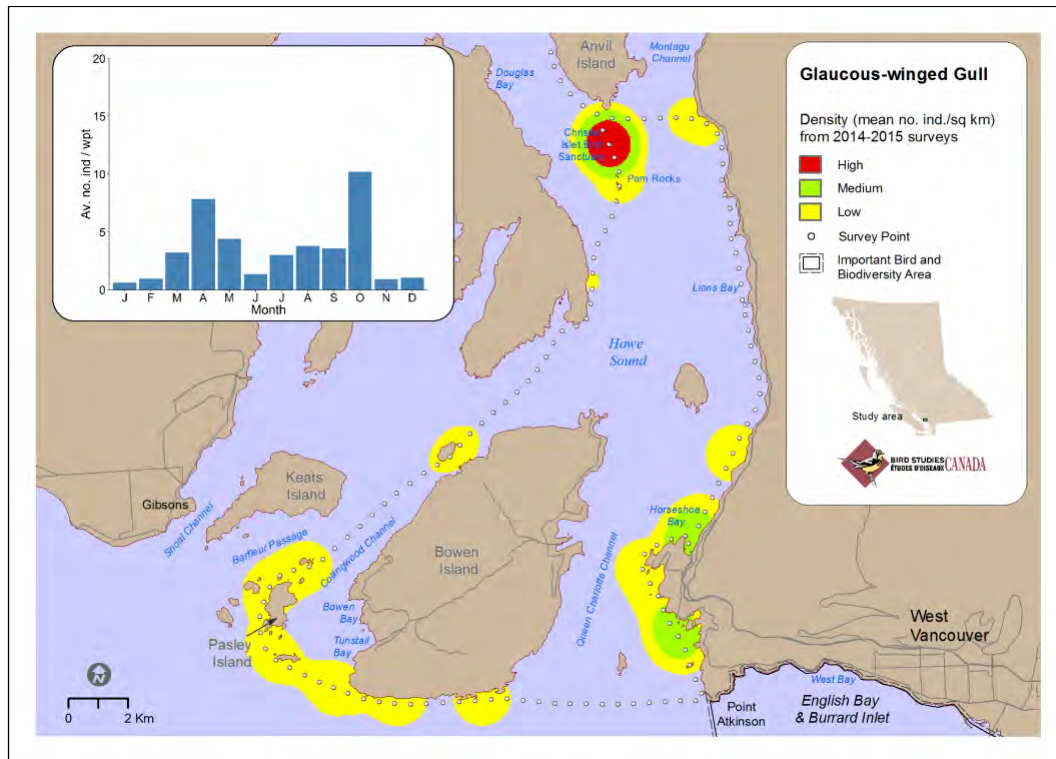


Fig. 39 Spatial distribution and seasonal abundance of Glaucous-winged Gull in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Glaucous-winged Gull is a year-round resident in the Salish Sea. The gull forages in the intertidal zone, estuaries and at landfills and breeds on uninhabited, treeless islands, rooftops and undersides of urban bridges. Large concentrations are routinely found, around herring spawning sites (Sullivan et al. 2002a).

In the Georgia Basin, numbers increased from the first monitoring records in 1900 to a maximum around 1973 and began to decline thereafter (Blight 2012). Nationally, Christmas Bird Counts suggest increases since the 1970s (Environment Canada 2011). In BC, Christmas Bird Counts and breeding surveys show declines since the 1990s possibly linked to increasing disturbance and predation by rising numbers of Bald Eagles (Environment Canada 2011). Glaucous-winged Gulls showed a significant declining trend of 4.3% in the BC Coastal Waterbird Survey dataset from 1999- 2011 (Crewe et al. 2012). Significant declines of up to 37% were reported from Christmas Bird Count data from the Salish Sea and Puget Sound, Washington, between 1975- 84 and 1998- 2007, PSMAP monitoring 1978-80 and 2003-05 (Bower 2009) and in Padilla Bay, Washington between 1978-79 and 2003-06 (Anderson et al. 2009). The number of nesting pairs in colonies in the Strait of Georgia shrunk in size by up to 31% from 1986 to 1997-1999 (Vermeer and Devito 1989, Sullivan et al. 2002b) and, by 2010, the Georgia Basin population estimate stood at approximately 5600 pairs (Blight 2012).

In Howe Sound, numbers of nesting pairs at Christie Islet, Pam Rocks and Passage Island rose between 1940 and 1980 before declining. Demographic changes during the nesting season as well as increased predation with increasing Bald Eagle numbers partially explain the decline (Blight 2012). Vermeer and Devito (1989) counted 384 nesting gulls on Passage Island in 1986, 111 nesting pairs of gulls on the Grebe Islets, 38 nests

on Bird Islet and 10 nests on an unnamed islet near Fishermans Cove.

Identification of large gulls to species was problematic at times on our survey because of their similar features, hybridization and the movement of the boat. We assumed that all the large gulls were Glaucous-winged Gulls because they were by far the most abundant species. Some Glaucous-winged X Western Gull hybrids (based on dark wing tips and pale backs) were present on the nesting colony on Christie Islet. A careful examination of gulls in Howe Sound would help to determine the abundance of these species.

Survey Records

The Glaucous-winged Gull was numerous and present year around in Howe Sound. Abundance peaked in fall and spring. Highest density was on Christie Islet and Pam Rocks , and moderate density occurred on the Grebe Islets and in Horseshoe Bay.

Conservation Issues and Recommendations

Declines in the Strait of Georgia may be attributed to increasing disturbance and predation at breeding colonies as numbers of Bald Eagles rise (Sullivan et al. 2002b) and declines in marine prey availability (Blight 2011). Threats to Glaucous-winged Gulls include entanglement in longlines, ingestion of marine plastic waste, mortality due to PCB exposure and chronic and catastrophic oil spills (Environment Canada 2013). It is a regional stewardship species in the Bird Conservation Region 5 strategy (Environment Canada 2013).

The large numbers of gulls descending on nearby Burrard Inlet after breeding to eat mussels underscore its significance as a food source. Similarly, in Howe Sound large numbers of gulls were present in October where they fed on mussels along the shore. Maintaining high quality conditions for mussels is important for this species, as well as several sea duck species. Locating mussel beds and regular monitoring of pollutant levels in the Sound is recommended.

Common Murre *Uria aalge*

Conservation Status

Conservation Data Centre: BC Red list

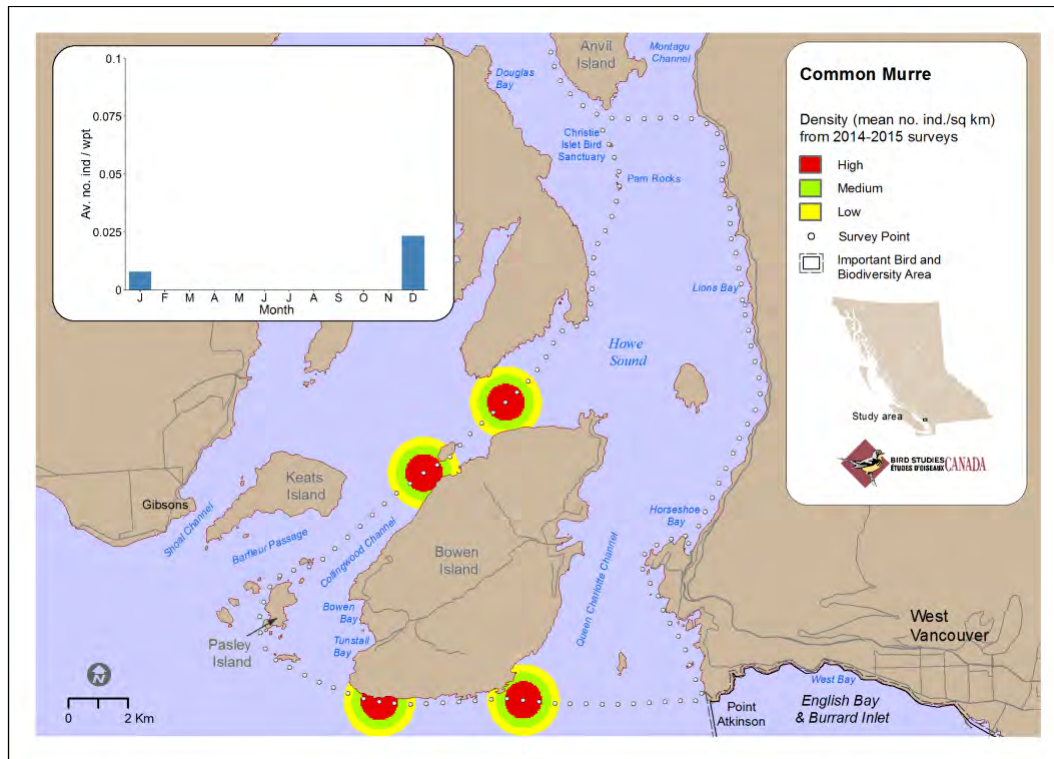


Fig. 40 Spatial distribution and seasonal abundance of Common Murre in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Large numbers of Common Murre that nest along the Pacific Coast outside the Salish Sea enter the Strait of Georgia in summer to moult feathers (Thompson et al. 1998). In spring, large numbers congregate around herring spawn sites and move farther offshore over the continental shelf break to spend the winter (Morgan et al. 1991, Hipfner 2015a).

Between 1989- 2003 the largest breeding colony in BC at Triangle Island declined by 27% (Hipfner 2005). Common Murres showed no significant trend in BC Coastal Waterbird Survey dataset from 1999-2011, but detection ability may be limited by a chiefly offshore distribution relative to survey locations (Crewe et al. 2012). Steep declines of 83-92% were reported from Christmas Bird Counts in the Salish Sea between 1975-84 and 1998-2007, and in the Puget Sound Ambient Monitoring Program in Washington between 1978-80 and 2003-2005 (Bower 2009). Common Murres are Red listed in British Columbia due to high risk of mortality to oil spills and high susceptibility to fisheries bycatch (BC Conservation Data Centre).

Survey Records

The murre was nowhere numerous in the Sound. The few we saw were in December and January surrounding Bowen Island.

Conservation Issues and Recommendations

Prevention and rapid cleanup response of oil spills in Sound is a priority for the persistence of this species.

Pigeon Guillemot *Cephus columba*

Conservation Status

Conservation Data Centre: BC Yellow list

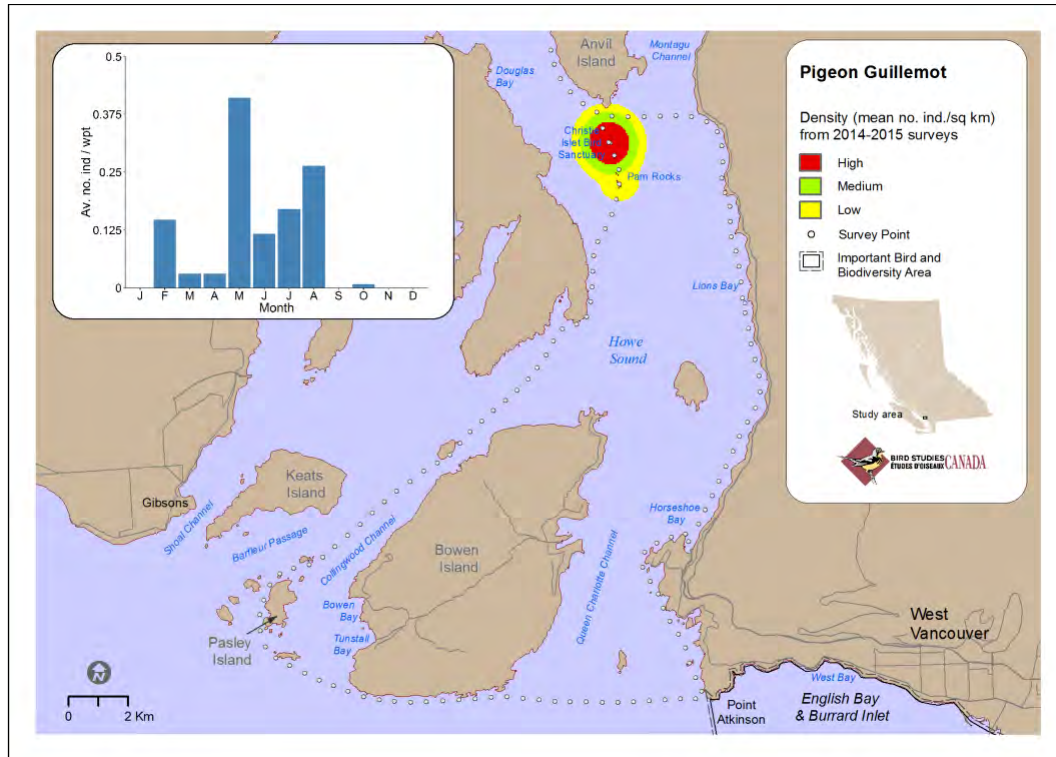


Fig. 41 Spatial distribution and seasonal abundance of Pigeon Guillemot in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Pigeon Guillemot is a resident species endemic to the Pacific Northwest, commonly found in sheltered, rocky inshore waters of the Salish Sea (Hipfner 2015b). It breeds along the British Columbia coast where it lays its eggs in rock crevices, under logs and among pilings and feeds primarily on fish in benthic, nearshore waters.

Pigeon Guillemots showed a strong, upward trend of 21.7% per year from 1999-2011 in the BC Coastal Waterbird Survey dataset (Crewe et al. 2012). Most notable were the large uptick in numbers off Victoria and the Saanich Peninsula since 2005 (Crewe et al. 2012). Pigeon Guillemots showed a large increase in numbers in the Salish Sea Christmas Bird Counts between 1975-84 and 1998-2007 (Sauer et al. 1996) and in Puget Sound Ambient Monitoring Program surveys in Washington between 1978-80 and 2003-05 (Bower 2009). In contrast, aerial surveys in Puget Sound showed declines from 1992-1999 (Nysewander et al 2001).

Historical breeding records for Howe Sound indicate breeding pairs on Passage Island, Christie Islet, Pam Rocks and Batchelor Point in West Vancouver (Munro and Cowan 1947).

Table 5. Historical records of Pigeon Guillemot nesting in Howe Sound. Data sources: Munro and Cowan (1947), Emms and Morgan (1989)

Year	Location	Number of pairs
1961	Passage Island	6
	Christie Islet and Pam Rocks	65
	Batchelor Point	adults present
1976	Passage Island	20
	Christie Islet and Pam Rocks	17
	Batchelor Point	2
1987	Passage Island	8
	Christie Islet and Pam Rocks	23
	Batchelor Point	no data

Survey Records

The guillemot was seen from February to October. Most sightings were during the breeding season from May to August at Pam Rock and Christie Islet.

Conservation Issues and Recommendations

This species shows one of the largest increases in the BC Coastal Waterbird survey. A generalist feeder, it is showing peak abundances in several surveys in the southern Gulf Islands (Crewe et al. 2012, Davidson et al. 2010). The main threats to Pigeon Guillemots include mortality in gillnets, ingestion of marine and terrestrial plastic waste, competition with humans for fish stock, introduced predators at breeding sites, human disturbance at nest sites, exposure to contaminants, chronic and catastrophic oil spills and changes in marine food webs and productivity due to climate change (Environment Canada 2013). Pigeon Guillemots are identified as a regional stewardship priority in Bird Conservation Region Strategy for Region 5 and expanded monitoring of the breeding population is recommended (Environment Canada 2013). The species takes to artificial nest sites but boxes placed on Popham Island in the 1990s has failed to attract any guillemots (RWB unpubl.).

Marbled Murrelet *Brachyramphus marmoratus*

Conservation Status

COSEWIC (2012): Threatened; SARA Status: Schedule 1, Threatened;
Conservation Data Centre: BC Blue list

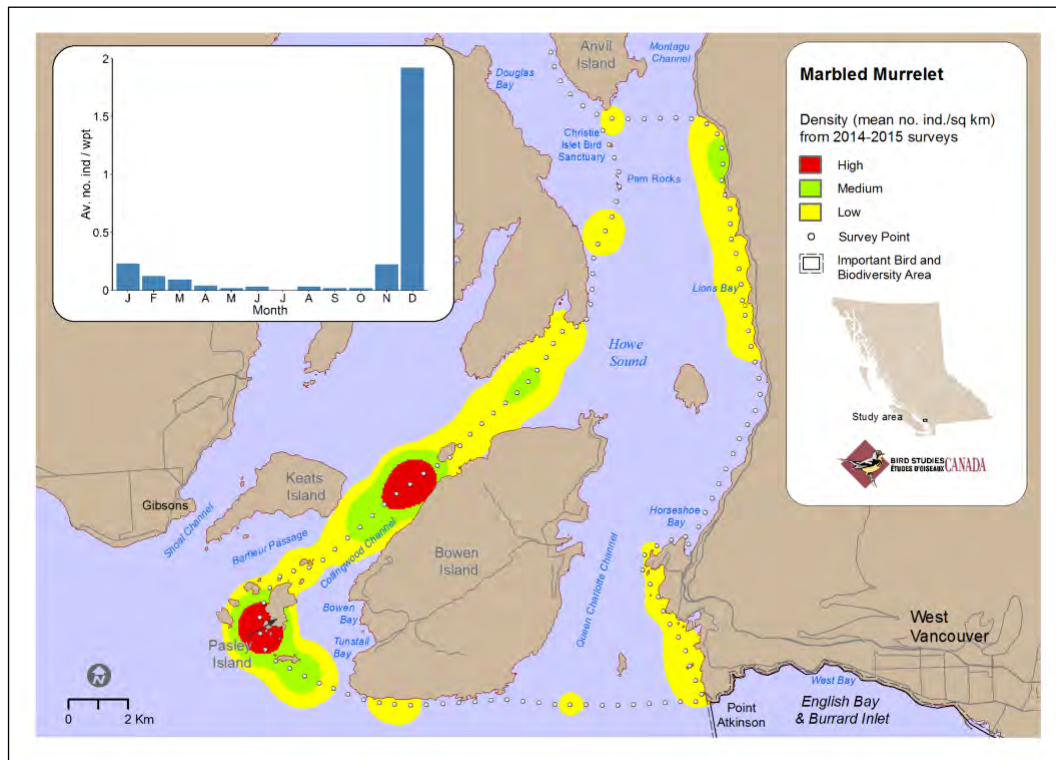


Fig. 42 Spatial distribution and seasonal abundance of Marbled Murrelet in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Marbled Murrelets are an iconic coastal species that rely on both marine habitats for food and nearby old-growth forests for nest sites. Murrelets eat forage small fish and marine invertebrates such as crustaceans and amphipods (Norris et al. 2007). Breeding birds carry their prey for many kilometers under the cover of darkness to nests built on limbs of old-growth trees.

The number of Marbled Murrelets in Canada is estimated to be about 99,000 birds (Bertram et al. 2015), or about 28% of the estimated global total of 357,900 birds (Environment Canada 2014). The Howe Sound breeding murrelets are part of the estimated 6,000-7,000 South Mainland Coast population which has been declining since at least 1996 (Bertram et al. 2015).

Survey Records

Small numbers of murrelets were detected year-round with an abrupt strong peak in abundance in December. Murrelets were widespread in Howe Sound with the highest density off the western shore of Bowen Island. Moderate densities were detected in the waters between Bowen and Gambier Islands and north of Lions Bay.

Conservation Issues and Recommendations

The potential threats to the Marbled Murrelet outlined by Environment Canada (2014) are loss of coastal old-growth forest nesting habitat, oil contamination, entanglement in fishing nets at sea, and disturbance

from shipping traffic. Norris et al. (2007) suggested that in the latter half of the 20th century their diet underwent a reduction in the proportion of small fish in favour of marine invertebrates. These authors proposed that the recovery of the murrelet population on the South Coast might require restoration of marine, as well as forest habitats.

The murrelet was once numerous in the waters around Vancouver in 1971 and 1972 (Campbell et al. 1972). The 1970 Christmas Bird Count reported 79 Marbled Murrelets in Vancouver – the highest previous tally was 268 birds. The murrelet was a breeding species around that time evidenced by an adult carrying food in English Bay and 88 individuals reported from English Bay, including 8 young, in July 1971. The numbers had declined noticeably by 1995 when the Vancouver Natural History Society (1995) wrote “The Marbled Murrelet is a resident species which seems to be decreasing in numbers. Small numbers can be seen off Lighthouse Park and Ambleside Park during the winter”. The decline in the number counted in the Strait of Georgia over the past 40 years (Norris et al. 2007; Crewe et al. 2012) reinforce our grim assessment for Howe Sound (Bertram et al. 2015).

One of the authors (RWB) witnessed flights by adults near dusk presumably to nests from a viewpoint beneath the Lion's Gate Bridge in the 1970s. Also in 1970, a ‘nest fugitive young’ was found in Stanley Park’s Lost Lagoon in July (Campbell et al. 1972) before the first nest ever of this species was discovered (Binford et al. 1975). The species also nests on the ground including in the Gulf Islands (W. Wartig, pers. comm.). Efforts to recover small forage fish, especially Pacific herring and sandlance might be essential to the recovery of the murrelet population. We recommend that Howe Sound be included in Critical Habitat designation under the SARA for the south coast Marbled Murrelets.

Rhinoceros Auklet *Cerorhinca monocerata*

Conservation Status

Conservation Data Centre: BC Yellow List

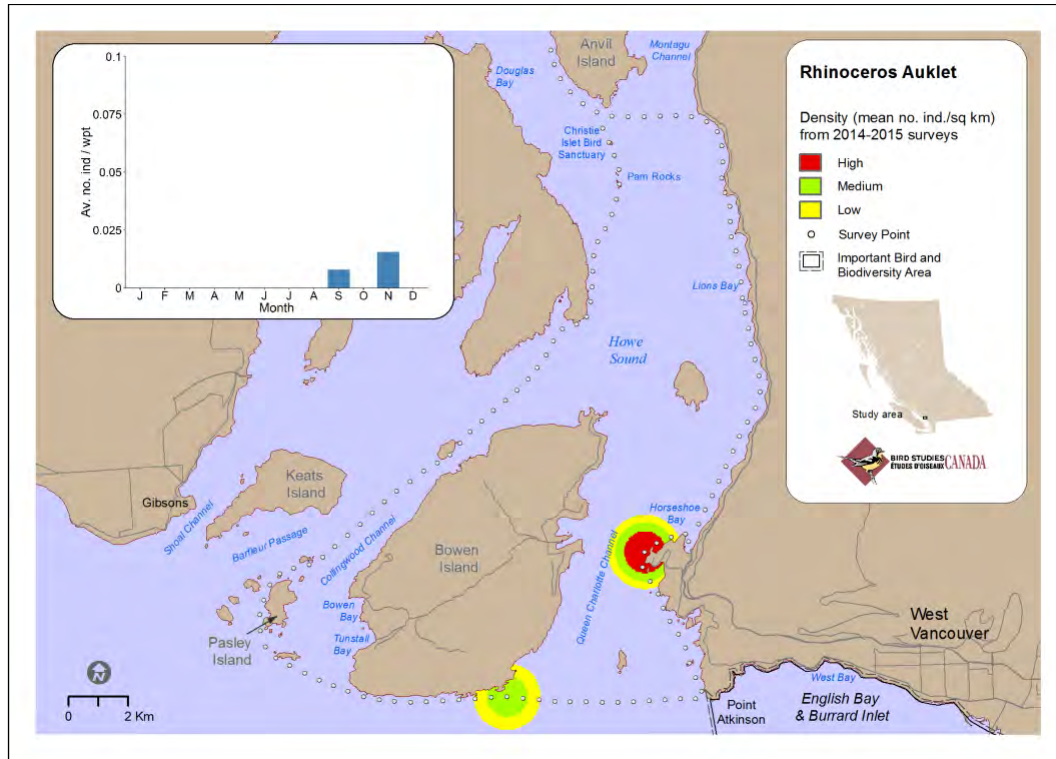


Fig. 43 Spatial distribution and seasonal abundance of Rhinoceros Auklet in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Rhinoceros Auklet forages on marine invertebrates and fish (Hipfner 2015). The auklet breeds in large colonies outside the Strait of Georgia. Some individuals are present in the Strait of Georgia during their non-breeding season although their winter movement is poorly understood (Hipfner 2015).

The global population is estimated to number > c.1,300,000 individuals (del Hoyo and Elliott 1996) of which approximately half breed in British Columbia (Hipfner 2015). The BC Coastal Waterbird Survey detected a sharp 17.6% per year decline from 1999-2011 (Crewe et al. 2012).

Survey Records

A few auklets were present near the entrance to Howe Sound in September and November and September.

Conservation Issues and Recommendations

The main threats to Rhinoceros Auklet populations in the province include gillnet bycatch (Hipfner 2015) and susceptibility to oil tanker spills. Due to their contaminant sensitivity, they are used as a sentinel species for tracking marine contaminants (Hipfner 2015). No recommendations are proposed.

Belted Kingfisher *Megasceryle alcyon*

Conservation Status

Conservation Data Centre: BC Yellow list

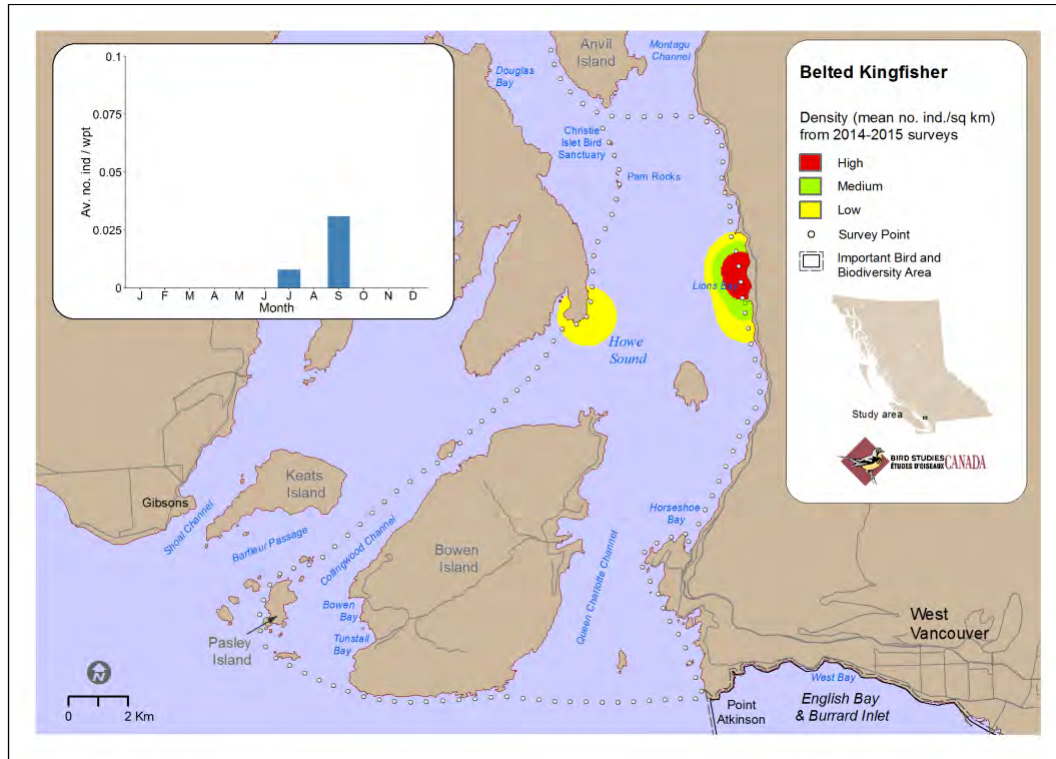


Fig. 44 Spatial distribution and seasonal abundance of Belted Kingfisher in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Belted Kingfishers are strongly tied to shallow estuaries, rocky shores and clear marine waters where they hunt for small fish (Kelley et al. 2009, Environment Canada 2013.) Kingfishers are migratory in much of British Columbia and a year-round resident on the coast (Campbell et al. 1990b).

This species has been overlooked in surveys around the Salish Sea and so its status is unclear. No significant trends in BC kingfisher populations were found in the Breeding Bird Surveys from 1965-1979 (Robbins et al. 1986).

Survey Records

Our boat survey route was too far from shore to properly census this species. The few kingfishers we saw occurred in July and September and most detections were in Lions Bay. In contrast, kayak-based surveys showed that several kingfishers frequented Pasley Island and bays on Bowen Island.

Conservation Issues and Recommendations

Belted Kingfishers are identified as a species of 'regional concern' and 'regional stewardship' in the Bird Conservation Region Strategy for Region 5 (Environment Canada 2013). No measures are proposed.

MAMMALS

Harbour Porpoise *Phocoena phocoena*

Conservation Status

COSEWIC (2003): Special Concern; SARA status: Schedule 1, Special Concern; Conservation Data Centre: BC Blue list

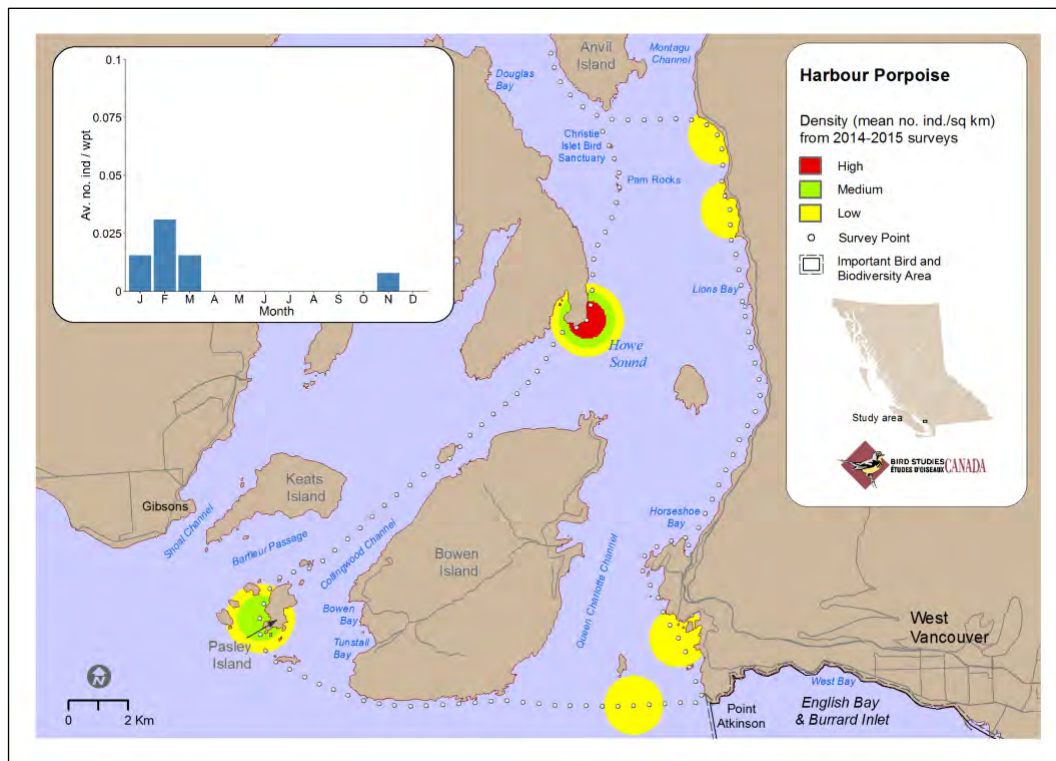


Fig. 45 Spatial distribution and seasonal abundance of Harbour Porpoise in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Harbour Porpoise occurs along the British Columbia coast in waters usually less than 150 meters deep, including in the Strait of Georgia (Ford 2014). The species is frequently encountered in Haro Strait to Race Rocks where there is strong tidal flow (Hall 2004, Davidson et al 2010). The waters near Lighthouse Park appear to be regularly used by Harbour Porpoises. The observation by Butler *et al.* (2017) of a super pod suggests that these waters have some special significance to this species.

There are no trend data available but an estimated 6,200 porpoises were present in the Strait of Georgia and Gulf Islands in 2002-03 (Ford 2014).

Survey Records

Harbour Porpoises were detected from November to March with a peak in February. The species was widespread in Howe Sound with sightings near Point Atkinson, Worlcombe Island, Gambier Island and the eastern shore of Howe Sound.

Conservation Issues and Recommendations

Entanglement in fishing gear and possibly avoidance of underwater noise is considered important to this species (Ford 2014).

California Sea lion *Zalophus californianus*

Conservation Status

COSEWIC (1999): Not at risk; Conservation Data Centre: BC Yellow list

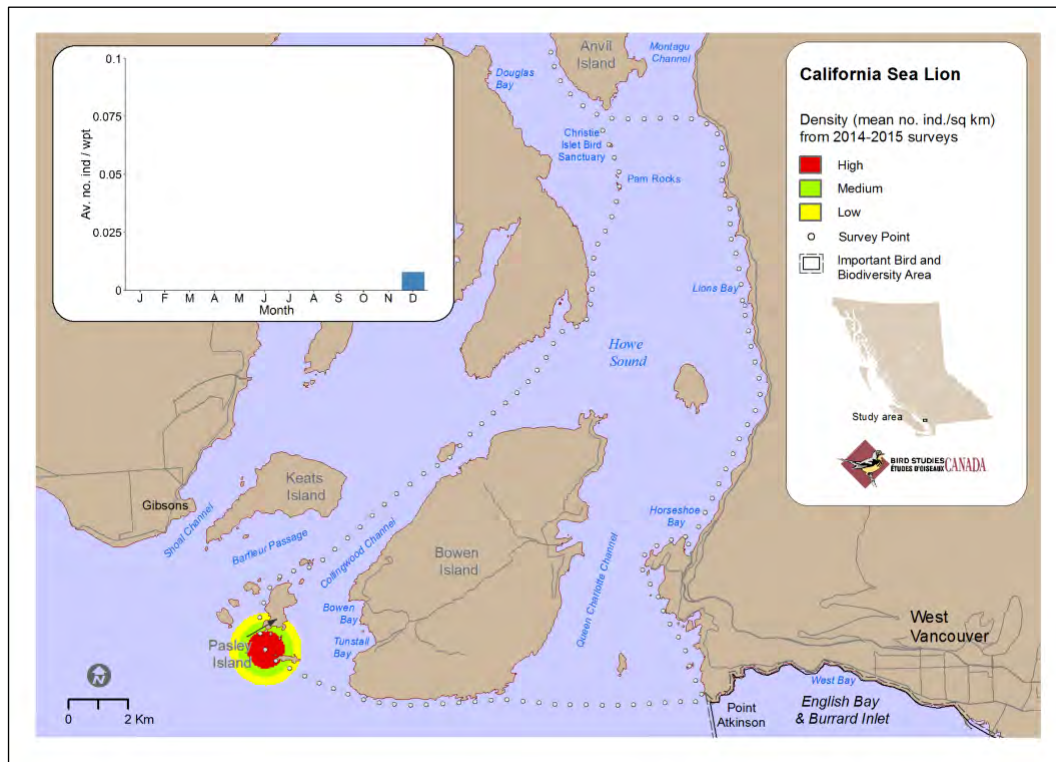


Fig. 46 Spatial distribution and seasonal abundance of California Sea Lion in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Small numbers of mostly sub adult male California sea lions visit the Salish Sea from autumn until spring before departing for California and Mexican breeding grounds (Trites 2014). From 2,000 to 10,000 sea lions visit BC each year (Trites 2014).

Survey Records

Our only record is of a male on rocks off the western end of Worlcombe Island.

Conservation Issues and Recommendations

No recommendations are proposed.

Harbour Seal *Phoca vitulina*

Conservation Status

COSEWIC (1999): Not at risk; Conservation Data Centre: BC Yellow list

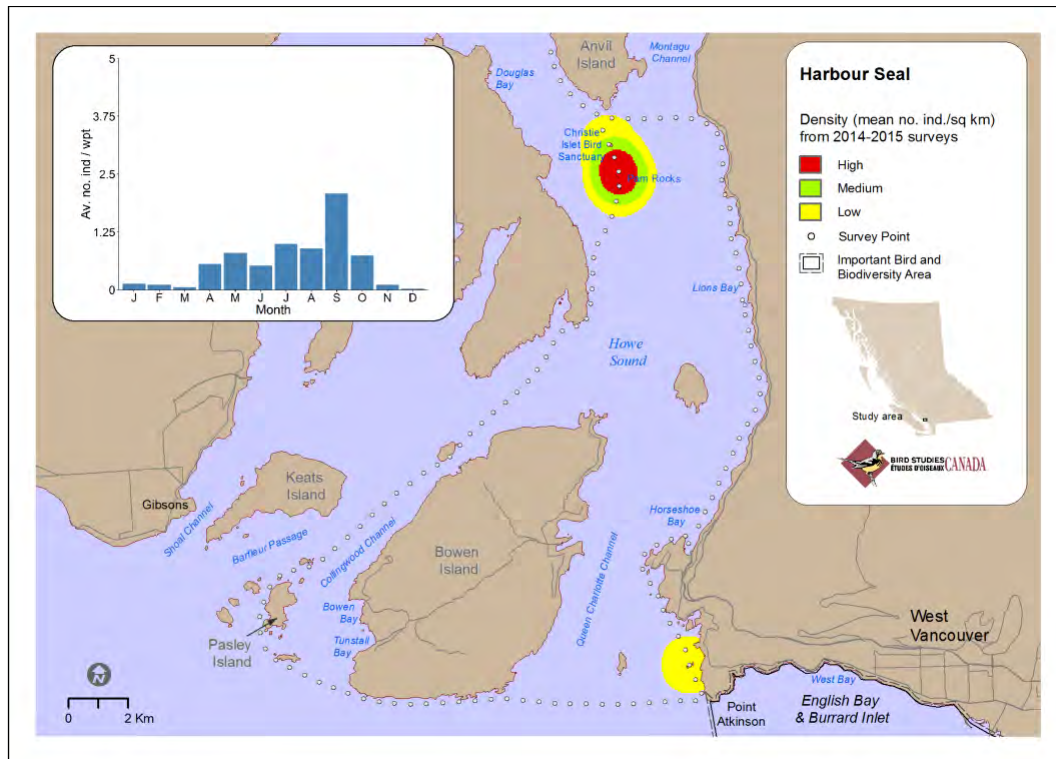


Fig. 47 Spatial distribution and seasonal abundance of Harbour Seal in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Harbour Seal is the most numerous marine mammal in the Salish Sea. Once hunted for their pelts and for bounty, the California-Oregon-Washington-British Columbian Harbour Seal increased significantly over the past 40 years, and the eastern North Pacific population was estimated to number 285,000 individuals (Cresswell et al. 2007). The Harbour Seal increased in the Strait of Georgia for many years (Olesiuk 1999).

The seal frequents coastal inshore waters and estuaries, rocky islands, sandy beaches and bays in the Salish Sea throughout the year. Seals eat fish and are eaten by transient Killer Whales. The majority of their diet consists of small reef or shallow dwelling fishes including rockfishes, greenlings, smelt, perch, and some herring and flatfishes. hake and salmonids.

Survey Records

The Harbour Seal is both abundant and a year-round resident of the Sound. Its numbers were higher from April to October, with a peak abundance falling in September. Highest density was at Christie Islet and Pam Rocks but lone seals were present throughout the Sound on the water or hauled out on beaches.

Conservation Issues and Recommendations

Seals require haul outs which could be provided in locations so that people can watch them. They are essential prey for transient Killer Whales that are highly prized by a thriving whale watching industry in and around the Sound.

Killer Whale *Orcinus orca* (Northeast Pacific Transient population)

Conservation Status

COSEWIC (2008): Threatened; SARA status: Schedule 1, Threatened;
Conservation Data Centre: BC Red list

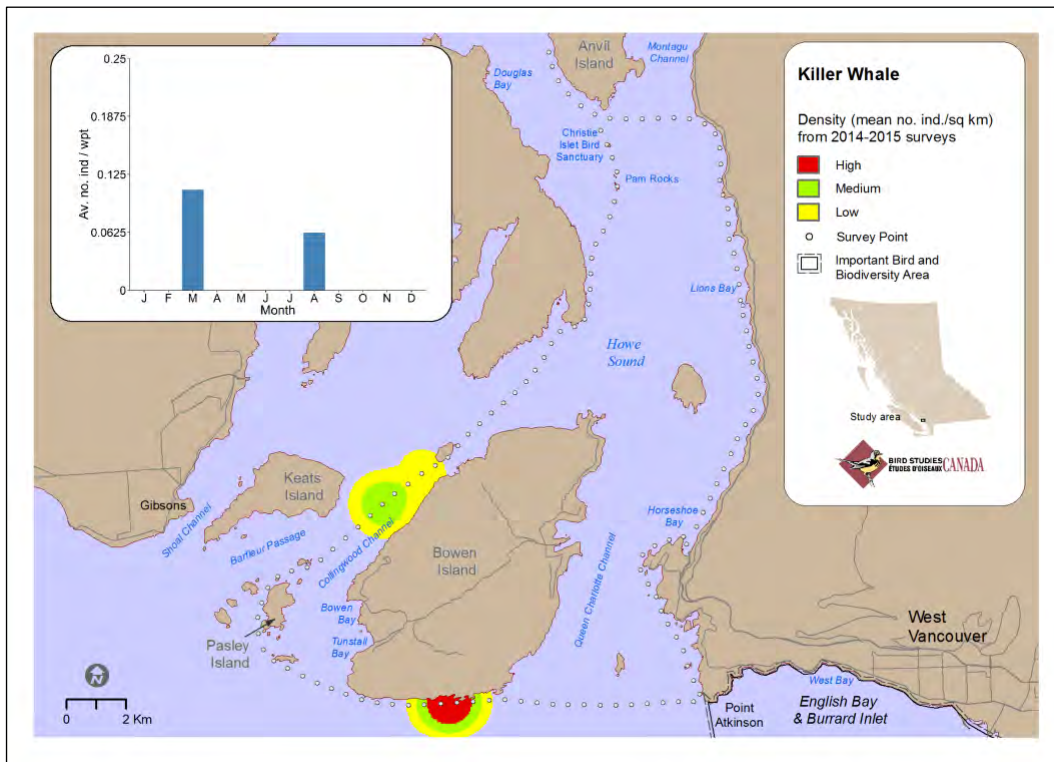


Fig. 48 Spatial distribution and seasonal abundance of Killer Whale in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The Northwest Pacific transient population of Killer Whales (a.k.a. Bigg's Killer Whales) was estimated to be about 521 individuals between 1990 and 2011. These whales specialize on marine mammals as prey that they hunt by stealth and often in small numbers. Bigg's Killer Whales regularly visit the Salish Sea on their travels along the coast. They were designated as Threatened by COSEWIC and the Species at Risk Act because of the small number of individuals, low reproductive rate and high chemical contamination.

Survey Records

We saw what we considered were 'transient' Killer Whales on surveys on along northern and southern shore of Bowen Island (Fig. 49). We assumed these were transient Killer Whales based upon their pointed dorsal fins and large saddle patches, small number (3 whales), and long dive times (Ford *et al.* 2000). There were reports of transient Killer Whales on 22 June 2015 off Snug Cove.



Fig. 49. Killer whales seen along the southern shore of Bowen Island during surveys.

Conservation Issues and Recommendations

A thriving whale watching industry in and around the Sound highly prizes being able to see Killer Whales. Assuring that a healthy population of their prey, in particular seals, is essential to continued presence of these whales in Howe Sound. The small population size, low reproductive rate and chemical contamination could conspire against the Killer Whales. Additional potential threats are disturbance, acoustic noise from ships and boats, toxic chemicals in the food chain and prey availability.

American Mink *Neovison vison*

Conservation Data

Centre: Yellow List

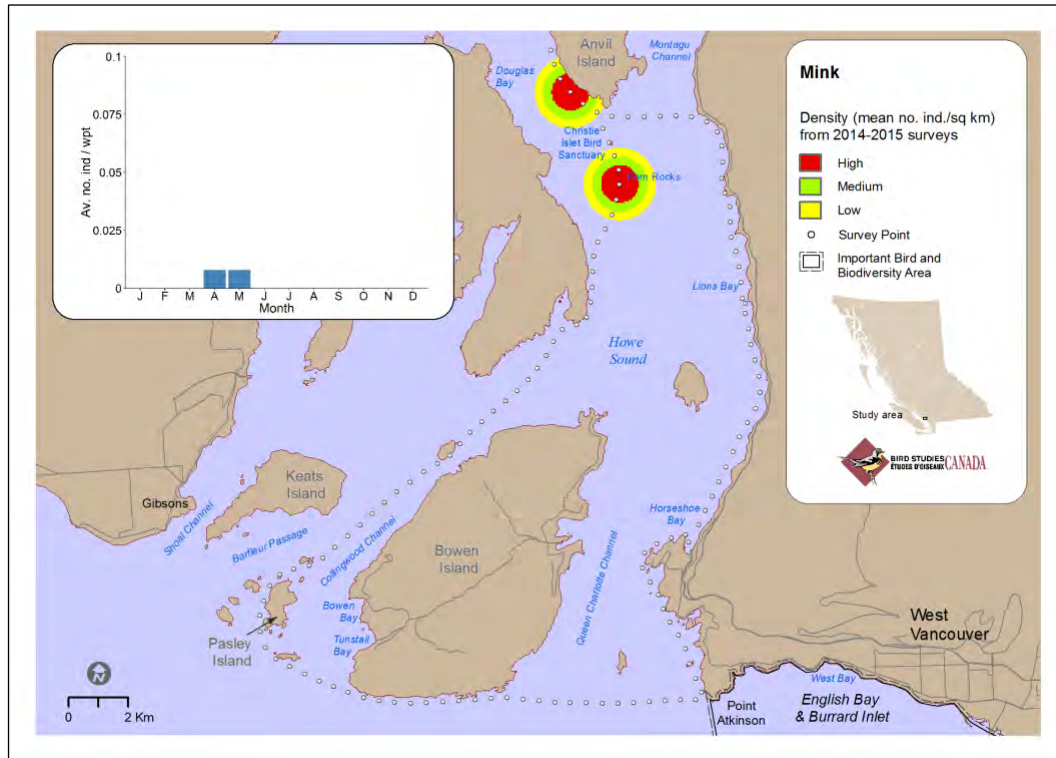


Fig. 50 Spatial distribution and seasonal abundance of American Mink in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

The American Mink is a secretive animal that frequents the shore along the coast of the Salish Sea. Individuals are seen regularly on the shore of the Salish Sea. In Howe Sound, mink are seen regularly on the shore of Bowen Island (PB) and presumably on other islands.

Survey Records

Despite our boat surveys being too far away in most places to see mink near shore, we saw an individual mink in April and May near Anvil Island and Christie Islet.

Conservation Issues and Recommendations

No recommendations are proposed.

North American River Otter *Lontra canadensis*

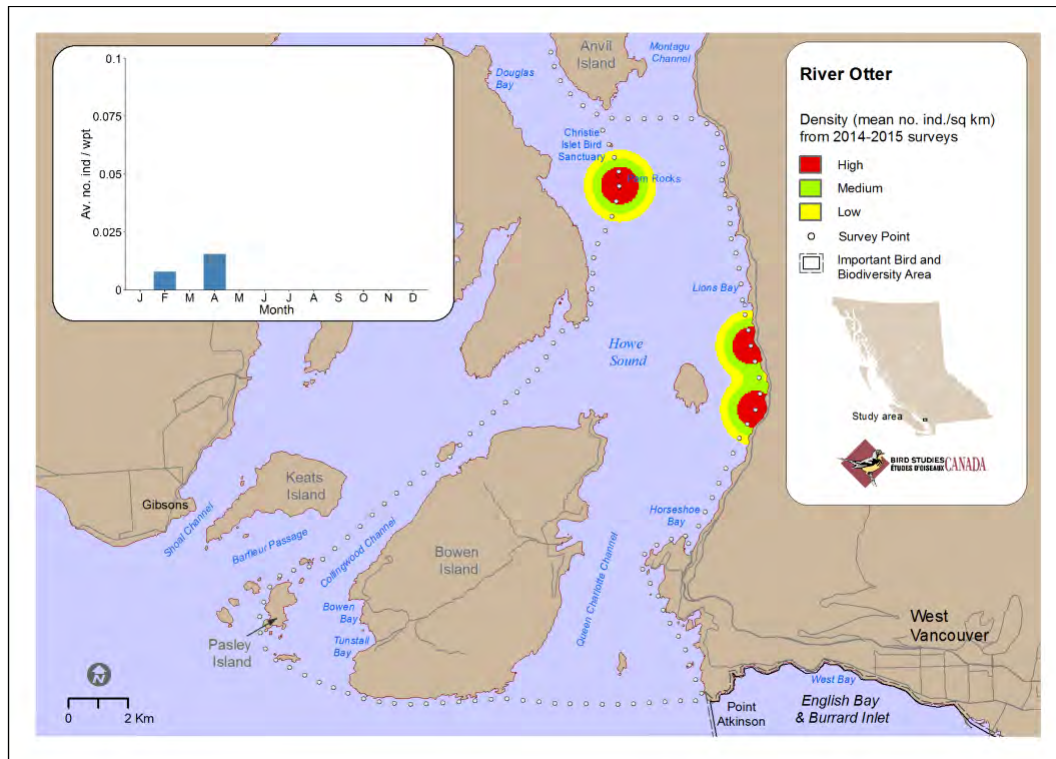


Fig. 51 Spatial distribution and seasonal abundance of Northern River Otter in Howe Sound June 2014-May 2015 and September 2015

Ecology and Regional Trends, Salish Sea Status

Northern River Otters are widespread along the shores of the Salish Sea where they are largely fish eaters (Stenson et al. 1984). In Howe Sound, a den has been in use for at least 16 years in Bowen Bay and otters are often seen among the islands.

Survey Records

We have a few records of otters in February and April from Pam Rock and Christie Islet and along the eastern shore of the Sound. The species is likely far more widely distributed than our records show.

Conservation Issues and Recommendations

No recommendations are proposed.