Status and Distribution of Marine Birds and Mammals in the Southern Gulf Islands, British Columbia.

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The data from this survey are publicly available for download at www.naturecounts.ca

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Executive Summary

The marine waters of the southern Gulf Islands support 22 species that are either federally designated as Endangered, Threatened, or Special Concern, provincially Red- or Blue-listed or considered high priority by the Conservation Framework of the government of British Columbia. The Gulf Islands National Park Reserve encompasses stretches of the southern Gulf Islands coastline used by some of these species. In addition, the proposed National Marine Conservation Area, if approved, will increase the jurisdictional area of Parks Canada to include marine waters. Parks Canada agency has a legal responsibility to manage these species, particularly federal Species at Risk.

Historically, high concentrations of some species used the southern Gulf Islands rocky shorelines, islets and sandy-bottomed tidal passages, leading to the designation of globally Important Bird Areas around Sidney Channel and in Active Pass. A thriving whale watching industry centered in Victoria depends largely on the presence of southern resident ecotype Killer Whales that use the area daily through the summer months.

A systematic year-round survey of all marine birds and mammals in the waters in the Southern Gulf islands has not been made. The purpose of this study was to conduct such a study through one annual cycle, with a particular focus on federal Species at Risk, and to compare the results with existing information on the distribution, abundance and conservation of marine birds and mammals in the southern Gulf Islands and the wider surrounding region.

Two observers conducted 14 transect counts of all birds and mammals along an 85 nautical mile route defined by approximately 500 waypoints at 250 m intervals, between 22 October 2008 and 23 September 2009. The route included a variety of water depths, open and enclosed channels, and areas of different tidal activity to represent the range of marine bird and mammal habitats. Kernel and cluster GIS analytical techniques were used to determine important areas along our survey route for each species and guild of interest. Key findings with respect to Species at Risk include:

- Boundary Pass and Haro Strait are key areas for marine mammal Species at Risk, particularly Harbour Porpoise (Special Concern), and the southern resident and western transient Killer Whale populations (both Endangered), which traversed the area almost daily in summer, and occur more sporadically year-round.
- The Belle Chain Islets is a regular non-breeding season haul-out for at least 112 Globally Endangered Steller Sea Lions between October and May.
- Marbled Murrelet (Threatened) underwent a significant decline in the southern Gulf Islands in recent decades, but a remnant population still uses the area year-round. It was most numerous in winter, where the Coal-Kerr-Dock-Little Island group and adjacent Prevost Passage provided key habitat; other important areas include the Strait of Georgia north and east of Tumbo Island, Sidney Channel, southern Haro Strait and the waters around the D'Arcy Island group. Historically, it may have been more widespread.
- Many hundreds of Ancient Murrelets (Special Concern) use the waters of Haro Strait (especially around Mandarte Island), Boundary Pass and adjacent Prevost Passage in late fall-early winter.

The sandy-bottomed Sidney Channel and strong tidal flow of Active Pass are important areas for forage-fish specialists, a guild experiencing widespread changes including some steep regional declines. Broadly comparing our results to a similar boat-based transect study conducted three decades ago suggest that order-of-magnitude changes have occurred in populations using the Southern Gulf Islands, including reductions in Western Grebe, Brandt's Cormorant, Pacific Loon, Surf Scoter and some other diving ducks, and increases in Pigeon Guillemot, Mew and Bonaparte's Gulls.

The many small offshore islets support important local populations of a guild of rocky shoreline specialists endemic to the north Pacific, including Black Oystercatcher, Black Turnstone, and Surfbird. Both narrow and wider tidal passages support many thousands of gulls year-round. The tidal rips around Boiling Reef off Saturna's East Point, and in Active Pass, concentrate foraging Mew Gull flocks throughout the winter, and Bonaparte's Gull flocks during spring and fall migrations respectively. Mandarte Island continues to support the region's largest breeding colonies of Glaucous-winged Gull, Pelagic and Double-crested Cormorant.

Several studies of marine birds and mammals have been conducted in the Southern Gulf Islands and surrounding area, most as part of wider geographic initiatives, and all during the past forty years. These datasets vary greatly in format, degree of digitization and geo-referencing, and few have been published at any level. However, combining as many as possible in a standard spatial and digital format will establish historical baselines from which to set population objectives.

Tracking the recovery of SARA-COSEWIC and other priority species will require a long-term monitoring program that covers the key tidal channels, open passages, rocky shorelines and offshore islets used by these species. Generating credible trend information requires a long-term commitment of resources. Boat-based transect surveys are required to monitor marine mammals and more pelagic bird species like Marbled and Ancient Murrelets. A combined approach building on existing shoreline-based monitoring like the BC Coastal Waterbird Survey is the most cost-effective option. Collaboration with the marine user community to investigate ways of capturing marine mammal sightings and related effort data may be the most cost-effective option for monitoring this guild.

Given the apparent changes in forage fish specialists within the Southern Gulf Islands and wider surrounding region, the establishment of a National Marine Conservation Area with a focus on the restoration of fish fauna as a priority should be considered. This will give Parks Canada greater jurisdictional control over marine resources and increase opportunities to recover populations of some species and prevent other species from becoming at risk.

Many marine bird and mammal species of conservation concern in the GINPR occur there as seasonal visitors. Natural and anthropogenic drivers of their population trends are region-wide, requiring broad action and collaboration with other agencies. Key linkages to be made are with: Fisheries and Oceans Canada, to better understand regional trends in forage and predator fish populations, and linkages between these and marine birds and mammals; NGOs and academic groups conducting monitoring and science-based research, including the University of British Columbia, Bird Studies Canada, and the BC Cetacean Sightings and Orca Networks; and Recovery Teams for SARA-listed Species at Risk.

1. Introduction

1.1 Background and Context

The waters of the southern Gulf Islands have historically held large numbers of non-breeding marine birds and mammals (Edwards 1965, Vermeer 1977, Vermeer et al. 1983, 1987, Important Bird Areas 2004). A substantial number of breeding birds also nest there (Vermeer and Butler 1989, Butler and Golumbia 2008). Aerial surveys by Vermeer et al. (1983) reported a respective density of 63.5 birds/km and 216.2 birds/km in January/February and March 1978 in the Gulf Islands. The regional waters of the Strait of Georgia, Puget Sound and Juan de Fuca Strait known colloquially as the 'Salish Sea' has globally and nationally important bird populations (Butler and Vermeer 1989, Butler 2009), including two Important Bird Areas within the Southern Gulf Islands (www.ibacanada.com).

A thriving whale watching industry centered in Victoria depends largely on the presence of Killer Whales in the region, with the return of Humpbacks providing an increasingly important secondary focus. Distribution in summer is well described, but less so at other times of the year (Hauser 2006). The 'southern resident ecotype' Killer Whale births in the region, and the 'transient ecotype' occurs year-round. Humpback Whale, Gray Whale and Minke Whales use the region for foraging and Dall's and Harbour Porpoises reside year-round and likely birth in the region (Hall 1996). Small numbers of non-breeding Steller and California Sea Lions are present outside of summer. Thousands of Harbour Seals birth and reside in the Gulf Islands. Recently, Elephant Seals gave birth in the region. Gray Whales in the region are genetically distinct from other eastern Pacific Gray Whales (Jim Darling, pers. comm.).

The region holds 22 bird and mammal species (Table 1) that are a) federally Endangered, Threatened and Special Concern; b) Red- or Blue-Listed by the provincial government; or c) assessed as priority level 1-3 (of 6) within the BC Ministry of Environment's Conservation Framework (Bunnell et al. 2009, BC Ministry of Environment 2009). The Conservation Framework is a science-based approach to assessing the conservation priority of all species and ecosystems within British Columbia, based on three goals: 1) contributing to global efforts for species and ecosystem conservation; 2) preventing species and ecosystems from becoming at risk; and 3) maintaining the diversity of native species and ecosystems.

The Gulf Island region's wildlife is potentially threatened directly by disturbance, underwater acoustics and chronic oil spills from increased shipping to and from ports in Vancouver and Washington, and indirectly through a variety of ecological changes (Brown and Gaydos 2007). For example, in the past three decades the region has experienced major changes in the distributions of some seabirds, and increases of eagles and seals (Butler 2009b; Olesiuk 1999).

The Gulf Islands National Park Reserve (GINPR) has a legal responsibility to manage these species, particularly federal Species at Risk in marine waters within their jurisdiction. Moreover, Parks Canada will be expected to be a stronger voice in their conservation if the National Marine Conservation Area proposal for the southern Gulf Islands is implemented. Marine birds and mammals are known to gather in tidally active areas of the Gulf Islands to feed on plankton and fish brought to the surface by currents (Vermeer et al. 1987).

The purpose of this report is to present results of a year-round census from 2008-09, with a special focus on Species at Risk, and compare with historical information on the distribution and abundance of marine birds and mammals in the southern Gulf Islands.

Table 1. Marine bird & mammal species of conservation priority in the Southern Gulf Islands

Scientific Name	Common Name	COSEWIC Status[1]	BC CDC Status[2]	BC Conservation Framework Priority[3]		
				Global Significance	Preventative Action	Maintain Diversity
Orcinus orca pop. 5	Killer Whale - Northeast Pacific Southern Resident Population	E	Red			*
Orcinus orca pop. 3	Killer Whale - West Coast Transient Population	T	Red	*		*
Megaptera novaeangliae	Humpback Whale	T	Blue		*	*
Brachyramphus marmoratus	Marbled Murrelet	T	Red	*		*
Eschrichtius robustus	Grey Whale	SC	Blue			
Phocoena phocoena	Harbour Porpoise	SC	Blue			
Eumetopias jubatus	Steller Sea Lion	SC	Blue	*		*
Synthliboramphus antiquus	Ancient Murrelet	SC	Blue	*		*
Podiceps auritus	Horned Grebe	SC	Yellow			
Ardea herodias fannini	Great Blue Heron *fannini* ssp.	SC	Blue		*	*
Aechmophorus occidentalis	Western Grebe		Red			*
Phalacrocorax penicillatus	Brandt's Cormorant		Red			*
Phalacrocorax pelagicus pelagicus	Pelagic Cormorant, *pelagicus* ssp.		Red			*
Uria aalge	Common Murre		Red			*
Ptychoramphus aleuticus	Cassin's Auklet		Blue	*		*
Phalacrocorax auritus	Double-crested Cormorant		Blue		*	*
Melanitta perspicillata	Surf Scoter		Blue			
Larus californicus	California Gull		Blue			
Clangula hyemalis	Long-tailed Duck		Unknown			*
Bucephala islandica	Barrow's Goldeneye		Yellow		*	*
Histrionicus histrionicus	Harlequin Duck		Yellow		*	*
Cepphus columba	Pigeon Guillemot		Yellow		*	
Hydroprogne caspia	Caspian Tern		Blue		*	*
Bucephala clangula	Common Goldeneye		Yellow		*	

[1] Committee on Species of Endangered Wildlife in Canada listing (www.cosewic.gc.ca): E =Endangered; T = Threatened; SC = Special Concern

[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] BC Conservation Framework assessment (www.env.gov.bc.ca/conservationframework/): all asterisked species are ranked priority 1-3 (on a scale of 1-6) for the indicated three goals of the Conservation Framework.

1.2 Previous Studies

Marine birds have been censused through a variety of formal and informal surveys in some areas of the Gulf Islands:

- Birds using Active Pass were tallied over two winter periods by Edwards (1965) and Vermeer (1977);
- Vermeer et al. (1983) produced a macro-scale atlas of marine birds for BC that included the Gulf Islands, based on aerial and boat-based transects;
- Finley et al. (unpublished data) conducted mid-winter transects (250m either side of the survey vessel) from 1993-1998, along a circular route connecting Shoal Harbour, Coal Island, Sidney Spit and the northern tip of James Island;
- Clowater (unpublished data) conducted transect surveys from Tsehum Harbour to Mandarte Island via Sidney Spit and Miners Channel from May 1992 – May 1993 and July 1994 – October 1995; surveys were conducted every week during much of these two periods; geo-referenced data are housed with the Canadian Wildlife Service;
- Morgan (unpublished Canadian Wildlife Service data) conducted bird surveys from the BC Ferries Tsawwassen-Swartz Bay route from August 1994 – September 1995;
- The Coastal Waterbird Survey (Badzinski et al. 2008), operated by Bird Studies Canada since 1999, monitors ~30 survey sites (0.5-3km in length) along the Saanich Peninsula, Mayne, Pender and south-east Saltspring Island coastlines. Monthly (September-April) shoreline-based transect and point count surveys are conducted over the high tide period. The data are combined with sites from around the Strait of Georgia to assess long-term trends, and investigate patterns of bird distribution and abundance;
- Christmas Bird Counts have been conducted in four count circles encompassing the Southern Gulf Islands: Anacortes – Sidney (1971-85; 1993-present); Sidney – South Saltspring (2005-present); Pender and Mayne Islands (1964-present); Galiano – North Saltspring (2005-present).
- RW Butler kept a bird log of sightings around Sidney Island during his research of Great Blue Herons on Sidney Island from 1986 to 2001;
- The BC Cetacean Sightings Network, a collaborative program of the Vancouver Aquarium and Fisheries and Oceans Canada, has maintained a database of sightings of whale and dolphin sightings from the BC coast since 1999;
- The online reporting website Orca Network has archived records of marine mammal sightings from the Southern Gulf Islands and Puget Sound region for over a decade, but are not consistently geo-referenced;
- An ongoing, long-term University of British Columbia research project focused on breeding birds on Mandarte Island has generated more than 30 years of data on breeding birds and related ecological parameters on and around the island, and has also collected data on Marbled Murrelets and other marine birds from boat trips between the island and the mainland (P. Arcese pers. comm.).

These datasets are in disparate forms, and vary in their format, degree of digitization, geo-referencing and level of publication.

2. Study Area and Methods

2.1 Study Area

The Southern Gulf Islands study area, including the Gulf Islands National Park Reserve, and many place names mentioned in the text of this report, is illustrated in Fig. 1 (below).

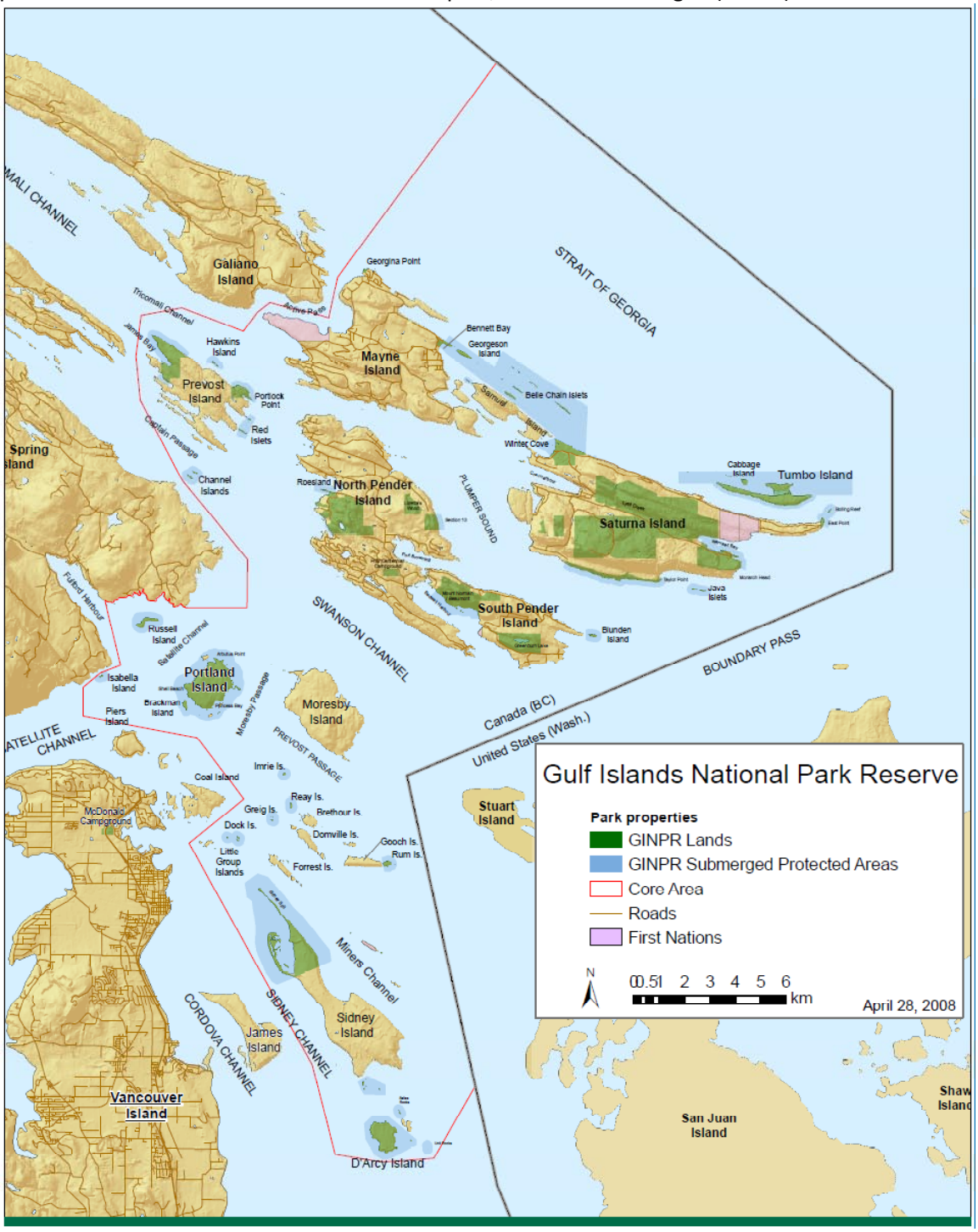

Fig.1 Southern Gulf Islands study area (courtesy of Parks Canada)

2.2 Transect route

We counted all birds and mammals observed along a transect route traversing about 85 nautical miles of the Southern Gulf Islands waters, on 14 days between 22 October 2008 and 23 September 2009 (the route is depicted on each individual species Figure in Appendices 2 and 4). The transect was defined by approximately 500 waypoints at 250 m intervals, and the route chosen included a variety of water depths, open and enclosed channels, and areas of different tidal activity to represent the range of marine bird and mammal habitats in the Gulf Islands.

We traveled mostly at 10-12 knots in a 3.5 m inflatable boat on generally calm days with no precipitation. Two observers were stationed in the bow. Transect waypoints were pre-entered into a handheld GPS and laptop, and the boat skipper called out each waypoint number in sequence. One observer recorded all birds seen within 100 m of either side of the boat. The second observer recorded all birds seen beyond 100 m of the boat, and all marine mammals regardless of location. Detection distances for murrelets, auklets, gulls and cormorants declined rapidly >80 m from the transect line in a similar study conducted by Ronconi and Burger (2009). We did not correct for detection distance and the bias should be consistent for comparisons between waypoint locations and survey days. We counted all individuals and estimated the size of larger flocks/groups by tallying multiples of 10s or 100s of birds. All sightings were assigned to one of the ~500 waypoint locations.

Sea state can negatively affect the number of birds seen (Ronconi and Burger 2009). Most of our surveys were conducted in sea conditions of Beaufort Sea State (BSS) 2 or less: of approximately 73 survey-hours, ~27% was BSS0, ~33% was BSS1, ~27% was BSS2 (i.e. 87% of survey time was conducted in a sea state of 2 or less), ~12% BSS3 and ~1% BSS4. Surveys were generally called off during persistent sea states of 3 and above. In particular, the 11 December survey was impacted by persistent choppy sea states, and eventually aborted in deteriorating weather conditions. The surveys on 22 and 28 October established different sections of the survey route, so did not cover as many waypoints as future surveys.

Survey data were entered into an MS Access database housed with Bird Studies Canada. We mapped the distribution and abundance of birds and mammals using ArcGIS 9.3 (ESRI 2009). Densities of birds and mammals per km^2 within the 200m wide transect strip (100m either side of the survey vessel) were calculated for each survey date by summing the total number of individuals of each species recorded during a single survey day, and dividing that by the total area of surveyed water within 100m of the vessel.

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. Hauser (2006) applied kernel analysis to identify core areas for killer whales (*Orcinus orca*) in British Columbia. 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 spatial distribution pattern of each species of interest. A cell size of 50 metres (resolution) and a search radius of 1,000 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. This method was determined to be the most suitable for the dataset in question. To allow comparison among species, we labelled 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.

2.3.2 Clustering Analysis

Our interest was to determine the degree to which distributions of particular species groups of interest overlapped within the study area. For this reason was important to use a common measurement scale and weights that allowed 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 weights for every kernel raster dataset the selected species were overlapped and summed together. The next step was to organize the calculated raster data into groups. The method used in this case was "equal interval" 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.

NOTE: It is important to note that the maps in this report show the results of applying Kernel analysis within 1,000m of the waypoints along the survey transect route only; the analysis does not extrapolate beyond 1,000m 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 >1km away from the transect line. It would be erroneous to extrapolate distribution beyond 1km distance from the transect line using kernel analysis techniques.

2.4 Other Observations

Where possible, results from the surveys and datasets listed in 1.2 Previous Studies have been incorporated into the text in this report. The data are in disparate forms, and require a separate project to catalogue them into compatible spatial and temporal formats. In particular, we summarise relevant BC Coastal Waterbird Survey data (Badzinski et al. 2006, 2008, BSC unpublished data) from the study area (see Fig. 2 – BC Coastal Waterbird Survey polygons around the Southern Gulf Islands – note, the four Saltspring Island and many Saanich peninsula Coastal Waterbird Survey polygons are not depicted), and anecdotal reports from Rob Butler's CWS field station on Sidney Island and surrounding waters of Sidney Channel and Haro Strait during the years 1986-2000, operated mostly during the summer months (RWB unpubl.). We also include data on marine mammal sightings summarized from Orcanet (www.orcanet.com).

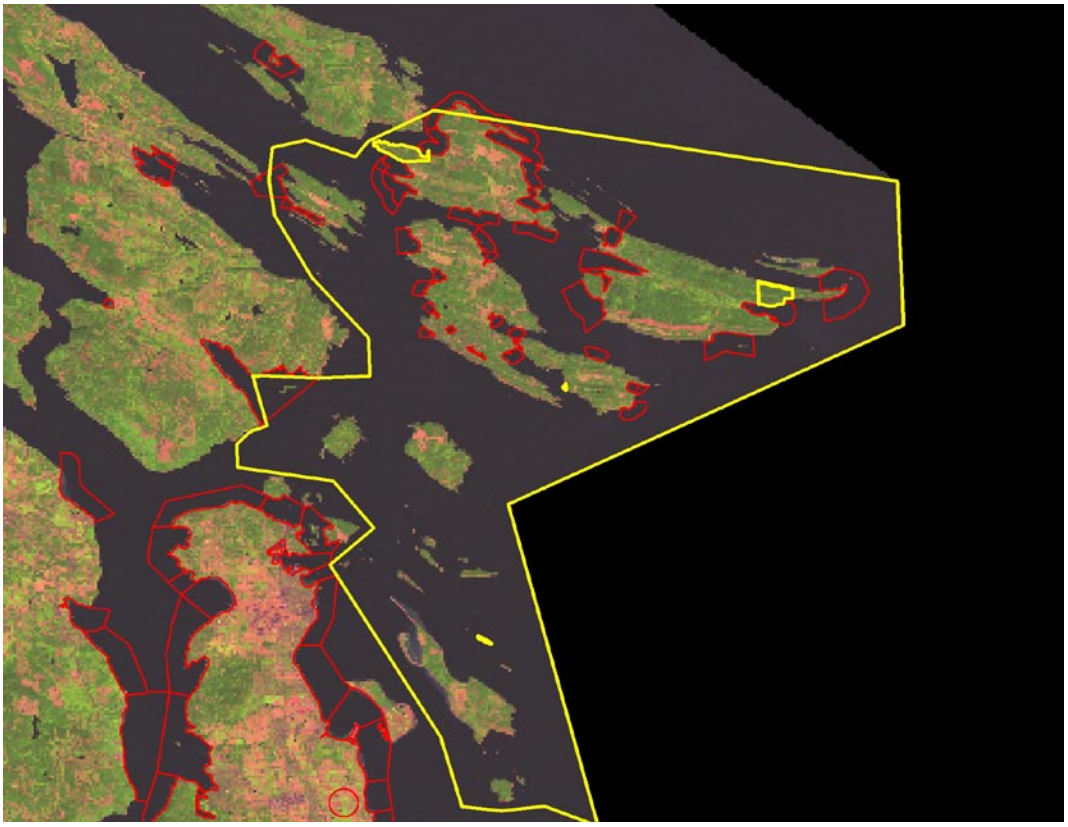

Fig. 2. BC Coastal Waterbird Survey polygons (in red) around the Southern Gulf Islands and Saanich Peninsula (surveyed at least once between September 1999 and December 2009); the Gulf Islands National Park Reserve boundary is shown in yellow.

2.5 Tidal Cycle Study

We estimated the effect of tidal flow on the numbers of birds in passages with different tidal flows: Active Pass (east & west) from Mayne Island, Navy Channel from Mayne Island, Swanson Channel from Pender Island and the Boundary Pass/Strait of Georgia confluence from East Point, Saturna. All species of birds were counted every 30 minutes through binoculars and telescope from fixed vantage points beginning at the top or bottom of a tidal cycle. Active Pass was selected as a site with strong tidal flows, and Navy and Swanson Channel was chosen for relatively weak tidal flows. The total number of birds seen was plotted every half hour in Excel.

Island	Survey Location	Date (2009)	Duration	Observer
Mayne	Georgina Point, Active Pass west	25 Feb	1210-1750 h	Michael Dunn
	Helen Point, Active Pass east	18 March	1215-1830 h	Michael Dunn
	Navy Channel east	20 March	1200-1815 h	Michael Dunn
	Navy Channel west	24 March	1135–1745 h	Michael Dunn
Pender	Swainson-Bridges Road	16 March	0800-1500 h	Gerry McKeating
	Brooks Point	17 March	0830-1600 h	Gerry McKeating
Saturna	East Point	15 February	0915-1515 h	Steve Dunsmuir
	East Point	13 March	1120-1720 h	Steve Dunsmuir

Table 2. Details of land-based point counts of marine birds and mammals made through the course of a complete tidal cycles in the Southern Gulf Islands, February – March 2009.

3. Results

3.1 Summary of Records

Fourteen surveys were conducted between 22 October 2008 and 23 September 2009, tallying approximately 4,815 records (waypoint-encounters) of 67,678 individuals of 63 marine bird and eight marine mammal species, summarized in Table 2. About 40% of all individuals were Bonaparte's and Mew Gulls; Glaucous-winged Gull was the third most abundant bird, comprising about 10% of records, followed by Pigeon Guillemot and Pelagic Cormorant at <5% of all records each. Harbour Seal was by far the most numerous marine mammal recorded, and fourth most numerous animal (comprising ~10% of all bird and mammal records). A detailed summary of records for all common species and species of conservation concern, together with relevant ecological, regional trend and conservation information, is presented in Appendices 2 & 4. Recommendations for further work, in particular for Species At Risk, are presented in the main body of the report and repeated in Appendices 2 & 4.

Our surveys captured most of the marine bird and mammal species that occur regularly in the Southern Gulf Islands region. Appendices 1 and 3 list the other marine/coastal species that regularly occur there.

3.2 Density Estimates for Selected Species

Species density estimates expressed as numbers of individuals per square kilometer of water surveyed are presented in Table 4. Only those more abundant species that regularly use open water habitats are included. Whilst our survey captured important rocky shoreline and offshore islet habitats, presenting densities for species using those habitats but not open water, would be mis-leading.

Two other studies that have presented boat-based, line transect-derived density estimates from the Southern Gulf Islands are Hall (2004), for Harbour Porpoise, and Vermeer et al (1983), for marine birds. Their methods differed from our survey, but nonetheless it is of interest to look at them in relation to our results.

Estimated densities of Harbour Porpoise from our surveys are very similar to those found to the south in the southern Haro Strait - Juan de Fuca confluence in 2002 by Hall (2004), and mirrored the distinct peak in abundance during the summer-early fall months that Hall (2004) noted. Highest densities noted during our summer surveys were 2.01km^{-2} compared to an average of 1.52km^{-2} recorded by Hall (2004); during winter, our maximum density of 0.45km^{-2} equated to the average winter density detected by Hall in Beaufort sea states of only 0 and 1. These results suggest that the seasonal abundance of Harbour Porpoise around the Southern Gulf Islands is very similar to that of the Juan de Fuca and southern Haro Strait.

Vermeer et al. (1983) conducted boat-based transects during March-April and November 1977, reporting on the Victoria to Neck Point (Nanaimo) area, a route that traversed our Southern Gulf Islands study area. They recorded densities an order of magnitude greater during spring than in autumn, for Surf and Black Scoters, Common and Barrow's Goldeneye, Bufflehead, scaup spp., Long-tailed Duck, and mergansers, with highest abundance shown by Surf Scoter and scaup

densities of >50km^{-2}. This seasonal difference is not apparent at all in our dataset, indicating a significant change over the ensuing three decades, likely related to changes in herring spawn events.

Vermeer et al. (1983) recorded Western Grebe densities of 87.5km^{-2} and 172.9km^{-2} in March-April and November respectively; our highest monthly estimate was ~0.4km^{-2}. This is the most dramatic difference in abundance between our study and Vermeer's for a single species. Conversely, the densities we estimated for Horned Grebe, recently recommended for listing under the Species at Risk Act by COSEWIC, are very similar to those found three decades ago by Vermeer et al. (1983).

Spring densities of Pacific Loon and fall densities of Brandt's Cormorant also differ by an order of magnitude between Vermeer et al (1983) and our study, suggesting large reductions in the densities of both species using the area. There are large differences in density estimates for gulls also, with an order of magnitude drop in spring Glaucous-winged Gull densities. In contrast, we found much higher densities during spring and fall than Vermeer did of both Mew and Bonaparte's Gulls.

Alcid densities recorded by Vermeer et al (1983) and our study suggest changes have also occurred with this group, including higher estimated densities of Pigeon Guillemot now compared to three decades ago, and a fall pulse in abundance of Ancient Murrelet noted during our study, a species for which no data were presented by Vermeer et al. (1983), suggesting too few or none were recorded.

3.3 General Findings for Species at Risk and conservation concern

The distribution of all SARA-COSEWIC listed marine bird and mammal species recorded on our surveys shows that the waters around Coal and Kerr Islands, and the Little and Dock Group, is primary habitat, used chiefly by large numbers of Marbled Murrelets, and groups of Harbour Porpoise (Fig. 2). Secondary and tertiary areas, also of high importance to federal SAR, include much of Sidney Channel, Haro Strait, Boundary Pass and Prevost Passage. Significant numbers of Marbled Murrelets, especially during fall-winter-early spring, large concentrations of Ancient Murrelet during fall-early winter, and Harbour Porpoise (year round) occurred there. The Belle Chain Islets are another important area, in particular as a haul-out for the Globally Endangered Steller Sea Lion outside its breeding season (Fig. 2).

Marine mammal SAR show a similar cluster distribution pattern to marine birds (combining all federally and provincially listed species, Figs. 3 & 4), but with some important differences. The primary and major secondary areas for marine mammal SAR are in Boundary Pass, where Harbour Porpoise is particularly numerous, and groups of Killer Whales were encountered. Secondary and tertiary areas of importance for marine mammal SAR included the Belle Chain Islets, and several parts of Haro Strait and Prevost Passage to the Kerr-Dock-Little Island group. There is considerable overlap with marine bird SAR, which have primary areas in Sidney Channel, Haro Strait and Prevost Passage, and secondary and tertiary areas in Active Pass, Captain Passage and Swanson Channel.

The forage fish specialists - Marbled Murrelet, Rhinoceros Auklet, Common Murre, Brandt's and Pelagic Cormorants, Pacific Loon, and Western Grebe – is a guild within which many species are

showing strong long-term regional or local declines (e.g. Bower 2009, Anderson et al. 2009, Christmas Bird Count unpublished data). They concentrated in Active Pass, Prevost Passage, Sidney Channel and Haro Strait (Fig. 5).

Our maps show the general distribution of these animals along our transect route but we know that several used much larger areas than the coloured areas indicated in Figs. 2-4. The kerneling technique does not extrapolate beyond 1km from the transect line. However, one apparent generality is that the sheltered waters within the Gulf Islands appear less important than the open passages. Sidney Channel and Haro Strait might have higher biological productivity because they receive the cold ocean water flushing in from the Pacific before it floods through the islands.

a)

b)

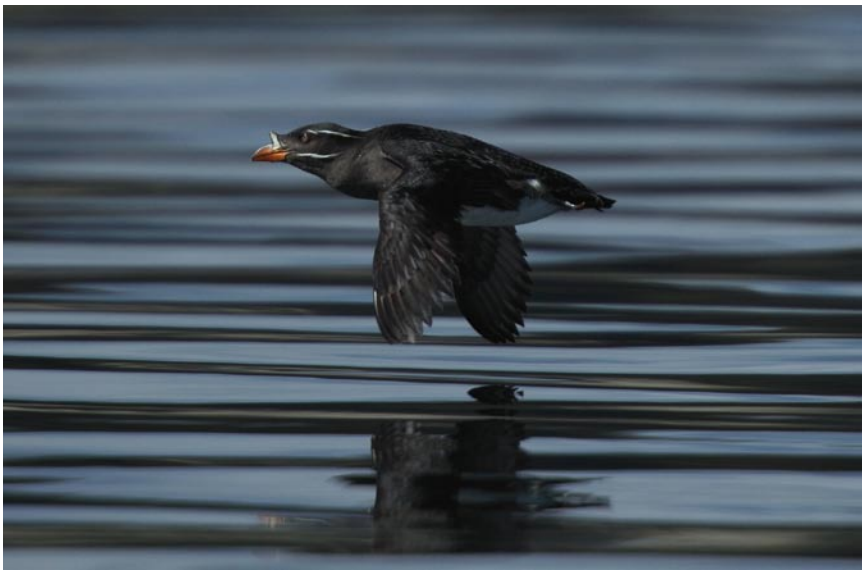

Fig.3 Forage fish specialists: a) Marbled Murrelet (in breeding plumage) off the D'Arcy Island group and b) Rhinoceros Auklet (also in breeding plumage) off Mandarte Island, April 2009 (Tom Middleton, Pacific Wildlife Foundation).

Table 3. Total numbers of marine birds and mammals counted during 14 line transect surveys (within and outside 100m strip either side of survey vessel) in the Southern Gulf Islands, British Columbia, 2008-09.

Species	Survey Dates and Times (mins)														Annual Total
	2008				2009										
	22-Oct	28-Oct	15-Nov	11-Dec	15-Jan	4-Feb	27-Feb	25-Mar	23-Apr	25-May	22-Jun	29-Jul	20-Aug	23-Sep	
	(205)	(199)	(333)	(127)	(376)	(361)	(351)	(254)	(284)	(322)	(328)	(334)	(363)	(301)	(4138)
Red-throated Loon							3								3
Pacific Loon	56	61	11	1	11	74	241	5	42		1			7	510
Common Loon	2			5	5	4	4		2						22
unidentified loon									34				1		35
Red-necked Grebe		1	2		1										4
Horned Grebe	7	2	2	3	2	3	3								22
Eared Grebe						40	32								72
Western Grebe		4	1			403	161								569
Clark's Grebe							1								1
Double-crested Cormorant	3	19	20	27	31	25	25	37	98	152	74	113	93	428	1145
Brandt's Cormorant	77	5	230	77	26	35	250	338	60	20		14	17	322	1471
Pelagic Cormorant	36	40	37	173	80	301	99	107	243	509	418	312	178	565	3098
unidentified cormorant	16	6	128		86		205	29	94		225		10	507	1306
Great Blue Heron		1		1		1	1	1	2	3	3	3	7	8	31
Greater White-fronted Goose					1		1		93						95
Brant				2		35	2	1	200	11					251
Canada Goose	1		59		12	139	22	11	31	10	45	12		7	349
Mute Swan			2			2		2						2	8
American Wigeon						15	42	15							72
Mallard				3		9		3							15
Northern Pintail				6											6
Green-winged Teal	34														34
Greater Scaup						12	5								17
Harlequin Duck	1	7	12	17	30	35	50	19	36	2		18	6	17	250
Surf Scoter	264	1	37	117	76	76	40	34	494				5	2	1146
White-winged Scoter		11	6					2				1			20
Black Scoter					2	3									5
unidentified scoter	6														6
Long-tailed Duck		1	1	22	17	2	39	20	9						111
Bufflehead			10	17	27	55	32	26	54		1				222
Common Goldeneye						4	42								46
Barrow's Goldeneye					120	320	3								443
Hooded Merganser				2	3	4	9	4							22
Common Merganser					17	65	5	5							92
Red-breasted Merganser			41	7	43	49	61	34	39						274
unidentified duck				150	212								25		387
Bald Eagle	4	3	12	2	24	21	21	9	23	20	19	4	9		171
Turkey Vulture												1	5		6
Black-bellied Plover					2	20									22
Black Oystercatcher	10		14	11	11	24	6	3	11	8	2	57	52	26	235
Wandering Tattler	1														1
Surfbird			350		5	27	16		3			3		64	468
Black Turnstone			46	10	27	87		4	2			36		27	239
Sanderling					17	28			40						85
Dunlin			6		80	64									150
Long-billed Dowitcher			1												1
Red-necked Phalarope													8		8
Parasitic Jaeger	1													1	2
Bonaparte's Gull	3523	547	1348			26	10	90	8883					197	14624
Mew Gull	1983	109	3233	33	1388	469	3781	1140	719			1		59	12915
Ring-billed Gull												19		3	22
California Gull	1	126						1	3		11	164	780	106	1192
Glaucous-winged Gull	69	233	252	50	134	319	372	572	603	891	1325	1566	676	281	7343
Heerman's Gull	1		3									163	108	23	298
unidentified gull	305		25		124	279	30	285	670		10	132	83	460	2403
Caspian Tern												2			2
Common Murre	170	13	116	52	118	128	65	1	1	1	1	1	2	292	961
Pigeon Guillemot	184	34	385	88	194	200	262	112	169	157	198	239	134	1213	3569
Marbled Murrelet	18	16	86	8	42	53	17	1		2	2	28	15	57	345
Ancient Murrelet	8		659	55	27	11									760
Rhinoceros Auklet	3	3	14		14	27	33	19	264	332	476	398	31	33	1647
Cassiin's Auklet			10												10
Belted Kingfisher				1											1
Common Raven				2											2
Harbour Seal	415	215	174	26	125	192	457	342	806	785	1447	446	729	1038	7197
Steller Sea Lion	79	5	94	1	57	6	49	19	118	2					430
California Sea Lion									2		1			2	5
Common Minke Whale	1							1							2
Killer Whale										6		13			19
Dall's Porpoise	6	8	9		14	9			18		3			9	76
Harbour Porpoise	31	40	13	4		18	3	9	32	20	59	24	5	41	299
Northern River Otter			1											7	8
Total birds	6784	1243	7159	942	3009	3494	5991	2930	12922	2118	2811	3287	2245	4707	59642
Total mammals	532	268	291	31	196	225	509	371	976	813	1510	483	734	1097	8036
All Species	7316	1511	7450	973	3205	3719	6500	3301	13898	2931	4321	3770	2979	5804	67678

Table 4. Estimated density (individuals/km^2) of select marine birds and mammals within 100m of transect line surveys of the Southern Gulf Islands, British Columbia, 2008-09. Blank cells indicate no animals were recorded within 100m of the transect line during surveys

Species	Survey Dates and Area Covered by Transect Strip <100m from Survey Vessel (km ^{2})													
	2008				2009									
	22-Oct	28-Oct	15-Nov	11-Dec	15-Jan	4-Feb	27-Feb	25-Mar	23-Apr	25-May	22-Jun	29-Jul	20-Aug	23-Sep
	(14.45)	(14.25)	(25.15)	(8.8)	(25.15)	(25.15)	25.15	(25.15)	(24.5)	(25.15)	(25.15)	(25.15)	(25.15)	(25.15)
Pacific Loon	0.28	2.18			0.12	1.07	0.40		0.57					0.04
Common Loon	0.07			0.34		0.08								
Horned Grebe	0.35	0.14	0.08	0.23	0.08	0.08	0.04							
Western Grebe		0.07	0.04				0.04							
Double-crested Cormorant	0.42	0.21	0.36	0.23	0.83	0.20	0.12	1.24		0.08	0.04	0.24		0.60
Brandt's Cormorant	4.78	0.21	0.95	0.57	0.08	0.60	0.04	8.83	0.04			0.08		2.15
Pelagic Cormorant	0.69	0.35	0.64	4.43	2.58	6.56	1.67	2.53	1.59	1.55	0.36	1.31	0.91	2.07
Great Blue Heron						0.04	0.04				0.04	0.12		0.20
Canada Goose			0.36			1.63	0.28	0.40	0.33	0.12				0.28
Harlequin Duck	0.07			0.68	0.40	0.64	0.24	0.94	0.12					
Surf Scoter	17.02		0.76	2.05	1.71	1.27	0.20							0.04
White-winged Scoter		0.77												
Black Scoter					0.08									
Long-tailed Duck					0.08	0.08		0.60						
Bufflehead				0.80	0.80	1.91	0.87	0.89	0.08		0.04			
Common Goldeneye						0.08	0.64							
Barrow's Goldeneye					0.52	12.72	0.04							
Hooded Merganser				0.23	0.04	0.16	0.32	0.20						
Common Merganser					0.44	2.58	0.20	0.25						
Red-breasted Merganser			0.12	0.80	0.83	0.80	0.20	0.05	0.29					
Bald Eagle		0.07	0.16	0.11	0.52	0.04	0.12	0.20		0.16	0.08	0.04		
Black Oystercatcher						0.44				0.20		0.08		0.04
Bonaparte's Gull	45.54	5.19	23.18			0.24		0.99	60.49					
Mew Gull	6.51	2.67	18.81	1.70	8.67	4.97	18.89	23.82	6.33					0.36
California Gull		4.98						0.05	0.04			2.74	14.31	0.80
Glaucous-winged Gull	3.11	8.00	1.79	1.70	0.83	1.31	3.06	2.03	0.94	5.96	2.82	2.43	2.94	1.95
Heerman's Gull	0.07		0.12									0.24		0.52
Common Murre	5.67		1.31	5.11	2.07	2.31	0.48			0.04	0.04	0.04	0.08	3.02
Pigeon Guillemot	7.89	0.70	3.18	7.84	6.24	4.10	3.58	2.73	3.80	3.50	2.07	2.31	2.70	16.46
Marbled Murrelet	0.55	0.98	2.78	0.68	1.43	1.35	0.20	0.05		0.08		0.64	0.48	1.15
Ancient Murrelet	0.28		17.38	3.52	0.87	0.32								
Rhinoceros Auklet		0.07	0.44		0.56	0.52	0.52	0.45	4.16	5.05	4.45	2.35	0.68	0.24
Harbour Seal	9.48	4.84	1.75	0.45	0.64	1.35	1.31	1.44	3.18	2.74	1.11	0.99	1.67	3.70
Steller Sea Lion	0.14	0.35	0.04	0.11	0.04									
Dall's Porpoise		0.56	0.36		0.56	0.16					0.12			0.36
Harbour Porpoise	1.11	2.04	0.32	0.45		0.36	0.12	0.45	0.41	0.83	1.35	0.52		0.68

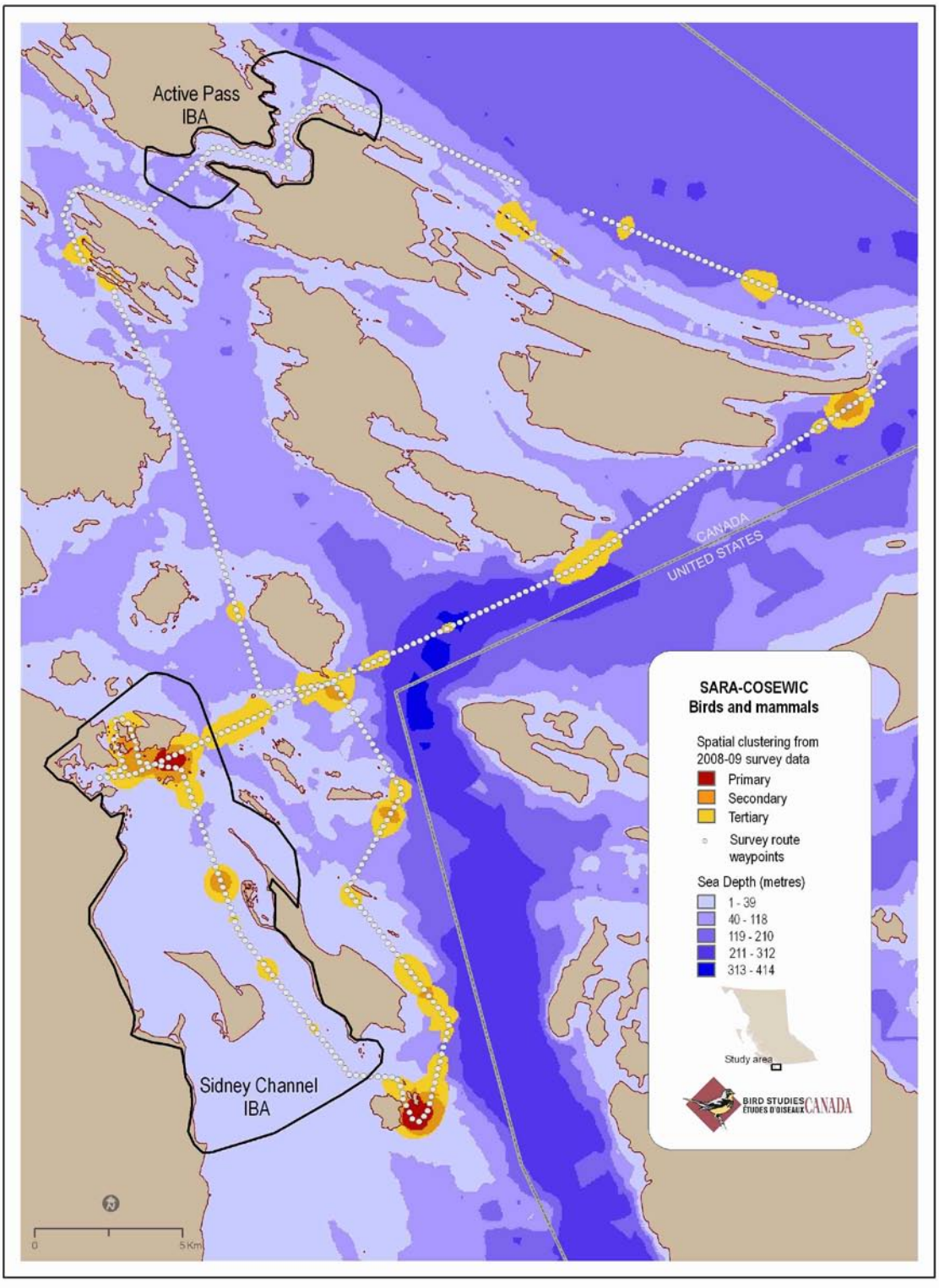

Fig. 4. Primary, secondary and tertiary areas for all federal Species At Risk along the transect route in the Southern Gulf Islands, based on spatial clustering analysis of all survey records of SARA-COSEWIC listed marine bird and mammal species.

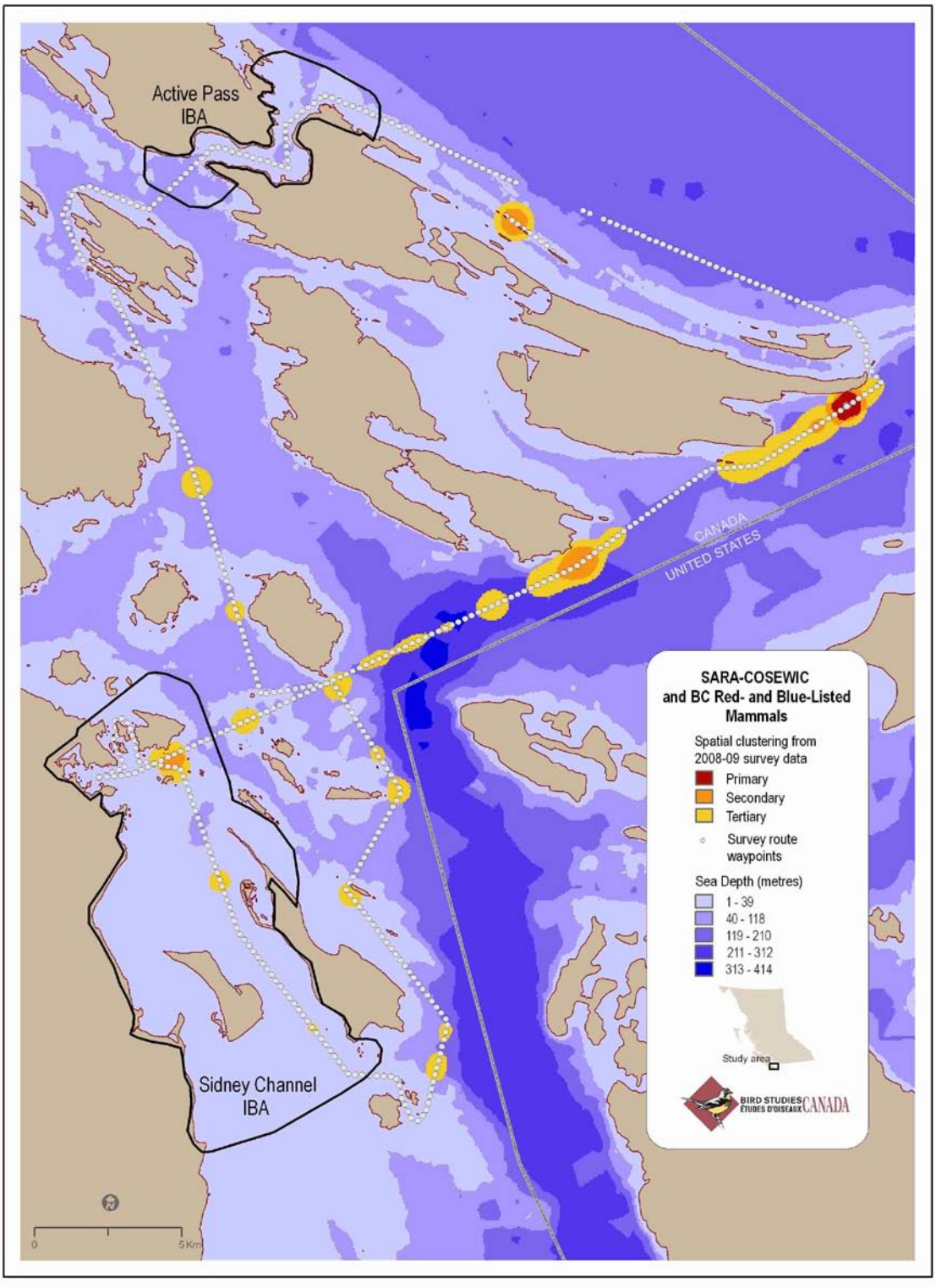

Fig. 5. Primary, secondary and tertiary areas for all federal and provincial marine mammal Species At Risk along the transect route in the Southern Gulf Islands, based on spatial clustering analysis of all survey records of SARA-COSEWIC BC Ministry of Environment Red- and Blue-listed marine mammal species.

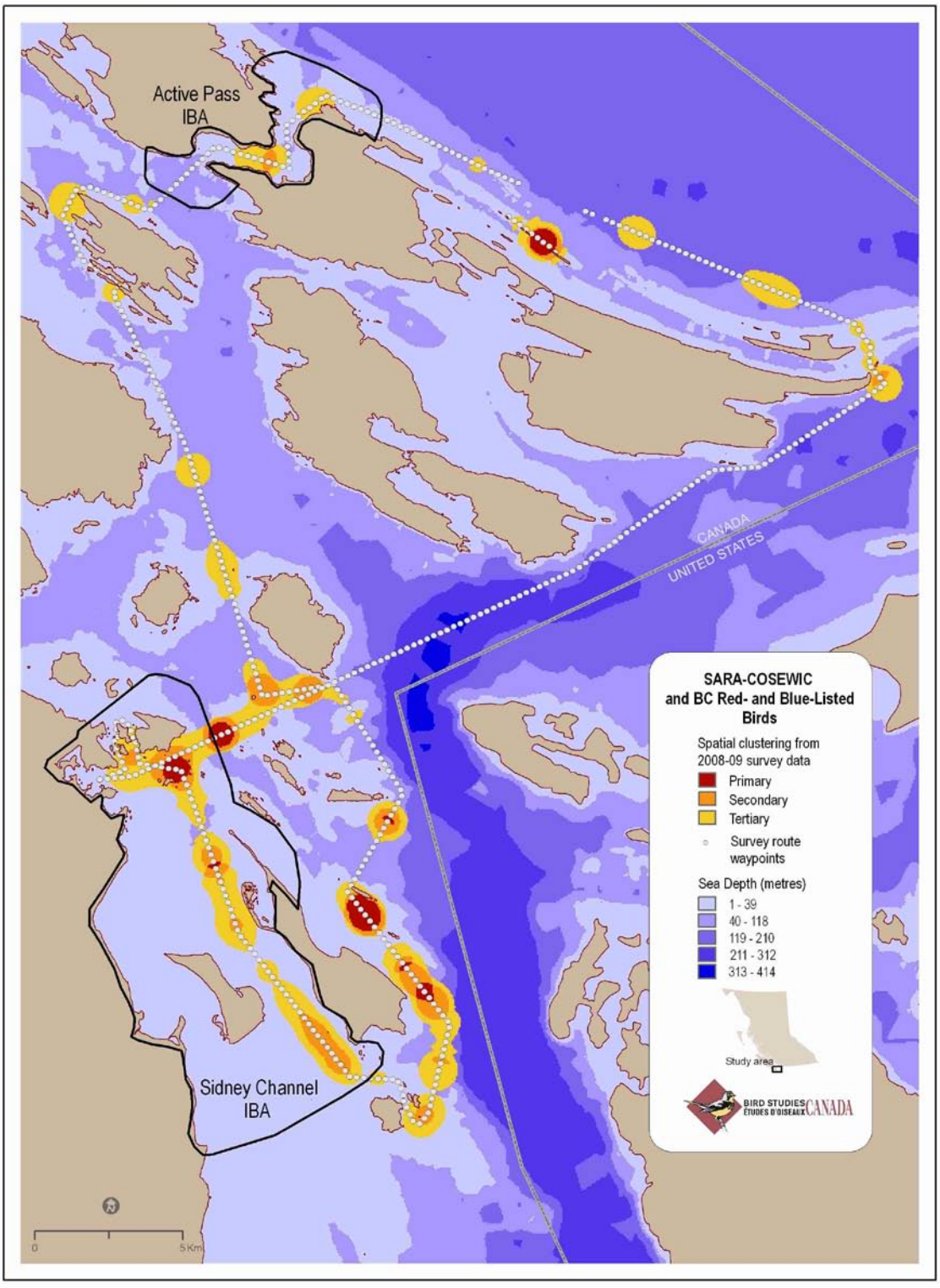

Fig. 6. Primary, secondary and tertiary areas for all federal and provincial marine bird Species At Risk along the transect route in the Southern Gulf Islands, based on spatial clustering analysis of all survey records of SARA-COSEWIC and BC Ministry of Environment Red- and Blue-listed marine bird species.

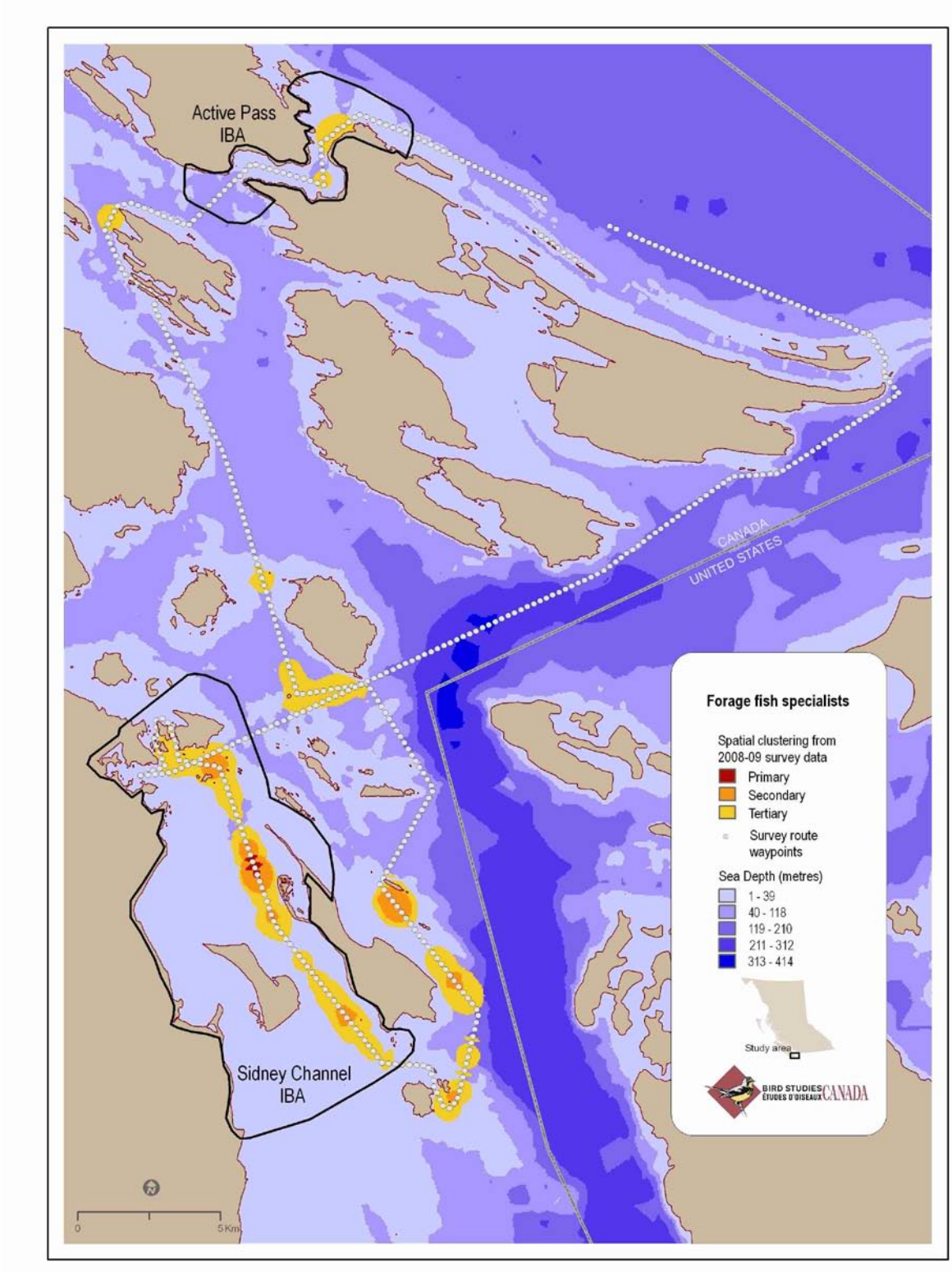

Fig. 7. Primary, secondary and tertiary areas for forage fish specialist marine birds along the transect route in the Southern Gulf Islands, based on spatial clustering analysis of all survey records of forage fish specialist marine bird species (Marbled Murrelet, Rhinoceros Auklet, Common Murre, Brandt's and Pelagic Cormorants, Pacific Loon, and Western Grebe).

3.4 Tidal Influence

The tide plays an important role in the daily movements of birds in the Gulf Islands. The number of all birds counted in Active Pass and Navy Channel was significantly affected by the tide cycle. The number of birds was greatest while the tide was ebbing especially in Active Pass (Fig. 6). In contrast, the greatest number of birds in Swanson Channel occurred during high tide and was smallest during the low tide. These differences likely reflect a movement in the Gulf Islands of some birds into the tidally active areas while the tide is running and dispersing to nearby waters at other times.

On Saturna Island, where proposies were often seen, we tallied the number present every half hour through two tidal cycles. On March 13 2009, no porpoises were seen on eight surveys during the flood tide and four surveys during the ebb tide, and 24 were seen on the slack tide. On 15 Feb 2009, when the first Saturna count was done, four Killer Whales were present for over 30 minutes, and no porpoises were there.

These results indicate that the numbers of some birds counted on a survey are influenced by the state of the tide and porpoises by the tidal cycle and presence of Killer Whales. They hint at the importance of understanding how species use the region over tidal cycles and across seasons. We did not account for tidal effects on our boat based surveys and future work could make a correction factor if the aim is to tally the number of individuals in the islands.

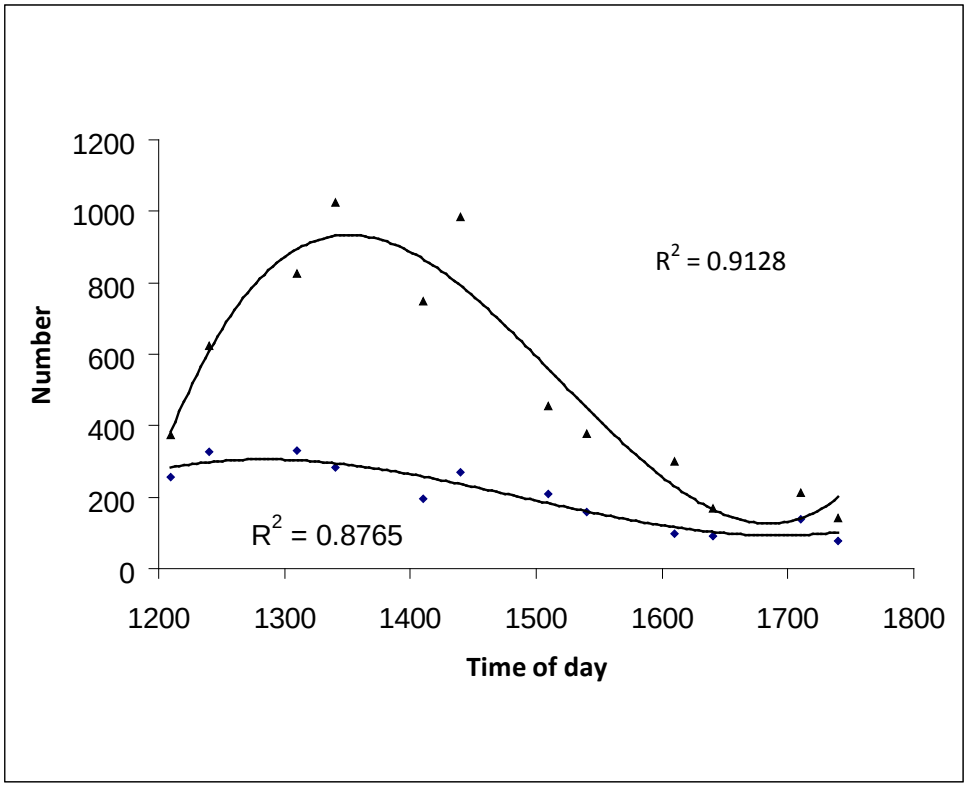

Fig. 8. Total number of birds counted every 30-minutes in Active Pass (triangles), and Navy Channel (diamonds) over tidal cycles in March 2009. High tide occurred in the morning and ebbed to a slack tide between about 1645 and 1745 hours.

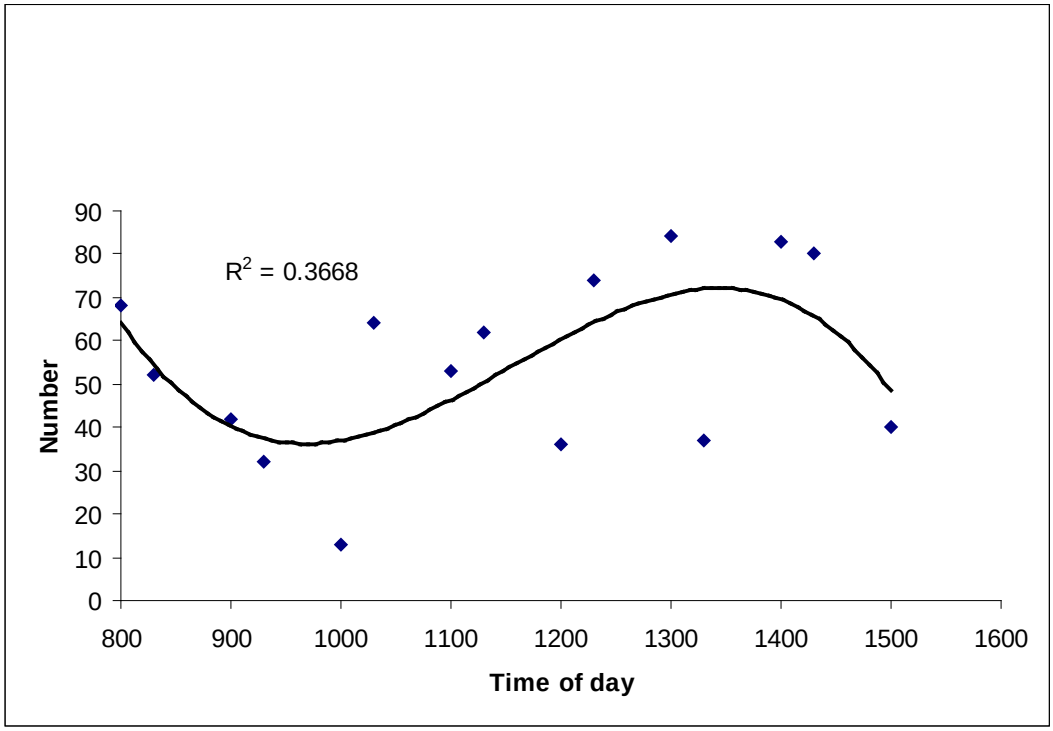

Fig. 9. Total number of birds counted every 30-minutes in Swanson Channel during a tidal cycle on 16 March 2009 beginning at high tide (0755h) and ending at low tide (1555h).

Fig. 10. Harbour Porpoise – a Species at Risk (Special Concern) – uses Boundary Pass, Haro Strait and parts of Swanson and Sidney Channels in significant numbers, with patterns of use likely influenced by the tidal cycle, and the presence of Killer Whales (Tom Middleton, Pacific Wildlife Foundation)

4. Discussion

4.1 Monitoring Long-term Species Trends

There is a paucity of census data from which to derive trends for birds and mammals in the Southern Gulf Islands. The two ongoing long term surveys are the Christmas Bird Count, begun in the 1980s, and the Coastal Waterbird Survey, which began at the end of 1990s. Both are volunteer-based, and neither provides extensive geographic coverage. However, the Coastal Waterbird Survey provides a peer-reviewed protocol for cost-effective shoreline-based monitoring where observers are available, both within the Gulf Islands National Park Reserve and adjacent areas (including Saltspring Island and the Saanich Peninsula). It could be expanded to include more coastal areas in the GINPR. A decade of Coastal Waterbird Survey monitoring at ~180 sites throughout the Georgia Basin is generating credible trend information (an annual detectable trend of 3% or less) for a wide variety of waterbird species (Badzinski et al. 2006; Bird Studies Canada unpublished data). Approximately 30 survey sites are located in and around the Southern Gulf Islands (including the Saanich Peninsula). Analyses have not been conducted to investigate the power of the Coastal Waterbird Survey dataset to rigorously detect trends at a local scale (i.e. within the Southern Gulf Islands).

A survey following a similar protocol to that used in this study would have immense value for marine bird and mammal conservation planning within and around the GINPR, but will require a long-term budget commitment of a decade or more if meaningful trend information is to be generated. Power analysis of the BC Coastal Waterbird Survey data collected on a similar monthly frequency to our survey indicated 5-10 years of data would be required to have confidence in the trends in the more numerous species (Badzinski et al. 2006). The perfect scenario would involve extensive boat-based transect coverage of the Southern Gulf Islands marine waters combined with land-based surveys of rocky shores in particular. A more realistic and cost-effective option may be to build on existing land-based monitoring efforts (e.g. Coastal Waterbird Surveys and regular breeding season monitoring on Mandarte Island) with boat-based transects covering waters that cannot be surveyed from land.

4.2 SARA-COSEWIC Species Habitat Delineation

Our one year survey has highlighted areas often used by SARA-COSEWIC species (Appendices 1 & 2). These species share commonalities in terms of diet and habitat use. Two broad habitat categories are of special importance to SARA-COSEWIC species and other species of provincial conservation concern: tidal channels and open water passages; and rocky shorelines and offshore islets. Areas of particular importance are:

- Boundary Pass and Haro Strait for Harbour Porpoise and Ancient Murrelet
- Waters around Coal, Ker and the Little Island group for Marbled Murrelet and Harbour Porpoise
- Sidney Channel for forage fish specialists (e.g. Rhinoceros Auklet, Common Murre)
- Belle Chain Islets and Boiling Reef for Steller Sea Lion (key non-breeding haul-outs – note, their feeding areas remain unknown)

To determine the 'critical habitat' areas pertaining to the Species at Risk Act will require refining the general picture of distribution and abundance that we present here. It will require accounting for the fact that for several species, many more individuals were present in the past, and were likely more widely distributed than our maps reveal. Core areas, particularly for Species at Risk, are very likely to be much larger than indicated by the primary, secondary, and tertiary areas from this study's transect-waypoint based analysis.

One option is to collaborate with agencies and groups like the Department of Fisheries and Oceans Vancouver Aquarium and the Orca Network, and develop a standard spatial framework within which to collate the large number of marine mammal sightings being reported through both the whale-watching industry and the marine user community. This is the most cost-effective way of capturing sufficient data to determine 'critical habitat' areas for marine mammals.

4.3 Addressing Species Management Needs

Changes in abundance of marine birds and mammals in the Southern Gulf islands should inform management actions. Among the SARA species, a priority would be to actions within the GINPR. A second level priority would be actions outside of the park boundaries for SARA species that overlap with the GINPR. A third priority is action for non SARA species that are in decline, and which are likely to be listed under SARA soon (e.g. Horned Grebe, Western Grebe). In all cases, the challenge is to separate natural from anthropogenic change. Most of the marine birds and mammals in GINPR eat fish or invertebrates, and a common theme amongst those in decline is that they are specialist forage fish feeders. Whether the changes in abundance reflect fluctuating forage fish abundance or some other factors, is unclear. The biomass of spawning herring in the Gulf Islands has been estimated since 1950 (www.pac.dfo-mpo.gc.ca/science/species-especes/pelagic-pelagique/herring-hareng/herspawn/sog_map-eng.htm). The tonnage of spawners in Saanich Inlet underwent a big decline from 1965 to 1999 but has shown a recent recovery approaching numbers not seen since 1960. In contrast, Swanson Channel herring declined after 1970 and have remained at a low level ever since. Plumper Sound herring biomass was low in the 1950-60 period, reached a peak in the early 1970s and collapsed soon after. Yellow Point herring biomass outstrips the other sites in tonnage. It underwent a decline between about 1965 and 1975 after which it rebounded. These data suggest that the number of herring has fluctuated widely in the Gulf Islands. Further analysis is required, to determine if the abundance of forage fish specialists closely mirrors the availability of both first-year herring from local spawning beaches, and sandlance – the other important forage fish for many species – in Sidney Channel and around Mandarte Island in particular.

A few species such as the Black Oystercatcher and Great Blue Heron reside year round in the Gulf Islands. Changes in abundance of these species will likely reflect local issues within GINPR. However, the majority of species spend only part of their annual cycle in GINPR. For them, the natural and anthropogenic causes of population trends seen in GINPR likely are region wide and therefore require broad action.

For several species, there are regional connections between National Parks. For example, Ancient Murrelets nesting in Gwaii Hanaas National Park Reserve very likely forage in GINPR. Black Oystercatchers that nest in GINPR might be a source of recruits to the oystercatcher

population in Pacific Rim National Park Reserve, and the wintering population of Black Oystercatchers in the GINPR may include individuals breeding in Gwaii Hanaas National Park Reserve. Harlequin ducks molting and wintering in GINPR nest in Rocky Mountain national parks. Marbled Murrelets that forage in Juan de Fuca Strait carry food toward Pacific Rim National Park - GINPR might be within flight range for the Pacific Rim National Park-breeding murrelets. Marbled Murrelets feeding in the southern Gulf Islands possibly nest in the watershed of Greater Vancouver (P. Arcese, pers. comm.). If this is corect, then joint management with Metro Vancouver for murrelets would be an important step in a murrelet recovery plan. Confirmation of the connections and coordinated conservation policy is an action within the Parks Canada jurisdiction.

There are probably some common human and ecological factors underlying declines of several marine birds and mammals in the GINPR. For example, it is possible that shellfish aquaculture in the Strait of Georgia has attracted sea ducks away from the Gulf Islands. Sea duck numbers have increased in Baynes Sound since the 1980s (S. Boyd, pers. comm.) and declined in the southern Gulf Islands. The nesting failure of cormorants and gulls, and the decline in wintering loon, murre and cormorant populations suggests that small fish may be less abundant now than a few decades ago. Sandlance and herring are major prey species of these birds in the region. Disturbance by eagles and humans is likely the reason for abandonment of nesting colonies by herons, and possibly some gull and cormorant colony declines (Sullivan et al. 2003, Vennesland 2004).

Primary areas for some Species at Risk and forage fish specialists, in particular the waters around the Coal and Dock Island groups, and the north end of Sidney Channel, appear to be among the busiest areas for small vessel traffic in the entire region, being the entry and departure point for Sidney Harbour. It is often reported that Harbour Porpoises tend to avoid boat traffic, yet our study shows that the current high traffic has not deterred porpoises entirely from the area. The Southern Gulf Islands are an ideal location to study the responses of a variety of marine animals, including Species at Risk (Marbled Murrelet and Harbour Porpoise both use the aforementioned areas regularly), to different levels of anthropogenic disturbance.

4.4 Establishing Baselines for Monitoring, Recovery and Protection

To effectively address recovery of depleted populations requires a baseline for comparison. Relatively few data exist on the birds and marine mammals of the Southern Gulf Islands region, most collected since the 1970s (P. Arcese pers. comm.), and very little of which has been published in any form. The datasets we are aware of are listed in section 1.2. These datasets contain the information from which to construct baselines, and combining as many as possible in a standard spatial and digital format will set the baseline from which to work.

5. Recommendations

5.1 General Recommendations

- **Establish a National Marine Conservation Area with restoration of fish fauna as a priority**

The Southern Gulf Islands marine environment has been heavily exploited over the past century and a half, resulting in the reduction or extirpation of baleen whales and Basking Sharks, halibut, rockfish and lingcod fisheries (Pauly et al. 1998). Our review of birds and marine mammals indicates that fish-eating species predominate on the federal SARA-COSEWIC and provincial Red and Blue lists. Recovery of all Species at Risk will likely require greater jurisdictional control over the exploitation of fish, and specific efforts toward understanding forage fish dynamics, to inform restoration of ecosystem function, structure and composition.

- **Establishing Baselines for Recovery and Monitoring**

We recommend that the relatively few disparate datasets (including P. Arcese, J. Clowater, J.K. Finley, K. Morgan, I. Robertson, K. Vermeer, RW Butler, Bird Studies Canada, BC Cetacean Sightings Network and Orcanet datasets) be collated with the aim of establishing a common baseline from which to design and gauge results of future monitoring, and to establish realistic recovery targets for Species at Risk within the Southern Gulf Islands.

- **Monitoring Trends of Priority Species**

Tracking the recovery of SARA-COSEWIC and other priority species will require a long-term monitoring program that covers key tidal channels, open passages, rocky shorelines and offshore islets used by these species. Generating credible trend information requires a long-term commitment of resources. There are several options for the design of such a monitoring protocol, all of which require boat-based transect surveys:

- Conduct monthly surveys based on the protocol and route described in this study; the route could be modified to more extensively cover the areas of interest to specific species or guilds, but should be possible to complete within one day at any time of year.
- Combine land- and boat-based protocols in an effort to most cost-effectively cover the area; this could include ongoing Coastal Waterbird Surveys, transects conducted along BC Ferries routes, and dedicated small boat-based transects to cover less accessible marine areas. Strong scientific expertise would be required to design an adequate protocol that combined the use of different techniques.
- Conduct monthly or even bi-weekly surveys of Species at Risk (and other priority species) hotspots, as identified by this study coupled with other information, to define the core areas and boundaries of Species at Risk use.
- Investigate ways of associating effort data with the many incidental observations of marine mammals that are being reported from the region almost daily now, and capturing this information in a standard spatial format, is one cost-effective way to monitor marine mammal trends.

- **Developing SARA-COSEWIC Species-Habitat Association Models**

Our one year survey has highlighted areas frequently used by SARA species. To determine the 'critical habitat' areas pertaining to the Species at Risk Act will require combining our data with other existing datasets, which are in a variety of different formats, and developing species-habitat association models. One example of an approach to tackling this potentially complex work is Hauser (2006). The task is probably best tackled species by species, accounting for each animal's specific ecological traits. For marine mammals, collaborating with the groups collating incidental sightings from the marine user community will be key, because these groups represent the best opportunity to cost-effectively generate the largest body of data on these animals.

- **Collaboration Outside the GINPR**

The majority of marine bird and mammal species of conservation concern in the GINPR occur there as seasonal visitors. The natural and anthropogenic drivers of their population trends are region-wide and therefore require broad action, and collaboration with other agencies. The most important and/or straightforward linkages to be made are with:

- Fisheries ecologists at Fisheries and Oceans Canada and academic institutions to better understand regional trends in forage and predator fish populations, and linkages between these and marine birds and mammals
- Parks Canada ecologists in other National Parks, particularly Pacific Rim National Park and Gwaii Hanaas National Park Reserve
- NGOs and academic groups conducting scientific research on marine birds and mammals in the region, in particular the University of British Columbia Zoology Department, Bird Studies Canada, Vancouver Aquarium/DFO (the BC Cetacean Sightings Network) and an international collaborative study investigating marine bird trends in the Salish Sea led by the SeaDoc Society
- The whale-watching community and extended network of contributors to the web-based marine mammal sightings portal Orca Network
- Recovery Teams for SARA-listed Species at Risk

Fig. 11. Herring spawn events, like this one in Baynes Sound, were once a regular annual feature in Southern Gulf Islands locations like Ganges Harbour, supporting large concentrations of coastal and marine birds in the (Art Martell).

5.2 Species- and Guild-Specific Recommendations

This section deals with species and guilds within the Southern Gulf Islands that are of global, national or provincial conservation concern, north-east Pacific regional endemics, and species that occur in high abundance in the Southern Gulf Islands, relative to surrounding areas.

Species	Guild(s)	Conservation Level	Recommendations
Steller Sea Lion	Forage fish predator	IUCN – Endangered SARA – Special Concern	• Regular monthly visits to the Belle Chain Islands and Boiling Reef haul-outs to photograph all animals and assess their sex and age class would contribute significantly to existing knowledge of haul-out use. • Investigate linkages between breeding populations and the non- breeding population in the Gulf Islands National Park Reserve and proposed NMCA. • Investigate foraging areas of animals using the Belle Chain and Boiling Reef haul-outs. • Maintaining the Steller Sea Lion population in the Southern Gulf Islands should be a high priority for Canada given the species global conservation status
Marbled Murrelet	Forage fish predator	IUCN – Vulnerable SARA - Threatened	• Investigate linkages between breeding populations in the Vancouver watersheds and Pacific Rim National Park Reserve, and the non-breeding population in the Gulf Islands National Park Reserve and proposed NMCA. • Collaborate with Marbled Murrelet Recovery Team to help address regional issues impacting the local GINPR population.
Killer Whale (Southern residents)	Large fish predator	IUCN – Data Deficient SARA - Threatened	• The methods used by Hauser (2006) of combining observational data from whale watching companies and naturalists to map the distribution of Transients could usefully be applied to delineate habitat use by both Southern Residents and Transients. • Collaboration with whale-watching groups, in particular those feeding into the Orca Network information base (now a decade old) could yield important information on Killer Whale use of the region's waters, and the potential to combine with Vancouver Aquarium/DFO's BC Cetacean Sightings Network database should be investigated. • Implement National Marine Conservation Area to establish protection zones, and work with DFO and the whale-watching community to ensure encroachment protocols are strictly adhered to within Parks Canada jurisdictional zones. • Work with DFO and fishing industry to ensure sufficient salmon are available to support resident whales.

Killer Whale (NE Pacific transients)	Marine mammal predator	IUCN – Data Deficient SARA - Endangered	• The methods used by Hauser (2006) of combining observational data from whale watching companies and naturalists to map the distribution of Transients could usefully be applied to delineate habitat use by both Southern Residents and Transients. • Collaboration with whale-watching groups, in particular those feeding into the Orca Network information base (now a decade old) could yield important information on Killer Whale use of the region's waters, and the potential to combine with Vancouver Aquarium/DFO's BC Cetacean Sightings Network database should be investigated. • Implement National Marine Conservation Area to establish protection zones, and work with DFO and the whale-watching community to ensure encroachment protocols are strictly adhered to within Parks Canada jurisdictional zones. • Track occurrence of Transients in relation to distribution and abundance of harbour seal and sea lion prey.
Humpback Whale	Plankton predator; Forage fish predator	SARA - Threatened	• Collate historical and new records from the Southern Gulf Islands in a database to provide better understand seasonal distribution. • Work with whale-watching community to ensure encroachment protocols are strictly adhered to within Parks Canada jurisdictional zones.
Horned Grebe	Forage fish and invertebrate predator	COSEWIC - Threatened	• COSEWIC's assessment of this species has made it a bird to watch for Parks Canada. Establishing an historical baseline for the Southern Gulf Islands and surrounding region, from which to attempt recovery, will be an important first step. • Investigate reasons for the apparent declines in the southern parts of the Salish Sea. • Reassessment of priority by the Conservation Data Centre.
Ancient Murrelet	Forage fish predator; Plankton predator Forage fish predator; Plankton predator	SARA – Special Concern SARA – Special Concern	• Investigate whether the late fall pulse in abundance is an annual phenomenon tied to a specific food resource (e.g. the euphausid *Euphasia pacifica*, or juvenile Pacific Herring – both major known components of the species diet in fall/winter) and determine what factors control the abundance of that food resource. • Establish the geographic extent of this seasonal pulse of Ancient Murrelets in the Salish Sea (e.g., high counts of up to 2,400 have been made along the Sunshine Coast in Dec-Jan), and the relative use of Southern Gulf Islands waters compared to other parts of the Salish Sea. • Investigate linkages between breeding populations in Gwaii Hanaas NP and the non-breeding population in the Gulf Islands National Park Reserve and proposed NMCA.

Great Blue Heron (*fannini* subsp.)	Forage fish predator	SARA – Special Concern	• Educate communities and control human activities near breeding colonies, including prevention of loud novel activities where possible, during the nesting season from February to July. • A coastal shoreline survey to identify foraging areas during the nesting (May-July) and non-breeding seasons (October- February) would define important areas to herons. There are likely a limited number of suitable winter heron territories, so heron presence will identify primary habitat.
Harbour Porpoise	Forage fish predator	SARA – Special Concern	• Investigate likely areas of dispersal of Harbour Porpoise using the Southern Gulf Islands-Haro Strait area, to better understand potential conservation issues and management responsibilities of Parks Canada. • Refine survey protocols to better understand tidal and seasonal variation in Harbour Porpoise use of the Southern Gulf Islands. The methods used by Hauser (2006) of combining observational data from whale watching companies and naturalists to map marine mammal distribution could usefully inform/augment this process.
Gray Whale	Soft sediment invertebrate forager	SARA – Special Concern	• Collate historical and new records from the Southern Gulf Islands in a database to provide better understand seasonal distribution. • Work with whale-watching community to ensure encroachment protocols are strictly adhered to within Parks Canada jurisdictional zones.
Western Grebe	Forage fish predators	BC Red List	• COSEWIC's prioritisation of this species makes it a bird to watch for Parks Canada. Establishing an historical baseline for the Southern Gulf Islands and surrounding region, from which to attempt recovery, will be an important first step. • Investigate reasons for the apparent declines in the southern parts of the Salish Sea, in particular the demise of herring (Thierrault et al 2009).
Brandt's Cormorant	Forage fish predators	BC Red List	• Investigate reasons for local declines in the Southern Gulf Islands, likely related to forage fish abundance. • Continue to monitor the local Southern Gulf Islands population.
Pelagic Cormorant	Forage fish predators	BC Red List (*pelagicus* subsp. only)	• Investigate use of the Southern Gulf Islands by the Red-Listed subspecies *P.p.pelagicus*, which breeds on Haida Gwaii, in particular any linkages with the Gwaii Hanaas NP breeding population. • Continue to monitor the Mandarte breeding colony (subsp. *P.p.resplendens*), and non-breeding populations using the Southern Gulf Islands, through surveys like the Coastal Waterbird Survey.
Common Murre	Forage fish predator	BC Red List	• Verify and investigate causes for the apparent steep regional declines.
Cassin's Auklet	Plankton predator	BC Blue List	• No specific recommendations for this occasional visitor to the Southern Gulf Islands

Double-crested Cormorant	Forage fish predator	BC Blue List	• Continue to monitor the Mandarte breeding population and the non-breeding population around the Southern Gulf Islands shorelines through the BC Coastal Waterbird Survey.
Surf Scoter	Rocky shore and soft sediment invertebrate predator	BC Blue List	• Continue to monitor the use of the Southern Gulf Islands population through expanding the BC Coastal Waterbird Survey to additional shorelines, and the Sidney Channel area using boat-based surveys.
California Gull	Forage fish predator	BC Blue List	• Continue to monitor this species using methods proposed for other species, and ongoing surveys (e.g. BC Coastal Waterbird Survey).
Caspian Tern	Forage fish predator	BC Blue List	• Monitor using methods proposed for other species, and ongoing surveys (e.g. BC Coastal Waterbird Survey).
Long-tailed Duck	Soft sediment invertebrate forager	Conservation Framework (BC) priority species	• Investigate reasons for regional declines and whether the effects are as strong locally in the Southern Gulf Islands. • Continue to monitor the local Southern Gulf Islands population and where possible other areas through boat-based surveys.
Barrow's Goldeneye	Rocky shore invertebrate predator	Conservation Framework (BC) priority species	• A few winter censuses of the shoreline for this species would provide a better idea of the number and distribution of this species.
Harlequin Duck	Rocky shore invertebrate predator	Conservation Framework (BC) priority species	• Continue to monitor the local GINPR population, and better understand linkages with breeding areas, which may include other National Parks within British Columbia's interior, and into Alberta. • Identify islands/islets used for moulting on the Southern Gulf Islands and minimize human disturbance there.
Pigeon Guillemot	Forage fish predator	Conservation Framework (BC) priority species	• Investigate drivers of the apparent widespread increases, and continue to monitor the species, in particular in Sidney Channel/Haro Strait area. • Identification of nesting sites other than on Mandarte would be useful to estimate the breeding population size in the Southern Gulf Islands.
Common Goldeneye	Soft sediment invertebrate forager	Conservation Framework (BC) priority species	• Monitor with other waterbirds

Forage Fish Predators (Ancient Murrelet, Great Blue Heron, Horned Grebe, Harbour Porpoise, Humpback Whale, Steller Sea Lion, Marbled Murrelet, Western Grebe, Brandt's, Pelagic and Double-crested Cormorant, Common Murre, California and Heerman's Gulls, Pigeon Guillemot, Caspian Tern)	Forage fish predators	SARA (7 spp.) and CDC (8 spp.) and Pacific coast endemics (2)	Research the recovery of Pacific herring as a breeding species and the requirements of Pacific Sandlance in the Southern Gulf Islands. Conduct census plots for rocky shore bottom fish. Determine prey species of each of these bird and mammal species in the Gulf Islands.
Rocky Shore Specialists (Barrows Goldeneye, Harlequin Duck, Black Oystercatcher, Black Turnstone, Surfbird, Rock Sandpiper)	Rocky shore foragers	Pacific coast endemics, and BC conservation priorities	Target censuses of rocky shorelines and offshore islets for Surfbird, Black Turnstone, Rock Sandpiper, non-breeding Black Oystercatcher and moulting Harlequin Ducks, and Prevost's western inlets and adjacent shorelines for Barrow's Goldeneye
Soft-sediment invertebrate foragers (Gray Whale, Common Goldeneye, Long-tailed Duck, Surf Scoter)	Soft sediment invertebrate foragers	SARA (1 spp.), CDC (1 spp.), and other (1 spp.)	Determine use by these species in the few soft sediment foraging areas in the region and in the GINPR.

Fig. 12. Black Oystercatcher (foreground) and Black Turnstones (background), two rocky shore specialists endemic to the north-east Pacific, which occur widely through the Southern Gulf Islands (Rob Butler, Bird Studies Canada/ Pacific Wildlife Foundation)

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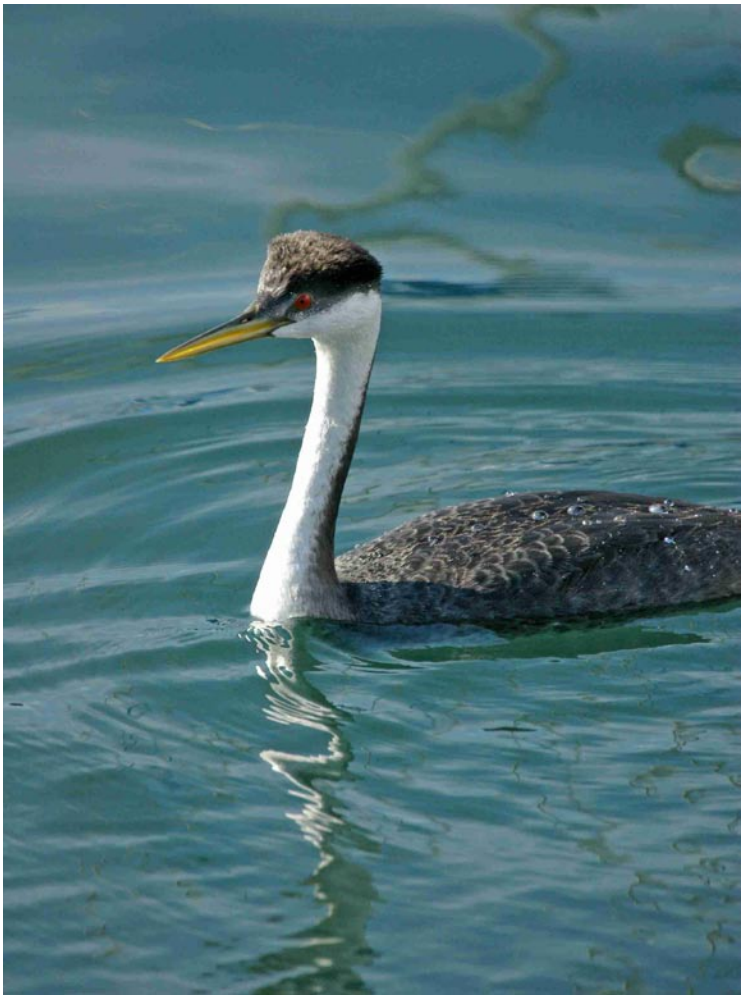


Fig. 13. Western Grebe – a forage fish specialist that has undergone a precipitous decline in the Salish Sea over the past three decades; flocks still occur in the Southern Gulf Islands, but are not as numerous now as they were two to three decades ago.

Appendix 1. Coastal and Marine Bird Species Recorded from Southern Gulf Islands

* indicates the species breeds in the Southern Gulf Islands

Species	Source(s) (for species not recorded during this survey)
Greater White-fronted Goose	
Emperor Goose	Christmas Bird Count
Snow Goose	Christmas Bird Count
Canada Goose*	
Cackling Goose	e-Bird
Brant	
Mute Swan*	
Trumpeter Swan	
Gadwall	
Eurasian Wigeon	BC Coastal Waterbird Survey; Christmas Bird Count; Finley et al.
American Wigeon	
Mallard	
Blue-winged Teal	
Cinnamon Teal	e-Bird
Northern Shoveler	
Northern Pintail	
Green-winged Teal	
Canvasback	Christmas Bird Count
Ring-necked Duck	BC Coastal Waterbird Survey
Greater Scaup	
Lesser Scaup	BC Coastal Waterbird Survey; Christmas Bird Count
Harlequin Duck	
Surf Scoter	
White-winged Scoter	
Black Scoter	
Long-tailed Duck	
Bufflehead	
Common Goldeneye	
Barrow's Goldeneye	
Hooded Merganser	
Red-breasted Merganser	
Common Merganser	
Ruddy Duck	Christmas Bird Count
Red-throated Loon	
Pacific Loon	
Common Loon	
Yellow-billed Loon	BC Coastal Waterbird Survey
Pied-billed Grebe	BC Coastal Waterbird Survey; Christmas Bird Count; Finley et al.
Horned Grebe	
Red-necked Grebe	
Eared Grebe	
Western Grebe	
Clark's Grebe	
Northern Fulmar	Christmas Bird Count
Brown Pelican	Christmas Bird Count; e-Bird
Brandt's Cormorant	
Double-crested Cormorant*	
Pelagic Cormorant*	
Great Blue Heron*	
Great Egret	Butler unpublished data
Turkey Vulture	
Osprey*	BC Coastal Waterbird Survey
Bald Eagle*	
Northern Harrier	Christmas Bird Count
Golden Eagle	e-Bird
Gyrfalcon	e-Bird
Merlin	BC Coastal Waterbird Survey; Christmas Bird Count

Species	Source(s) (for species not recorded during this survey)
Peregrine Falcon*	Christmas Bird Count
American Coot	BC Coastal Waterbird Survey
Black-bellied Plover	
Semipalmated Plover	e-Bird
Killdeer*	BC Coastal Waterbird Survey
Black Oystercatcher*	
Spotted Sandpiper	BC Coastal Waterbird Survey; Christmas Bird Count
Wandering Tattler	
Greater Yellowlegs	BC Coastal Waterbird Survey; Christmas Bird Count
Lesser Yellowlegs	e-Bird
Whimbrel	
Long-billed Curlew	e-Bird
Ruddy Turnstone	BC Coastal Waterbird Survey; Christmas Bird Count
Black Turnstone	
Surfbird	
Sanderling	
Semipalmated Sandpiper	e-Bird
Western Sandpiper	Butler unpublished data
Least Sandpiper	e-Bird
Baird's Sandpiper	e-Bird
Rock Sandpiper	Christmas Bird Count
Dunlin	
Short-billed Dowitcher	e-Bird
Long-billed Dowitcher	
Buff-breasted Sandpiper	e-Bird
Red-necked Phalarope	
Red Phalarope	e-Bird
Franklin's Gull	e-Bird
Bonaparte's Gull	
Heermann's Gull	
Mew Gull	
Ring-billed Gull	
California Gull	
Herring Gull	BC Coastal Waterbird Survey
Thayer's Gull	BC Coastal Waterbird Survey; Christmas Bird Count; Finley et al.
Slaty-backed Gull	e-Bird
Glaucous-winged Gull*	
Western Gull	e-Bird
Glaucous Gull	Christmas Bird Count
Black-legged Kittiwake	Christmas Bird Count
Caspian Tern	
Common Tern	BC Coastal Waterbird Survey
Arctic Tern	e-Bird
Pomarine Jaeger	e-Bird
Parasitic Jaeger	
Common Murre	
Pigeon Guillemot*	
Marbled Murrelet*	
Ancient Murrelet	
Cassin's Auklet	
Rhinoceros Auklet*	
Tufted Puffin	Clowater (1992-3); e-Bird
Snowy Owl	Christmas Bird Count
Belted Kingfisher*	
Northwestern Crow*	
Common Raven*	
Purple Martin	e-Bird

Appendix 2. Annotated List of Selected Bird Species

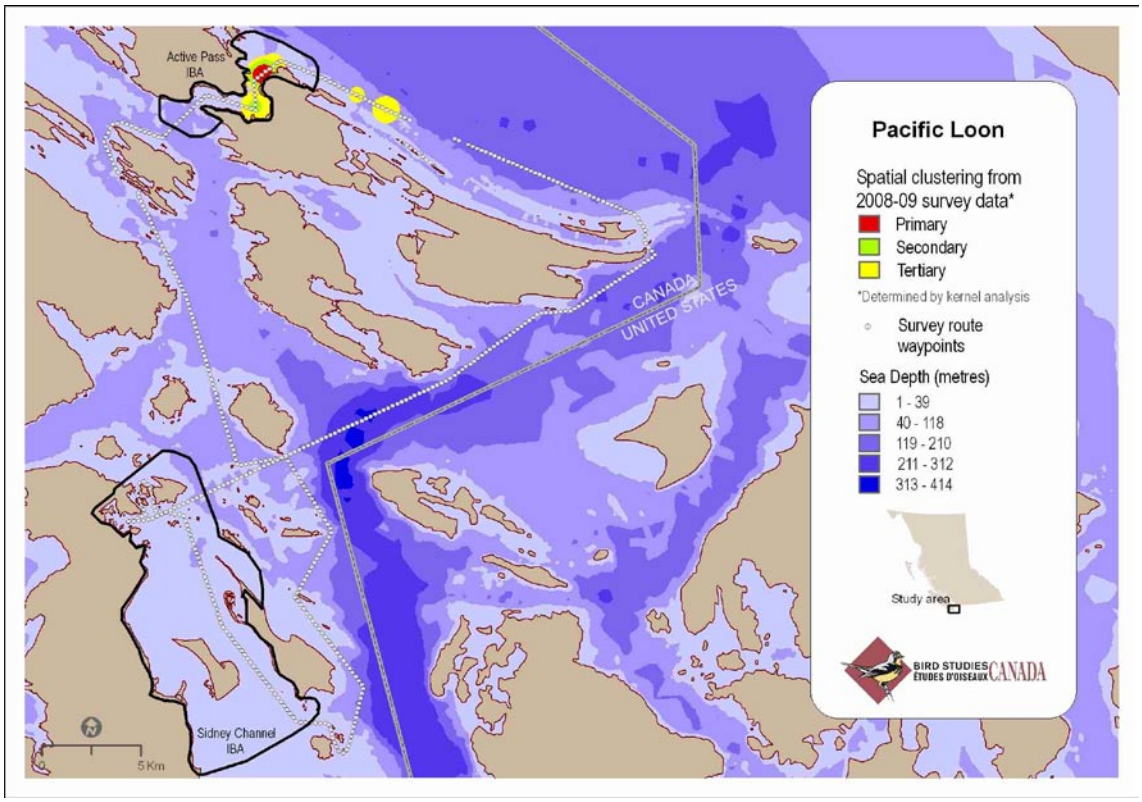
The following accounts summarize the distribution and abundance of the most abundant species, and all species of conservation concern, recorded on this survey. Species recorded on the survey but omitted from this annotated list are considered by the authors to have insignificant Southern Gulf Island populations from a local, regional and national perspective, and/or be of no current conservation concern or relevance to Parks Canada. Spatial distribution showing important (primary, secondary and tertiary) areas for each species based on kernel estimator modeling is presented in the figures, and temporal distribution is illustrated using seasonal abundance bar graphs showing the average number of individuals recorded per waypoint on each survey. Information from previous studies and ongoing surveys, like Bird Studies Canada's Coastal Waterbird Survey, eBird and the Christmas Bird Count, is also incorporated into these accounts.

Fig. 14. Citizen science surveys and databases, like Bird Studies Canada's Coastal Waterbird Survey, eBird and the Christmas Bird Count, are providing valuable long-term information sources from the Southern Gulf Islands region. Here, Ann McNeill is pictured conducting a monthly count at Active Pass, from Mayne Island (Pete Davidson, Bird Studies Canada).

Pacific Loon *Gavia pacifica*

Conservation Status	Not listed federally or provincially, and assessed as low priority by the BC Conservation Framework (BC MoE 2008).
Ecology & Regional Trends	Pacific Loons are piscivores and tend to flock where strong tidal currents concentrate zooplankton and schooling fish. Peaks in abundance regionally occur in spring and fall, often associated with herring events. A 50% decline was reported between the 1975-84 and 1998-2007 periods, based on Christmas Bird Count data from the Salish Sea (Bower 2009). The Conservation Data Centre considers its short-term trend in British Columbia to be stable (BC MoE 2008). In the Strait of Georgia alone, no trend was apparent between 1999-2009 data, based on the BC Coastal Waterbird Survey (Bird Studies Canada unpublished data). An apparent increase in density was noted in Padilla Bay, WA, between 1978/79 and 2003-06 (Anderson et al. 2009). These different results suggest a complex pattern of temporal and spatial distribution and abundance in this region.
Southern Gulf Islands Status	Historically, Active Pass was the single most important site for this species in the Strait of Georgia, with 2,000-4,000 birds regularly using the site in winter (Vermeer 1977, Campbell et al. 1990), and a spring passage maximum of 10,000 reported in 1972 (Campbell et al. 1990). These counts exceed 1% of the global population, and led to the site being designated a global Important Bird Area (www.ibacanada.com). The highest recent count recorded on the monthly BC Coastal Waterbird Survey is 920 (in March 2007; BSC unpublished data).
Survey Records 2008-09	Forty-six waypoint-encounters were tallied with 510 individuals. Recorded regularly, but in low numbers, chiefly at Active Pass and in the Strait of Georgia east of Mayne and Saturna Islands, with peak survey-counts in October (56, 61), February (74, 241) and April (42). A flock of 30 unidentified loons feeding between Sidney and the D'Arcy Islands in April were most likely this species. The maximum survey-count of 241 on 27 February included a flock of 220 at the eastern entrance to Active Pass. The tidal cycle surveys indicated marked shifts in distribution and abundance of Pacific Loons, with peak counts (e.g. 250 on 25 February) occurring when the tide was in full flood. All BC Coastal Waterbird Survey counts of >30 birds were from Active Pass, with maxima of 474 (Nov 2008), and 660 (April 2009).
Conservation Issues	A substantial reduction in numbers using Active Pass over the past four decades is apparent. Similar reductions in other forage fish feeders (e.g. Brandt's Cormorant) suggest there may be a link to prey availability.
Recommendations	Attention should be given to tracking numbers in Active Pass.

a)



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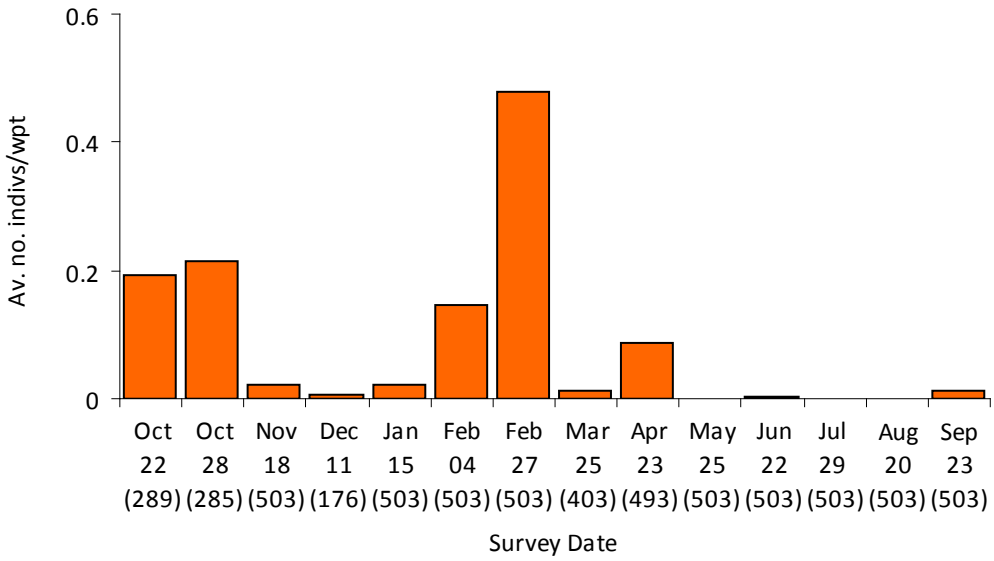
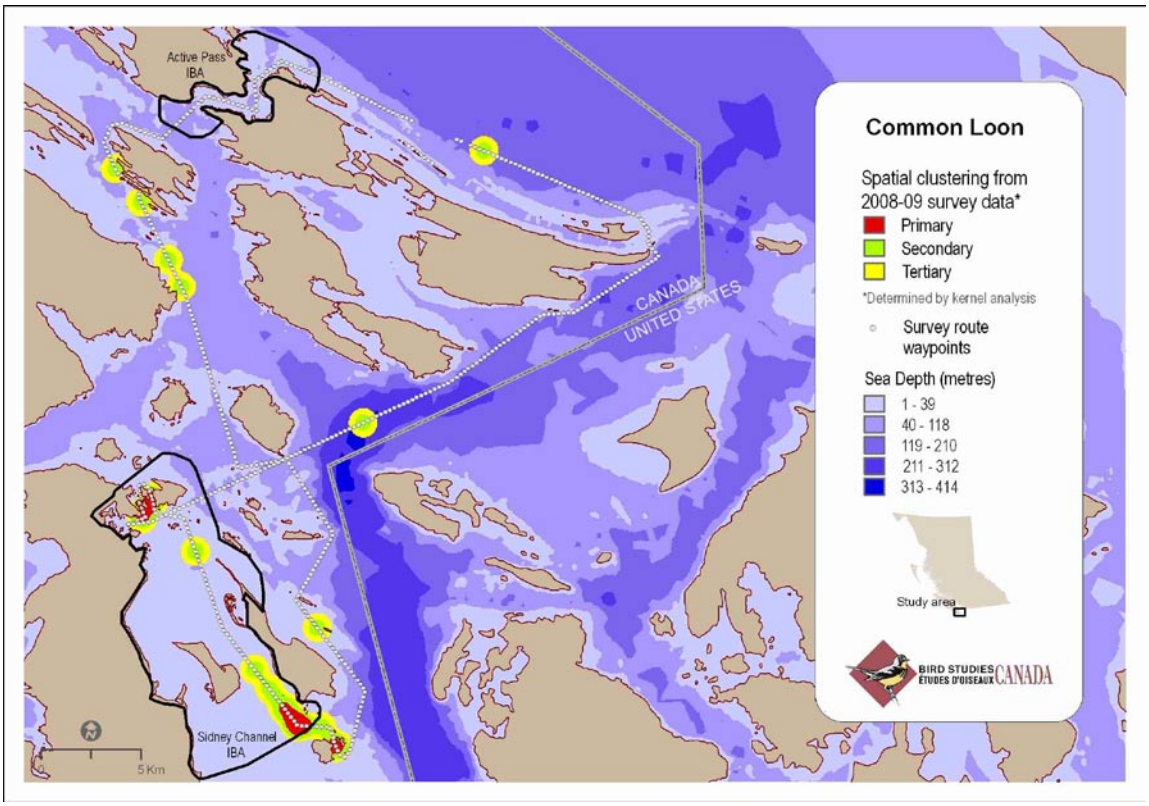


Fig 15. Spatial distribution (a) and seasonal abundance (b) of Pacific Loon in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Common Loon *Gavia immer*

Conservation Status	Not listed federally or provincially, and assessed as low priority by the BC Conservation Framework.
Ecology & Regional Trends	A widespread, relatively common non-breeding visitor (in all seasons, chiefly winter and on passage) to coastal and marine habitats in the region. An apparent increase was reported between the 1975-84 and 1998-2007 periods, based on Christmas Bird Count data from the Salish Sea (Bower 2009). The Conservation Data Centre considers its short-term trend in British Columbia to be stable (BC MoE 2008). In the Strait of Georgia alone, a 3% annual decline occurred between 1999-2009 data, based on the BC Coastal Waterbird Survey (Bird Studies Canada unpublished data). An apparent increase in density was noted in Padilla Bay, WA, between 1978/79 and 2003-06 (Anderson et al. 2009). These results suggest that regional numbers are stable or increasing in Washington, but potentially declining in British Columbia.
Southern Gulf Islands Status	Common Loons occur mostly as solitary individuals in the Gulf Islands. The Coastal Waterbird survey has recorded occasional winter concentrations in Miners Bay and along the eastern shores of Mayne Island, but indicates a local strong decline along the North Saanich-Sidney shoreline over the past decade.
Survey Records 2008-09	Eighteen waypoint-encounters were tallied with 22 individuals, all in singletons or twos, spread widely across the study area. Within the Southern Gulf Islands, there were only four records (maximum count five birds) of this species on the BC Coastal Waterbird Survey between October 2008 and September 2009.
Conservation Issues	The slight decline noted by the BC Coastal Waterbird Survey over the past decade may be within the cycle of natural variation.
Recommendations	No species-specific measures are proposed.

a)



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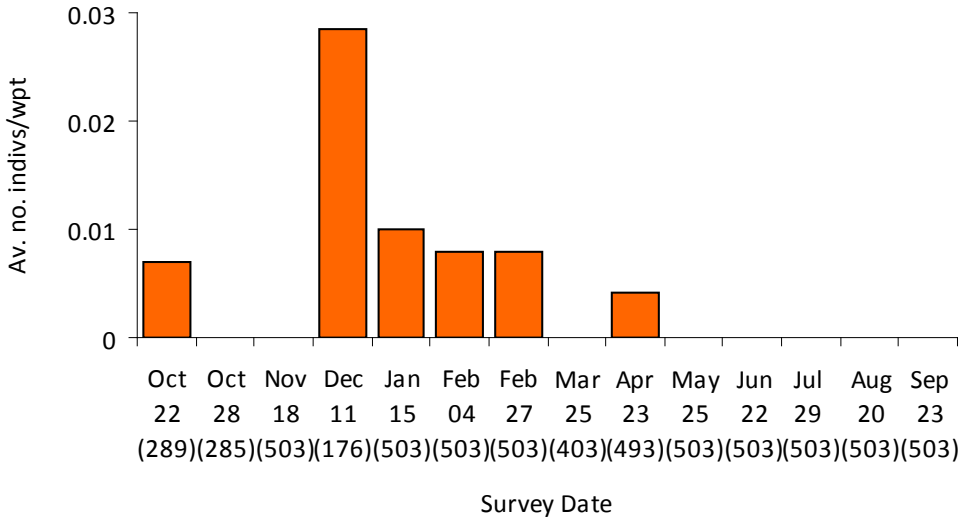
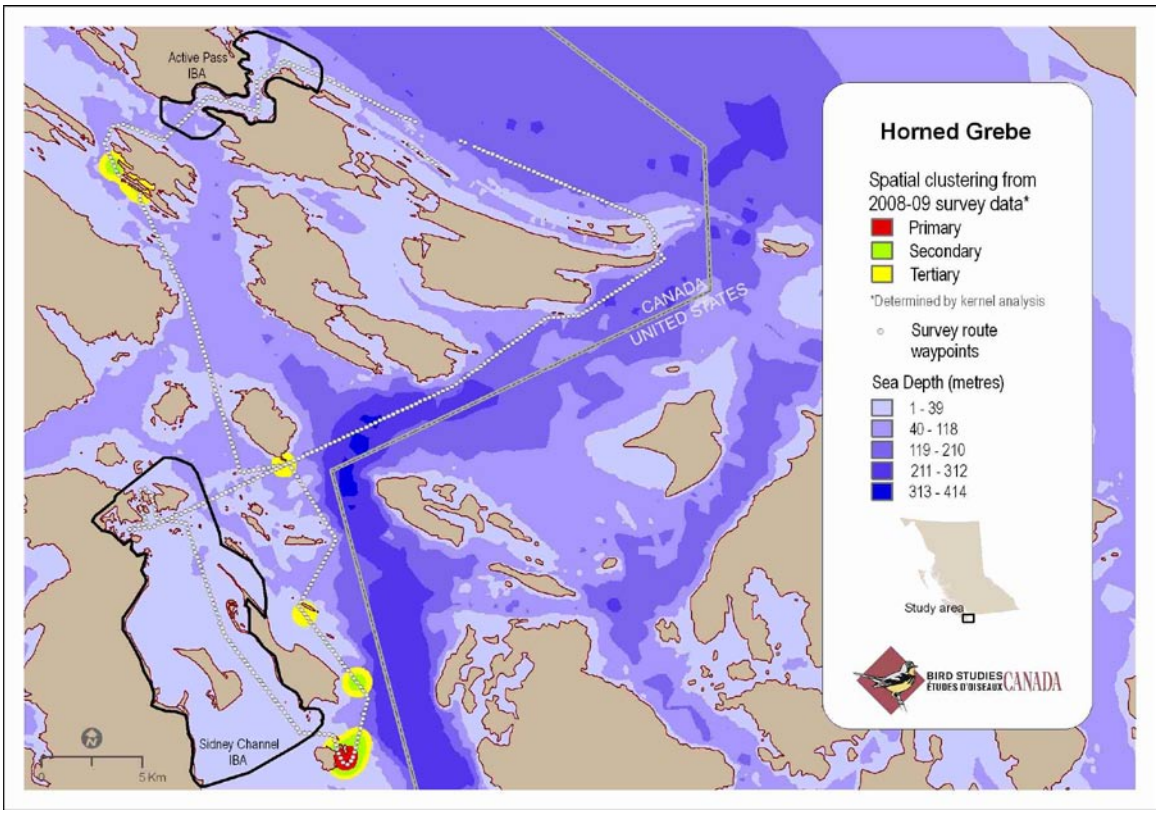


Fig 16. Spatial distribution (a) and seasonal abundance (b) of Common Loon in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Horned Grebe *Podiceps auritus*

Conservation Status	The western North American population was recommended by COSEWIC for SARA-listing in the category Special Concern due to declining abundance (COSEWIC 2009). This species is not listed provincially, and assessed as low priority by the BC Conservation Framework.
Ecology and Regional Status	This fish- and marine invertebrate-eating small grebe is a widespread and numerous non-breeding visitor (in all seasons, chiefly in winter) to coastal habitats in the region. A 30% decline was reported between the 1975-84 and 1998-2007 periods, based on Christmas Bird Count data from the Salish Sea (Bower 2009). The Conservation Data Centre considers its short-term trend in British Columbia to be stable (BC MoE 2008). Through the Strait of Georgia, the trend was apparently stable between 1999-2009 data, based on the BC Coastal Waterbird Survey (Bird Studies Canada unpublished data), but surveyors have noted a marked long-term decline around the Victoria and Saanich peninsula shorelines over the past three decades (K. Finley unpublished data). A ~60% decrease in density was noted in Padilla Bay, WA, between 1978/79 and 2003-06 (Anderson et al. 2009).
Southern Gulf Islands Status	A non-breeding visitor in small numbers, chiefly in the winter (October – March), most frequently recorded on the BC Coastal Waterbird Survey from Mayne Island's southern and western shoreline (maximum counts seldom exceed ten birds, usually in December and January), and sheltered bays along Saltspring Island's eastern shoreline.
Survey Records 2008-09	Fifteen waypoint-encounters with 22 individuals were recorded. We saw very few Horned Grebes, likely because our route was mostly in open waters >1km from shorelines, where the species is less often seen. More than half our encounters were off the south end of Sidney Island and the Darcy Islands, which is clearly a favoured area for the species within the southern Gulf Islands. Ten birds were recorded around Mayne Island's shoreline during November-February 2008-09 by the BC Coastal Waterbird Survey.
Conservation Issues	The declines most apparent in the wintering population in the southern Salish Sea are a major cause for concern that until now have received little attention.
Recommendations	• COSEWIC's assessment of this species has made it a bird to watch for Parks Canada. Establishing an historical baseline for the Southern Gulf Islands and surrounding region, from which to attempt recovery, will be an important first step. • Investigate reasons for the apparent declines in the southern parts of the Salish Sea. • Reassessment of trend by CDC.

a)



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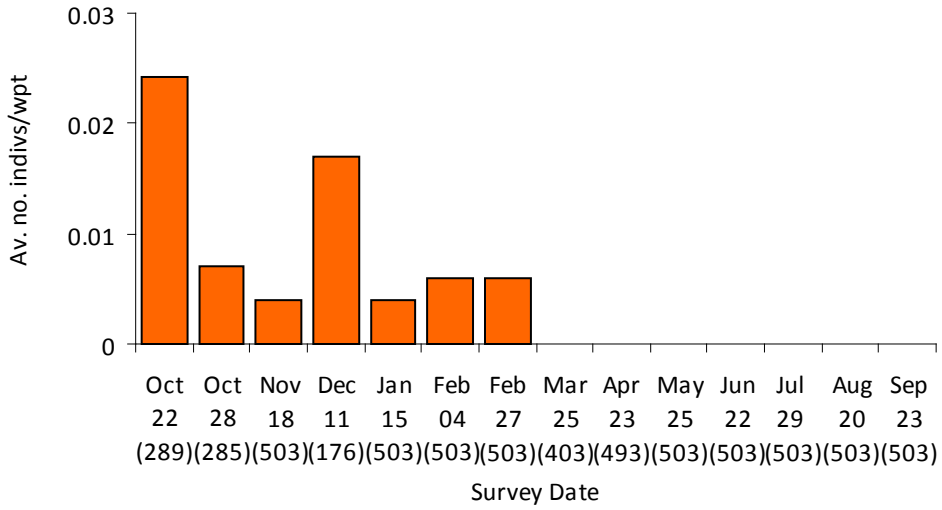
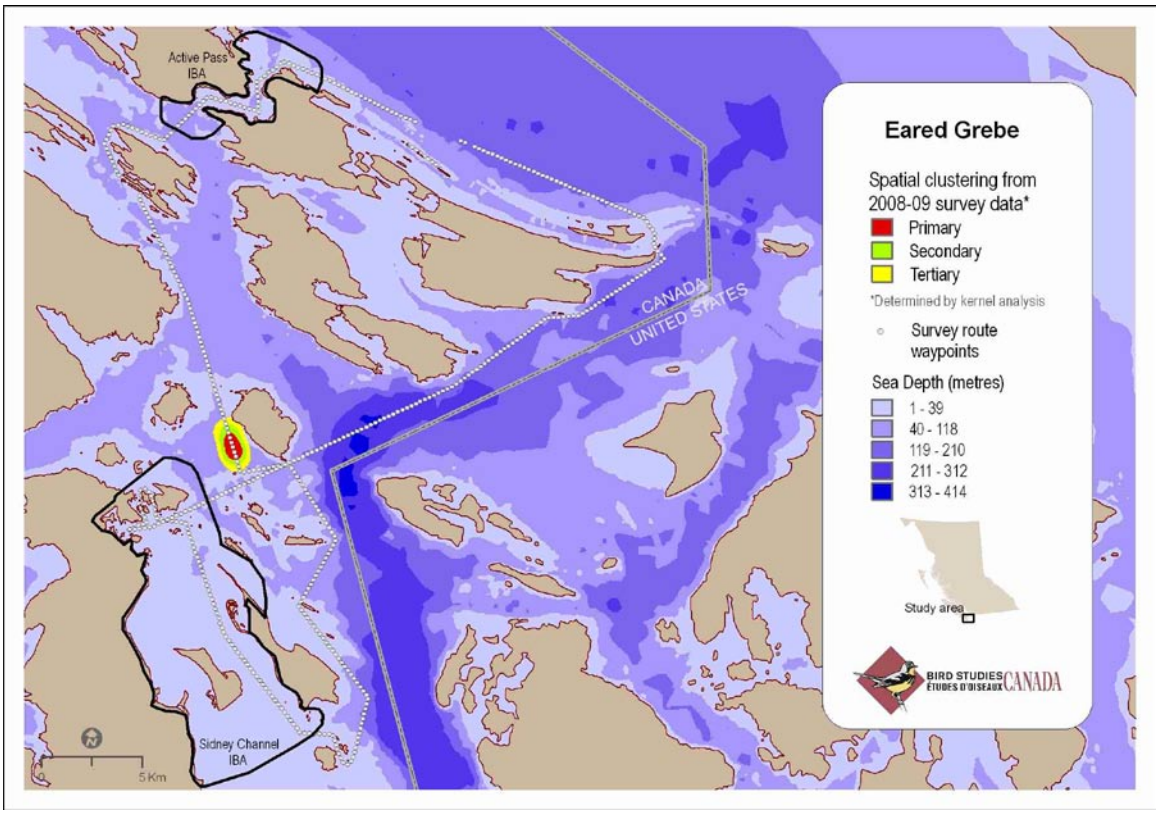


Fig 17. Spatial distribution (a) and seasonal abundance (b) of Horned Grebe in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Eared Grebe *Podiceps nigricollis*

Conservation Status	Neither at risk nationally nor provincially, and assessed as a moderate or low priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	The Conservation Data Centre considers its short-term trend in British Columbia to be stable (BC MoE 2008).
Southern Gulf Islands Status	A non-breeding visitor to the region, flocks apparently using the area to stage in late winter-spring. RWB reported 75 Eared Grebes near the Little Group of islands on 18 April 1988. Campbell et al (1990) reported 725 in Ganges Harbour during herring spawn in March 1972. This grebe is a scarce species around the south coast of British Columbia, with most BC Coastal Waterbird Survey records comprising one or two individuals (BSC unpublished data). This indicates that the flocking occurrence of Eared Grebe in the Southern Gulf Islands is of particular note.
Survey Records 2008-09	We tallied four waypoint-encounters, all in February and all in Prevost Passage just west of Moresby Island, including on flock of 40 on 4 February, and a more dispersed group of 32 individuals spread across a kilometer of transect line (in the same location) on 27 February. These observations suggest that the Southern Gulf Islands may be a regular staging area for flocks of this grebe, perhaps as it returns from its wintering grounds in coastal Mexico/California to its breeding grounds in the Prairies and northern Canada.
Conservation Issues	The abundance of this species in the Gulf Islands appears to be related to the presence of spawning herring.
Recommendations	Continue regular surveys to confirm status.

a)



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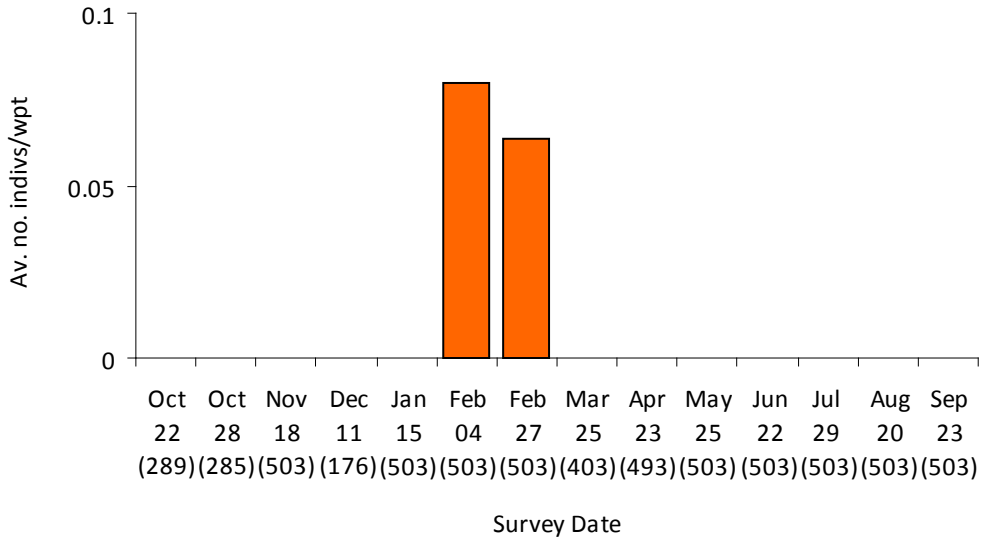
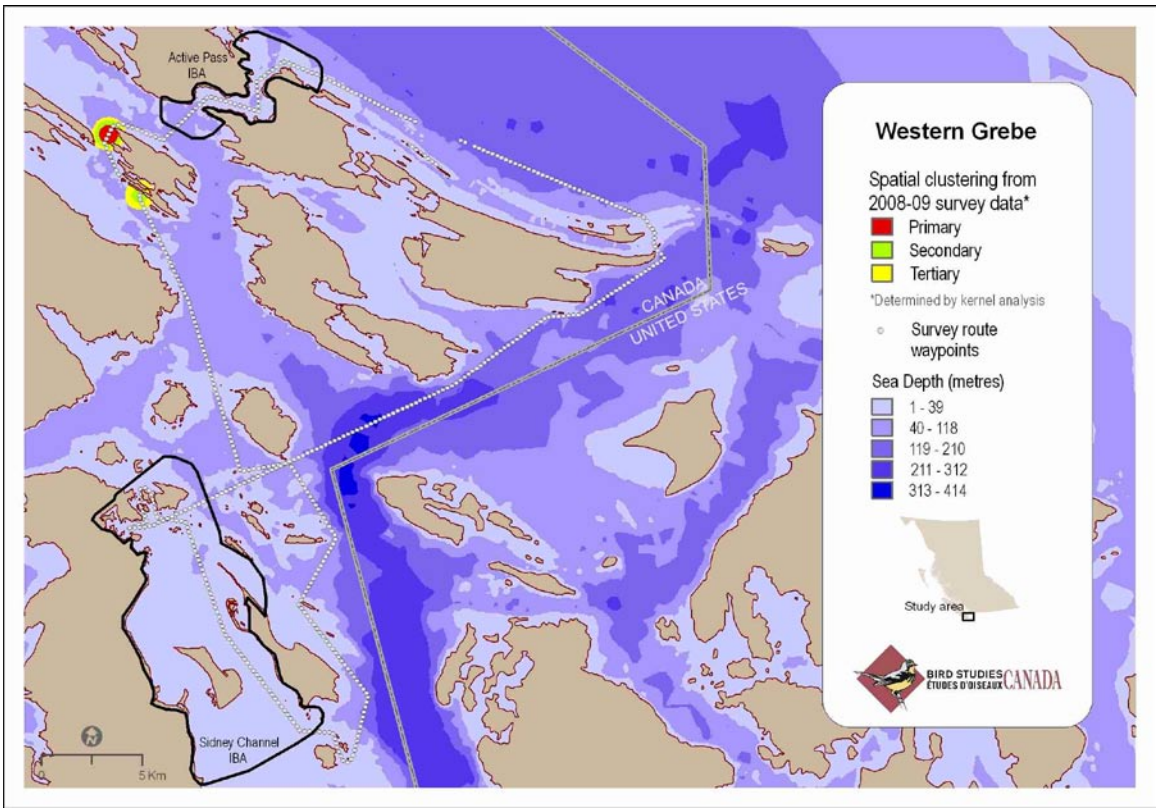


Fig 18. Spatial distribution (a) and seasonal abundance (b) of Eared Grebe in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Western Grebe *Aechmophorus occidentalis*

Conservation Status	Identified as highest priority on the COSEWIC Candidate List for status report production, review and ranking by COSEWIC (www.cosewic.gc.ca/eng/sct3/index_e.cfm#2). Red-listed by the province of British Columbia and assessed as a high priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	A non-breeding visitor to the Salish Sea, where an 85% decrease was reported between the 1975-84 and 1998-2007 periods, based on Christmas Bird Count data (Bower 2009). This decline is supported by the BC Coastal Waterbird Survey trend data for the 1999-2009 period (Badzinski et al 2006, Bird Studies Canada unpublished data), which suggest a 7% annual decline.
Southern Gulf Islands Status	Large flocks (thousands-strong) were recorded in the relatively recent past, particularly associated with herring spawn events in and around Ganges Harbour (I. Robertson pers. comm.). Clowater (1998) censused Western Grebes between 24 July 1994 and 22 October 1995, completing 57 boat-based surveys from Robert's Bay to Boatswain Bank and Mill Bay to Patricia Bay. Western Grebes arrive in Saanich Inlet in late August and later in Sansum Narrows, Vesuvius Bay, and Fulford Harbour. The total number of grebes seen by Clowater (1998) was over 3,500 birds. Butler (unpubl. notes) tallied 163 grebes at the western entrance to Porlier Pass on 11 October 1998.
Survey Records 2008-09	There was an influx into the area in February: about 400 were tallied in Trincomali Channel northeast of Prevost Island in early February, and about 160 were north-west of Prevost at the entrance to Ganges Harbour in late February, quite likely the same groups of birds. We observed seven birds off transect in the Georgeson Passage area between Saturna and Mayne Island on 22 October, an area that local birders reported seeing flocks of the species in previous years.
Conservation Issues	The western grebe in the region and islands is approaching a perilous state. A survey of former areas identified by Clowater (1998) would provide a better assessment of the size of the population in the GINPR and nearby areas. Changes in herring abundance in GINPR is key to their continued presence (Thierrault et al. 2009).
Recommendations	• COSEWIC's assessment of this species has made it a bird to watch for Parks Canada. Establishing an historical baseline for the Southern Gulf Islands and surrounding region, from which to attempt recovery, will be an important first step. • Investigate reasons for the apparent declines in the southern parts of the Salish Sea, in particular the demise of herring (Thierrault et al 2009).

a)



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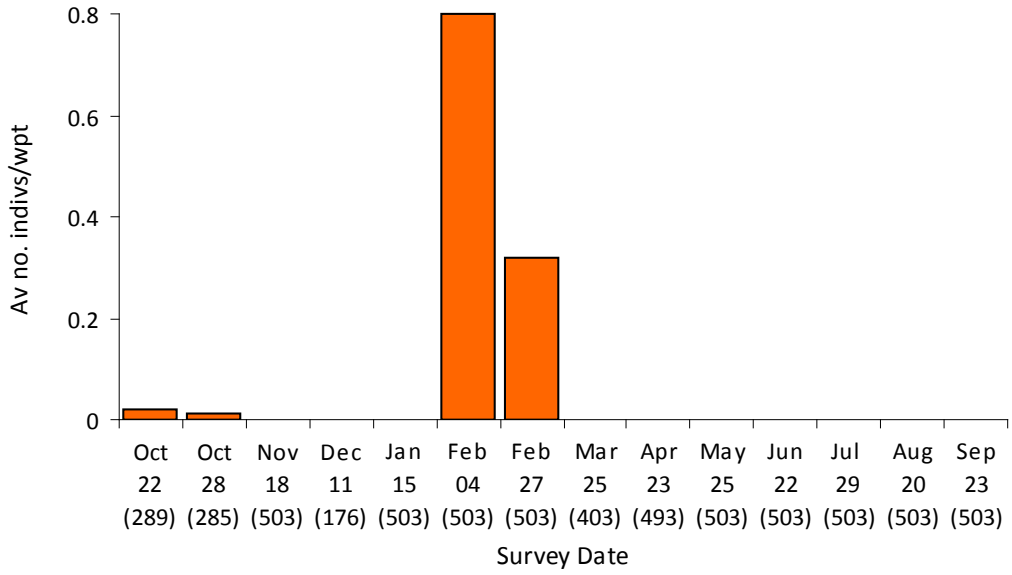
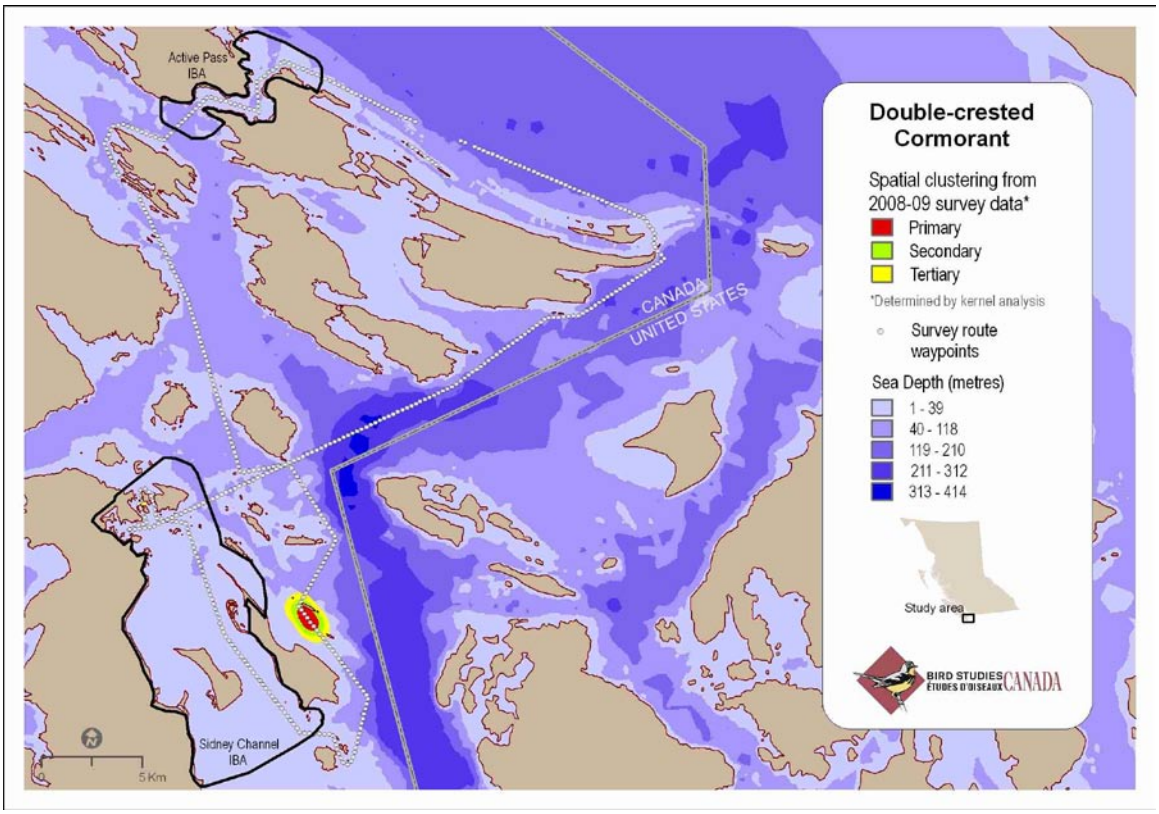


Fig 19. Spatial distribution (a) and seasonal abundance (b) of Western Grebe in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Double-crested Cormorant *Phalacrocorax auritus*

Conservation Status	Not at risk nationally, but Blue-listed by the province of British Columbia and assessed as a high priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	Since the 1980s (Vermeer et al. 1989), the breeding population in the Strait of Georgia plummeted by two thirds, perhaps due to eagle disturbance or food web changes (Chatwin et al 2002). However, the Coastal Waterbird Survey indicates that the winter population in the Georgia Basin has been increasing over the 1999-2009 period (BSC unpublished data).
Southern Gulf Islands Status	Common, relatively widespread and present year-round, with a large breeding colony on Mandarte. Double-crested Cormorant is widespread in the southern Gulf Islands. They roost on islands and channel markers in the inner islands and forage throughout the islands. This more generalist feeder compared to the other two cormorant species forages often over soft substrates such as the sandy bottom in Sidney Channel and Sidney lagoon. Historically, it has nested on many islands in the Southern Gulf Islands including Ballingal Islands, Trincomali Nature Reserve on Galiano Island, Canoe, Rose, Chain, Channel and Mandarte Islands (Vermeer et al. 1989, RWB). Numbers in the southern Gulf Islands grew from about 200 nesting pairs in the 1960s, to 500 in the 1970s, and 1,500 in the 1980s (Vermeer et al. 1989).
Survey Records 2008-09	The least numerous of the three cormorants, but present year-round, with a distinct peak in September, when numbers at the breeding colony on Mandarte totaled ~400 birds, including many juveniles. Widespread away from the colony, but the only place consistently supporting waypoint-encounters of >10 (year-round) were the Goudge-Coal-Kerr Island group. The BC Coastal Waterbird Survey confirms this widespread distribution during the non-breeding season, with regular counts from many sites, the maximum site-count being 21 along the north-east Mayne shoreline in February.
Conservation Issues	The mixed trends among survey methods suggest the species is mobile and many nests might be overlooked. Cormorants have undergone population declines on Mandarte from eagle disturbance but they might also be suffering from food shortages.
Recommendations	Continue to monitor the Mandarte breeding population and the non-breeding population around the Southern Gulf Islands shorelines through the BC Coastal Waterbird Survey.

a)



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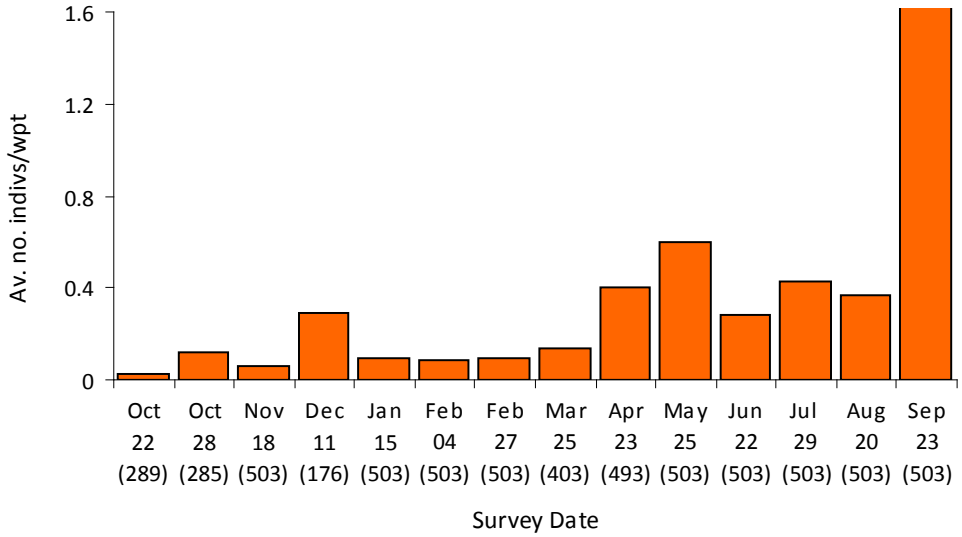
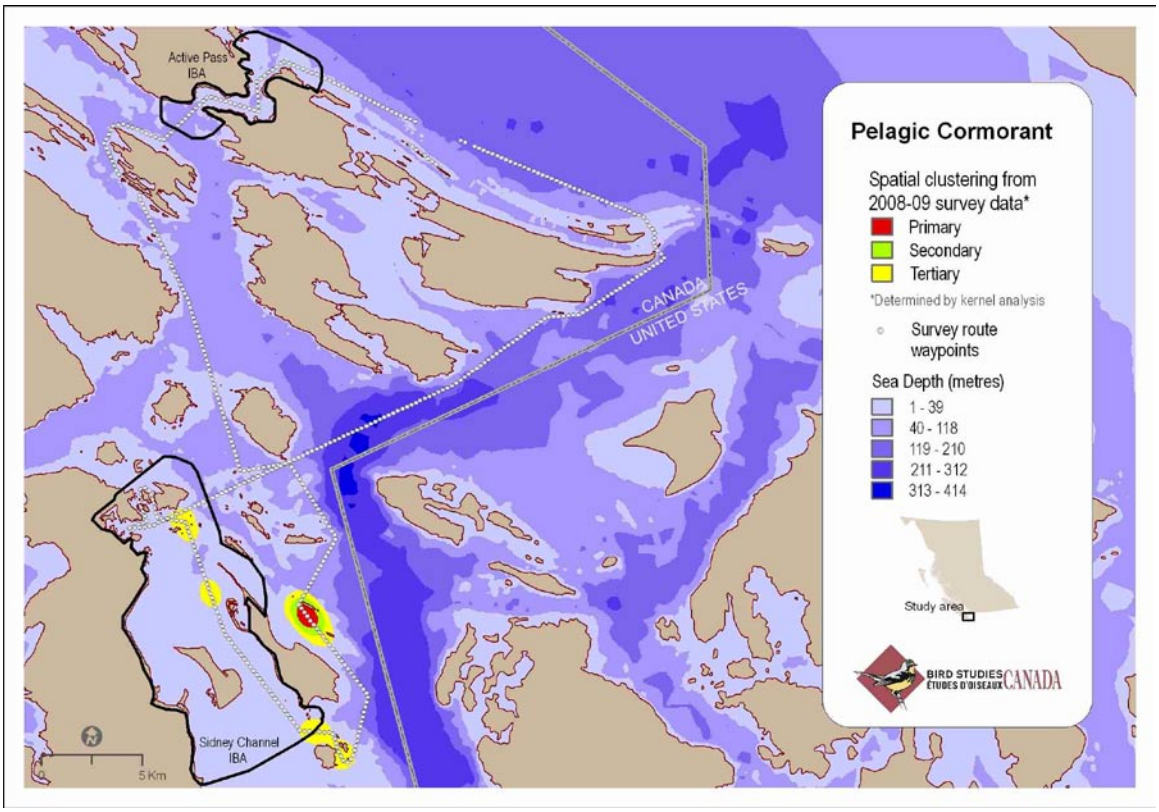


Fig 20. Spatial distribution (a) and seasonal abundance (b) of Double-crested Cormorant in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Pelagic Cormorant *Phalacrocorax pelagicus*

Conservation Status	Not at risk nationally; the *P. p. pelagicus* subspecies is Red-listed by the province of British Columbia and assessed as a high priority by the BC Conservation Framework (BC MoE 2008), but the subspecies that breeds in the Southern Gulf Islands is *P. p. resplendens* which is not listed by the province of British Columbia.
Ecology and Regional Trends	This cormorant is a benthic feeder, but also favours forage-fish species like sandlance. Regional and local studies of non-breeding populations in the Salish Sea indicate stable or increasing trends (Anderson et al. 2009, Bower 2009, Badzinski et al. 2006, BSC unpublished data). The Conservation Data Centre considers its long-term trend in British Columbia to be increasing (BC MoE 2008).
Southern Gulf Islands Status	The Pelagic Cormorant is the most widespread cormorant in the Gulf Islands. It resides year round in the islands foraging on small fish it captures by diving. This species prefers to forage over rocky and gravel substrates. Historically, the nesting population was about 700 to 1000 pairs between 1960s and 1980s (Vermeer et al. 1989) but in the 2000s, the numbers dropped significantly perhaps due to eagle disturbance or food web changes (Chatwin et al. 2002).
Survey Records 2008-09	With ~400 waypoint-encounters and ~3,100 individuals, this was the commonest cormorant encountered on this survey (Fig. 11b). The largest concentrations away from the breeding colony on Mandarte comprised 20-80 birds, mostly recorded around the Darcy Islands, Halibut Island, the Kerr-Dock group and feeding aggregations in Sidney Channel. At least 400 individuals were counted in the Mandarte breeding colony, which is driving the primary area clustering in Fig 11a. The BC Coastal Waterbird Survey recorded small numbers from localities throughout the Mayne, Pender and south-east Saltspring coastlines, with no single monthly site-count exceeding 15 individuals (BSC unpublished data).
Conservation Issues	This species appears to be faring well, both locally and regionally, and is presumably adaptable in its foraging to exploit other food sources than forage-fish. Cormorants have undergone population declines on Mandarte from eagle disturbance but they might also be suffering from food shortages.
Recommendations	• Continue to monitor the Mandarte breeding population, and the local Southern Gulf Islands population, through surveys like the Coastal Waterbird Survey.

a)



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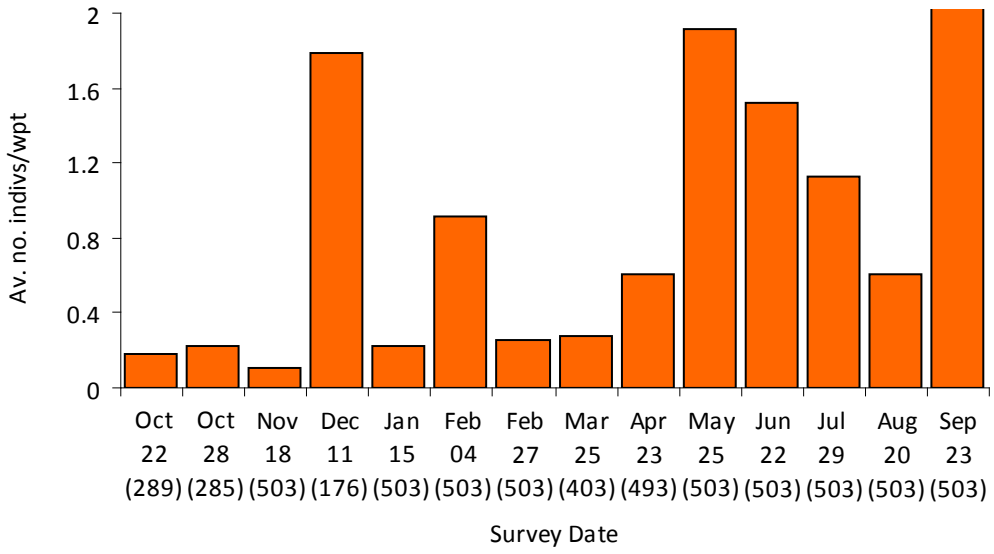


Fig 21. Spatial distribution (a) and seasonal abundance (b) of Pelagic Cormorant in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Brandt's Cormorant *Phalacrocorax pencillatus*

Conservation Status Not at risk nationally, but Red-listed by the province of British Columbia and assessed as the highest priority by the BC Conservation Framework (BC MoE 2008).

Ecology and Regional Trends This cormorant is more of a mid-water feeder and forage-fish specialist than the other cormorant species. The Conservation Data Centre considers its short-term trend in British Columbia to be unknown (BC MoE 2008). A 40% decline was reported between the 1975-84 and 1998-2007 periods, based on Christmas Bird Count data from the Salish Sea (Bower 2009).

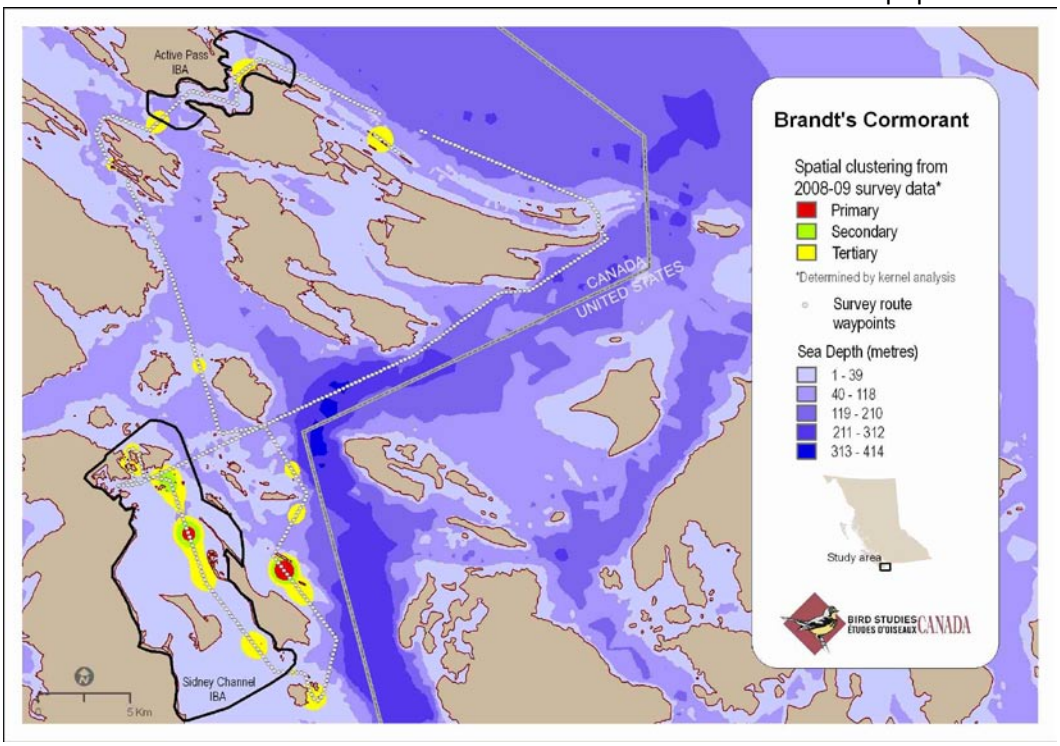
Southern Gulf Islands Status Brandt's Cormorant was an abundant visitor to the southern Gulf islands. Active Pass formerly supported large numbers of this species (in the thousands), which exceeded global thresholds and triggered Important Bird Area designation (www.ibacanada.com). Brandt's Cormorant is a species that has undergone a rapid decline in numbers in the region. Thousands were present in spring in Active Pass in the 1960s and 1970s coinciding with the spawn of Pacific herring (Edwards 1965, Vermeer 1977) but the species seldom occurs in three-figure numbers there now. Large numbers were also present in late summer. Drent et al (1964) reported up to 1,000 Brandt's cormorants roosting on Mandarte Island in August. Large numbers were present in late summer between 1987 and 1994. Butler's unpublished field notes from Sidney Island and environs indicated that the species was very numerous in Sidney Channel, with year-maxima between 1986 and 1994 of 60, 600, 450, 200, 800, 90, 600 and 200 birds. He recorded none from 1995 to 2000, and in 2001 just a single sighting of one bird. No monthly site-counts from the BC Coastal Waterbird Survey over the past decade (1999-2009) have exceeded 50 individuals.

Survey Records 2008-09 Approximately 115 waypoint-encounters with 1,471 birds were recorded. Highest survey-counts occurred in November (230), February (250, 338) and September (322), and the maximum waypoint-encounters were feeding aggregations (likely gathering to feed on sandlance) of 248 in Sidney Channel in March (smaller foraging groups of 20-60 were regularly recorded in Sidney Channel from September-March), and 200 (with other cormorants) off Mandarte in September. Feeding and roosting flocks of up to 60 were also recorded frequently around the D'Arcy Island group and rocky islets off the south end of Sidney Island. Active Pass formerly supported large numbers of this species (in the thousands); the largest flock we encountered there numbered just 20 birds. However, 1,500-2,000, most in mid-moult (flight feathers), were estimated on Mandarte and adjacent rocky islets on 27 October 2008 (L.K. Blight & P. Arcese in litt. 2009). Of 17 widely scattered monthly site-counts of the species recorded by the BC Coastal Waterbird

Survey during the period, the maximum count was 24 individuals.

Conservation Issues There appears to have been a substantial long-term decline in the Southern Gulf Islands, especially evident around Active Pass IBA.

Recommendations
- Investigate reasons for local declines in the Southern Gulf Islands, likely related to forage fish abundance.
- Continue to monitor the local Southern Gulf Islands population.



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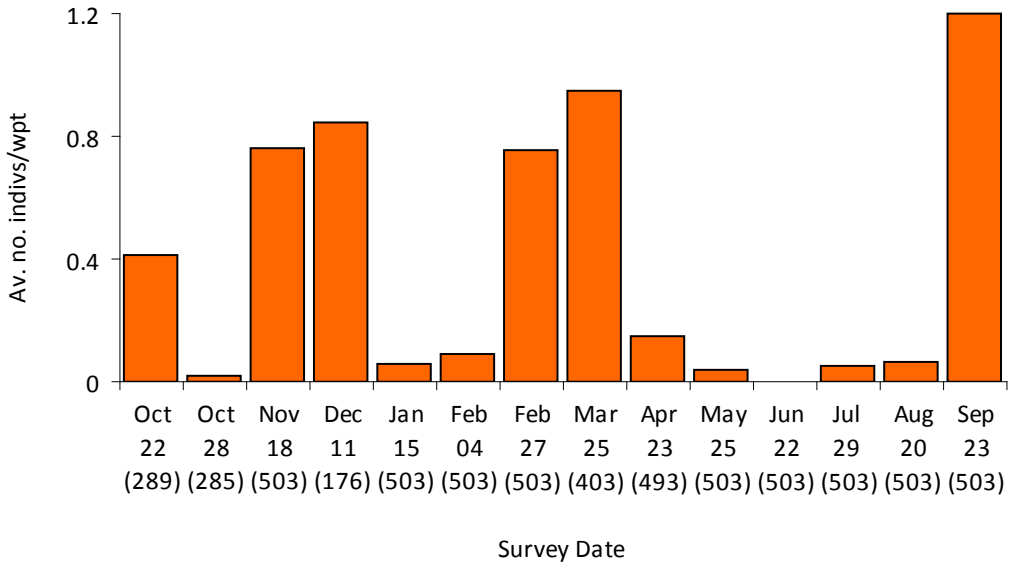


b)

Fig 22. Spatial distribution (a) and seasonal abundance (b) of Brandt's Cormorant in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Great Blue Heron *Ardea herodias*

Conservation Status

The coastal subspecies *A. h. fannini* is listed as SARA/COSEWIC – Special Concern; if taxonomic reviews currently underway split *A. h. fannini* into two subspecies, up-listing to Threatened may be recommended, based on a continuing decline (RWB). *A. h. fannini* is Blue-listed by the province of British Columbia and assessed as a high priority by the BC Conservation Framework (BC MoE 2008).

Ecology and Regional Trends

The Conservation Data Centre considers its short-term trend in British Columbia to be either stable or undergoing a 10-30% decline (BC MoE 2008). The BC Coastal Waterbird Survey indicates a significant declining trend in the Strait of Georgia population over the decade 1999-2009 (BSC unpublished data).

Southern Gulf Islands Status

The Great Blue Heron resides year round in the Gulf Islands. Forty-one nests were counted in the forest on Sidney Island at the east end of the lagoon in 1985, and 86, 103, 99 44 and 14 nests were used in each subsequent year (Butler 1997). The colony abandoned in 1990 but herons continued to forage in the lagoon each summer. It formed n a woodlot near Saanichton in the early 1990s and used that site for several years. A colony of about 20 pairs established at the end of Harbour Road in Sidney in the early 2000s. A few scattered pairs nest on Pender Island. Herons have historically nested throughout the region including Cowichan, Crofton, Gabriola, Genoa Bay, Ladysmith, Mandarte, Prevost, Salt Spring, Saturna, Secretary and Swartz Bay (Butler 1997). Heron nesting success has dropped significantly in the last decade to a point where biologists are concerned whether the Vancouver Island population is sustainable. The BC Coastal Waterbird Survey regularly records herons around Pender and Mayne Islands, with a maximum site-count of 15 coming from Thieves Bay in November 2004. All other Coastal Waterbird Survey counts of >5 individuals are from the Mayne shoreline.

Survey Records 2008-09

Of the 26 waypoint-encounters, which recorded 31 individuals, half were in August and September. Almost all records came from the Coal-Goudge-Ker-Little Group Islands, Sidney Channel and Prevost Island. Thirty BC Coastal Waterbird Survey records for the same 2008-09 period totaled 57 individual birds, derived from eight sites on Saltspring, Mayne and Pender Islands.

Conservation Issues

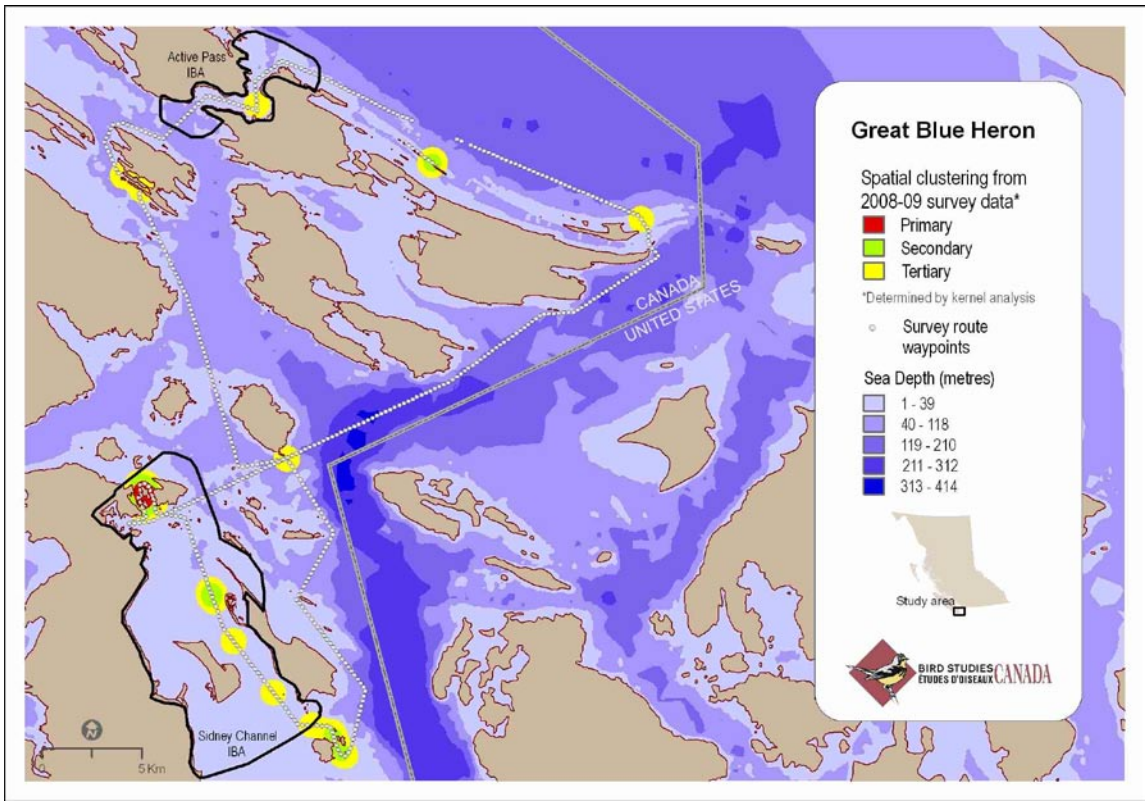
Disturbance is a key issue for this bird, both from eagles and secondarily from humans near their colonies (Vennesland and Butler 2004). The colony in the housing complex on Harbour Road, Sidney, is testament to the tolerance of some herons to humans when left unmolested. In contrast, herons nesting in the forest on Sidney Island were far less tolerant, flushing when humans walked beneath their nests. In addition, undisturbed foraging areas such as the eelgrass bed on Sidney Island are very important.

Our survey of the marine habitats is not adequate to census the Great Blue Heron. Nevertheless, we have extensive knowledge of the species in the GINPR from Butler's research (Butler 1997). The subspecies occupying the south coast of BC is undergoing a population retraction from Vancouver Island. If the current trend continues, the subspecies will likely be designated threatened. Colonies have occurred in several locations in the southern Gulf Islands including Sidney Island, Saanichton, Coal Harbour, Prevost Island, and Saltspring Island. Individual nests are present on Pender and Mayne Island. Eelgrass meadows and intertidal flats on Sidney Island, Roberts Bay, and Tsehum Harbour are used by foraging herons. They also hunt along the rocky shores of all the islands. Quiet forested areas are important habitats for nesting herons. A population estimate in winter when the birds are on territories might be considered. The survey would have to trace the shoreline of the Gulf Islands and could be combined with a census of several other shoreline species (turnstone, oystercatcher, surfbird, seaducks) not well served by our largely offshore route.

Recommendations

- Educate and control human activities near colonies when the herons are nesting, and prevent loud novel activities, where possible, near colonies during the nesting season from February to July.
- A coastal shoreline survey to identify foraging areas during the nesting (May-July) and non-breeding seasons (October-February) would define important areas to herons. There are likely a limited number of suitable winter heron territories, so their presence will key suitable habitats.

a)



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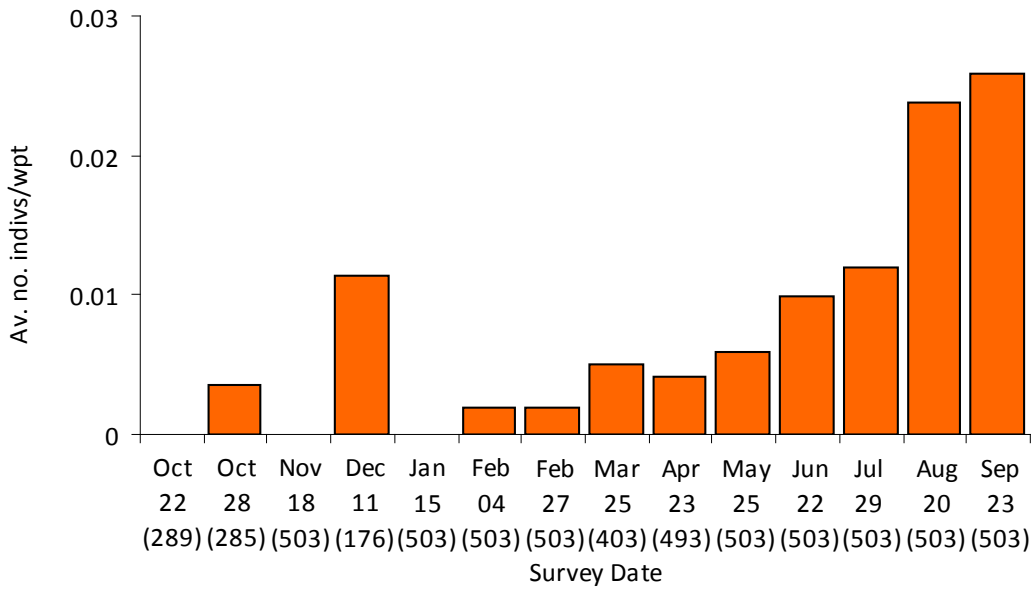


Fig 23. Spatial distribution (a) and seasonal abundance (b) of Great Blue Heron in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses). Note that transect sightings include herons in flight and may not accurately represent the habitats they require.

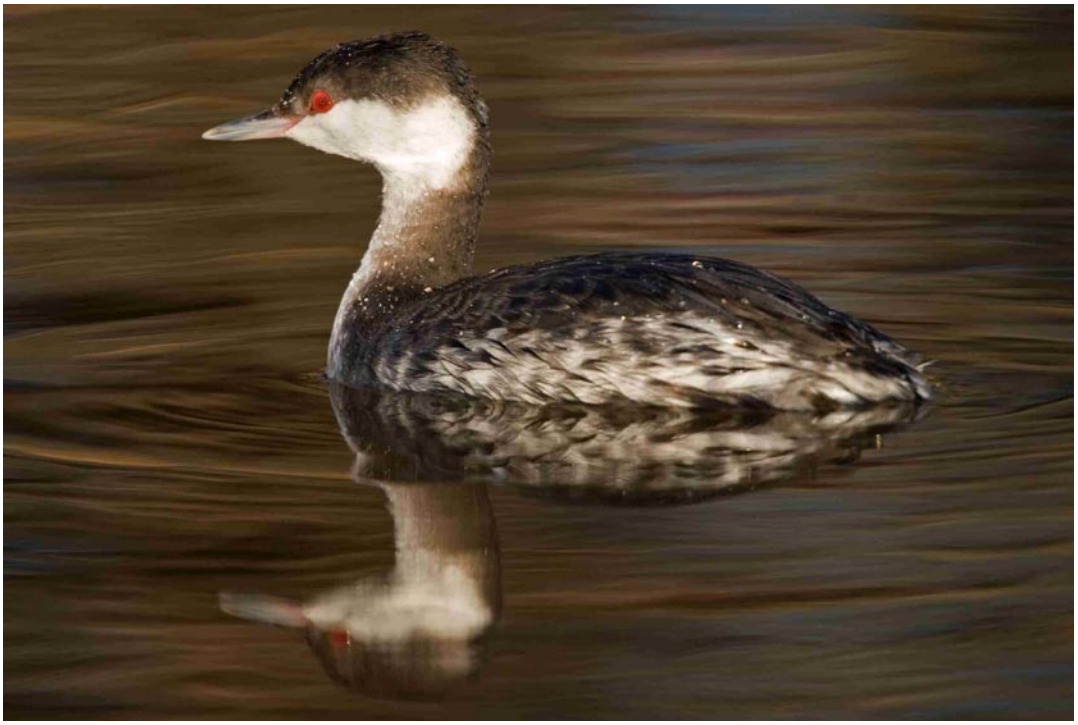


Fig. 24a. Horned Grebe *Podiceps auritus* - recently recommended by COSEWIC for listing as Special Concern under the Species at Risk Act, this small grebe is a widespread non-breeding (chiefly winter) visitor to the Southern Gulf Islands and surrounding region (Tom Middleton, Pacific Wildlife Foundation).

Fig. 24b. Great Blue Heron *Ardea herodias fannini* – listed as Special Concern under the Species at Risk Act, this bird particularly favours eelgrass beds and intertidal flats for foraging in the Southern Gulf Islands and surrounding region Tom Middleton, Pacific Wildlife Foundation).

Canada Goose *Branta canadensis*

Conservation Status

Not at risk nationally or provincially, with the exception of the subspecies *B. c.* occidentalis is Blue-Listed by the province of British Columbia, and assessed as high priority by the BC Conservation Framework (BC MoE 2008).

Ecology and Regional Trends

The Canada Goose on the BC coast is a mix of native populations that are migratory and an introduced population that resides year round. The migratory population regularly flies over the south BC coast en route to winter quarters in Oregon. Some stop on migration on the Fraser River delta but most make high altitude flights over the region. The resident Canada Goose was introduced into the Fraser River Delta in the early 1970s to improve hunting and public attention to wetlands. Geese from Saskatchewan, Ontario and Minnesota were the source of the transplants. From a few hundred geese grew the thousands that we see along the south coast today. The BC Coastal Waterbird Survey trend for the species as a whole in the Georgia Basin is a 7% annual increase (BSC unpublished data).

Southern Gulf Islands Status

The goose has become a widespread breeding species in the Gulf Islands. Beginning in the 1980s, geese nested on small islands in the Gulf Islands and foraged along its shores. RWB reported pairs of geese on Sidney in 1987 and a family with 17 young in 1988. A nest was found on the Dock Islands in 1996. He saw flocks of 100-200 geese in the summer of 1999 using Sidney Lagoon as a night roost. Grassy areas in school yards, municipal parks and residential lawns, and intertidal areas have become feeding sites. Favourite nesting sites in the GINPR are many small islands but larger islands are also used.

Survey Records 2008-09

We recorded 53 waypoint-encounters with ~350 individuals. Most encounters were with singles and pairs, from widely scattered locations. Flocks >10 birds were regularly recorded from the Dock-Kerr Island group, Sidney Channel, and one record of 45 birds came from the south shores of Tumbo Island. BC Coastal Waterbird Survey data from the period show that the species is widespread and common throughout the area during the September-April period when the survey is conducted.

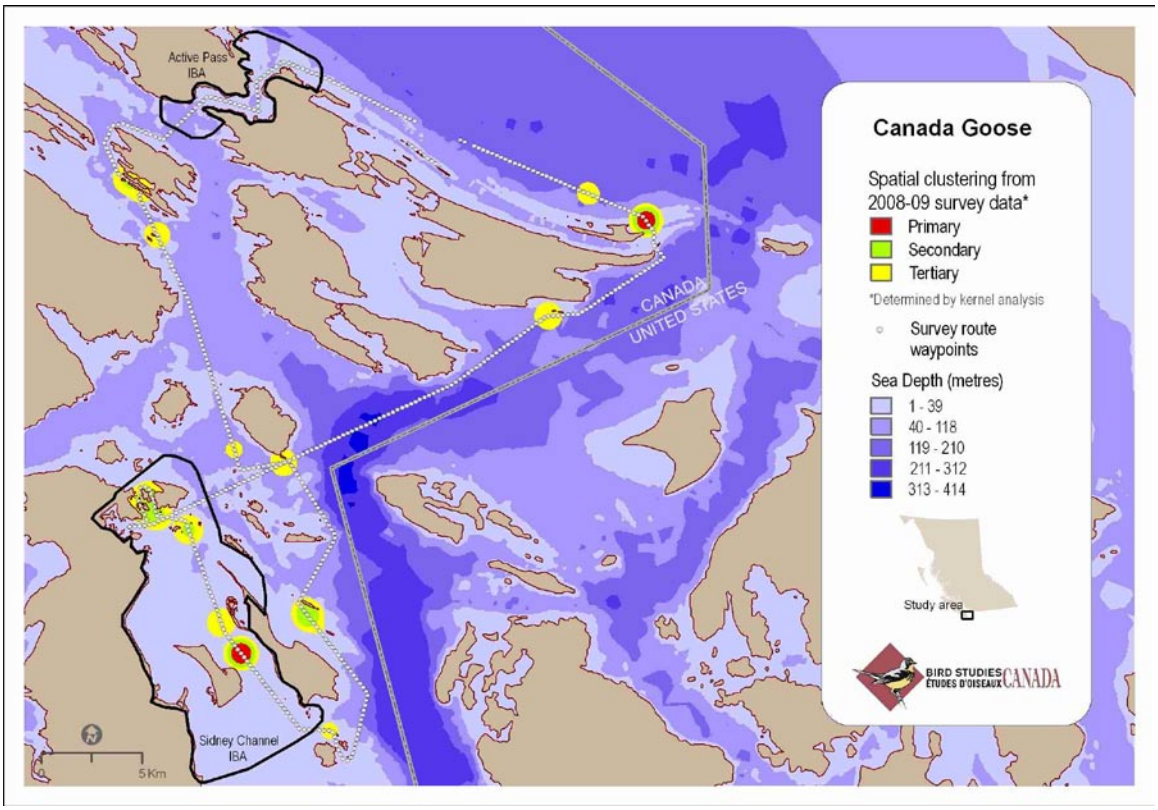
Conservation Issues

Grazing, trampling and erosion of Threatened plant communities, and facilitation of invasive grass colonization and domination of short sward plant communities through excessive nitrogenous nutrient input from faeces are considered to be major conservation issues within the Southern Gulf Islands (Best & Arcese 2009).

Recommendations

Explore options to reduce the ecological footprint of the non-native breeding population of Canada Geese within the Southern Gulf Islands.

a)



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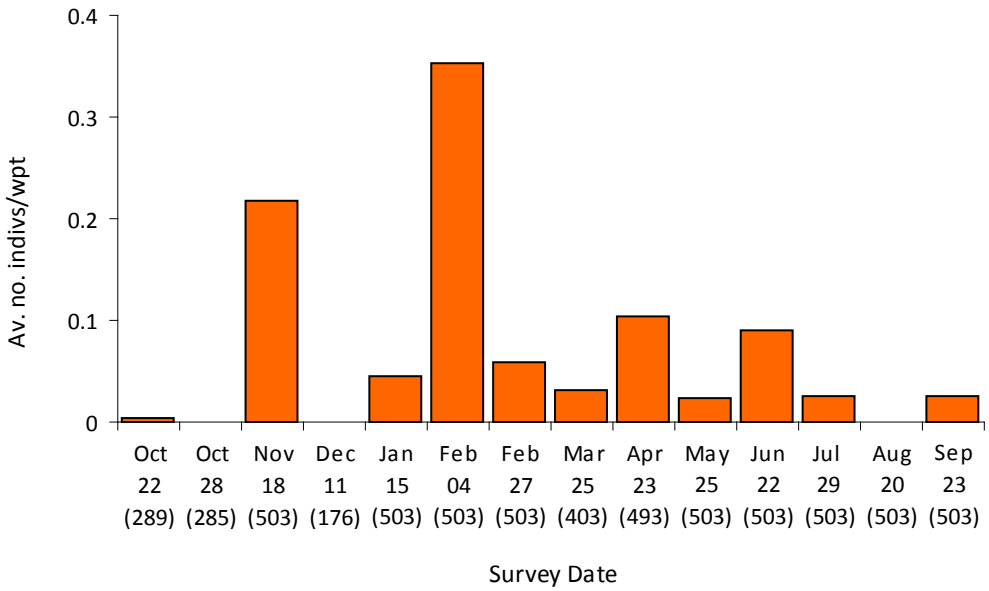


Fig 25. Spatial distribution (a) and seasonal abundance (b) of Canada Goose in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Brant *Branta bernicla*

Conservation Status

Not at risk nationally or provincially, but assessed as a high priority by the BC Conservation Framework (BC MoE 2008).

Ecology and Regional Trends

Brant is a coastal goose that resides along the Pacific Coast in winter and breeds in the Arctic in summer. A pale-bellied race is an uncommon winter visitor to northern Puget Sound and southern Strait of Georgia, breeding in the eastern Arctic and is part of the Atlantic Flyway population including northern Europe. This was likely the brant that was very numerous in the Strait of Georgia in the 1920 and 1930s. Most Brant seen in GINPR winter in Mexico and breed in the western Arctic, although an increasing number appear to be wintering locally in the Salish Sea. Numbers of Brant using the Parksville-Qualicum area of Vancouver Island in spring appears to be declining, but the Fraser River Delta wintering population has been steadily increasing from virtually nothing in the mid 1980s (BSC unpublished data and A. Breault, Canadian Wildlife Service).

Southern Gulf Islands Status

Migratory Brant pass through the Gulf Islands from February to May. RWB was periodically on Sidney Island in early spring where he recorded 461 on 4 April 1986, 156 on 11 April 1987, 388 on 22 April 1988, 712 on 10 April 1989 and 220 on 8 May 1996. Three thousand (3,000) were recorded in spring 1995, which triggered continental Important Bird Area status for Sidney Channel (www.ibacanada.com). These numbers suggest that substantial numbers of Brant used Sidney Island on migration.

Survey Records 2008-09

Eight waypoint-encounters were made between February and May, with one outlier in December, all from the Sidney Channel-Haro Strait-Prevost Passage area, most of birds flying through, with a maximum flock size of 200 in March. The December and February records indicate that small numbers may be using the area in winter. There were no BC Coastal Waterbird Survey records from the Southern Gulf Islands during the period; Sidney Island is not covered by the BC Coastal Waterbird Survey.

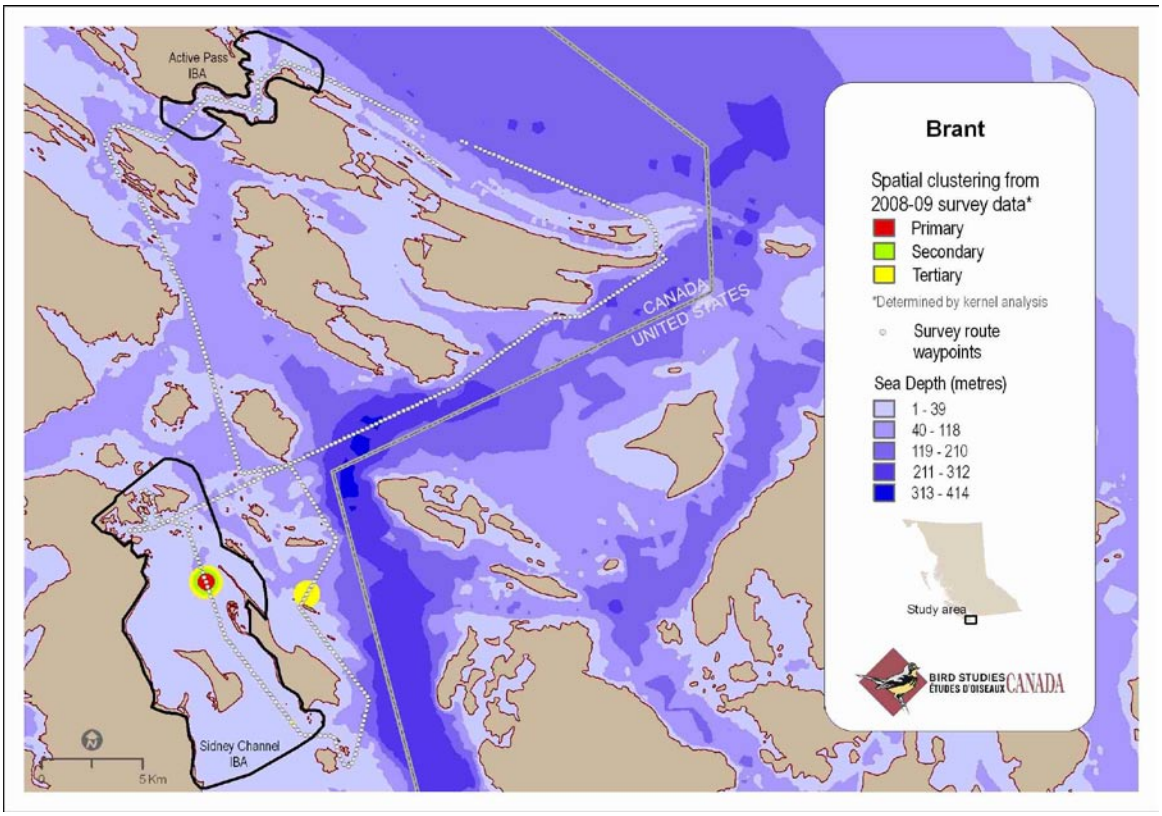
Conservation Issues

Brant are very susceptible to disturbance, and their preponderance for the habitats of Sidney Island lagoon and adjacent areas, which are all subject to relatively high human use, make this a potentially important issue for the species locally. Identification of brant to see if they are pale or dark bellied birds would help delineate if the birds are part of the eastern or western Arctic.

Recommendations

- Implementation of measures to minimize disturbance around Sidney Island lagoon and environs during the February-May period.

a)



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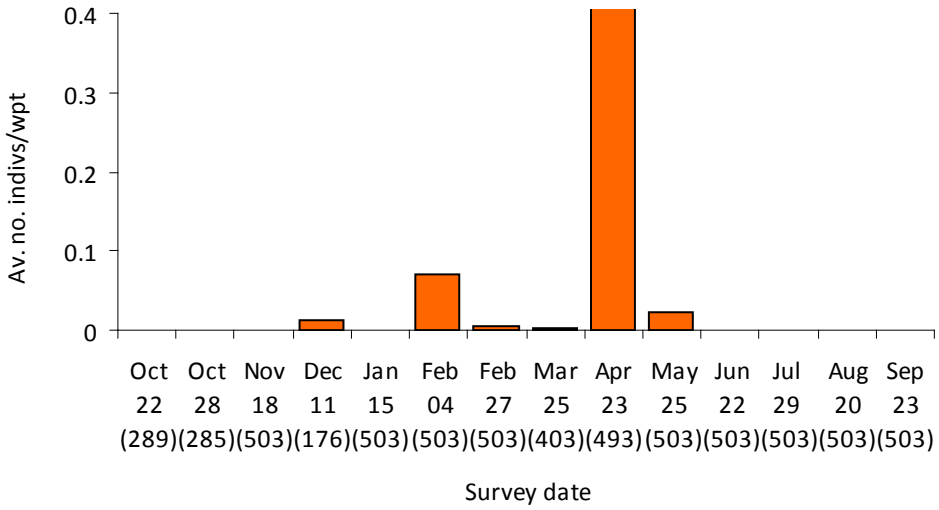
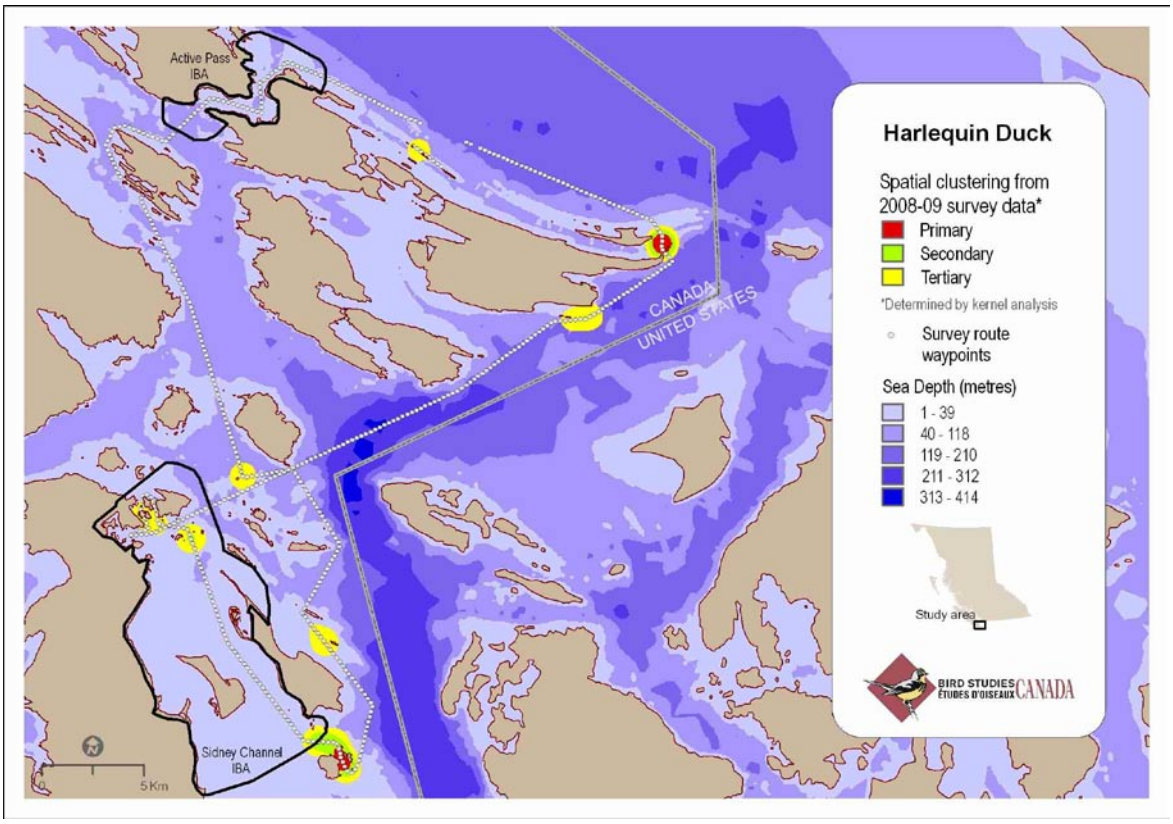


Fig 26. Spatial distribution (a) and seasonal abundance (b) of Brant in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Harlequin Duck *Histrionicus histrionicus*

Conservation Status	The western population is not at risk nationally nor provincially, but it is assessed as the highest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	In coastal regions, this omnivorous duck favours rocky shorelines and islets, with specific groups of individuals showing strong site-fidelity over long time periods to specific stretches of coast, even patches of rocks. The BC Coastal Waterbird Survey indicates a shallow declining trend in the Strait of Georgia population over the decade 1999-2009 (BSC unpublished data). A 7% increase was reported between the 1975-84 and 1998-2007 periods, based on Christmas Bird Count data from the Salish Sea (Bower 2009). Males are absent from the coast for a brief period in May and June when they leave to breed along mountain streams. Females are absent from May until August or September when they are breeding. Molting occurs in summer along the coast including isolated islets in the Southern Gulf Islands.
Southern Gulf Islands Status	A non-breeding visitor to the islands, small flocks of Harlequins regularly use the same rocky shores and islets from year to year.
Survey Records 2008-09	We recorded 51 waypoint encounters with 250 individuals, at eight locations. Most-used sites were the D'Arcy Islands (highest count 14 individuals), the Coal-Goudge-Kerr Islands group (highest count 14 individuals), and on Halibut Island (highest count 6 individuals). Boiling Reef regularly supported flocks, and the largest group recorded on the survey (21 on February 27). Small groups were also regularly encountered on Imrie Island, the Belle Chain and the Java Islets. The BC Coastal Waterbird Survey regularly records small numbers (up to ten individuals) at two additional locations, the Brook's Point area of Pender Island, and Bennett Bay on Mayne Island.
Conservation Issues	The apparent decline shown by BC Coastal Waterbird Survey data over the past decade may be within the long-term natural variation of the population. Harlequins are flightless during the feather molt in July and August.
Recommendations	• Continue to monitor the local GINPR population, and better understand linkages with breeding areas, which may include other National Parks within British Columbia's interior, and into Alberta. • Identify islands used for molting on the Gulf Islands and minimize human disturbance there.

a)



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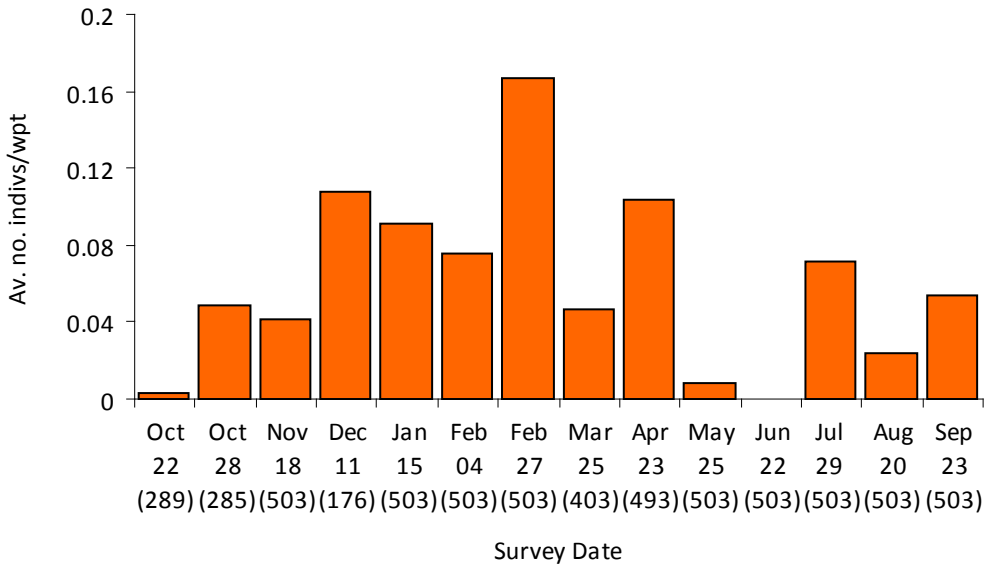
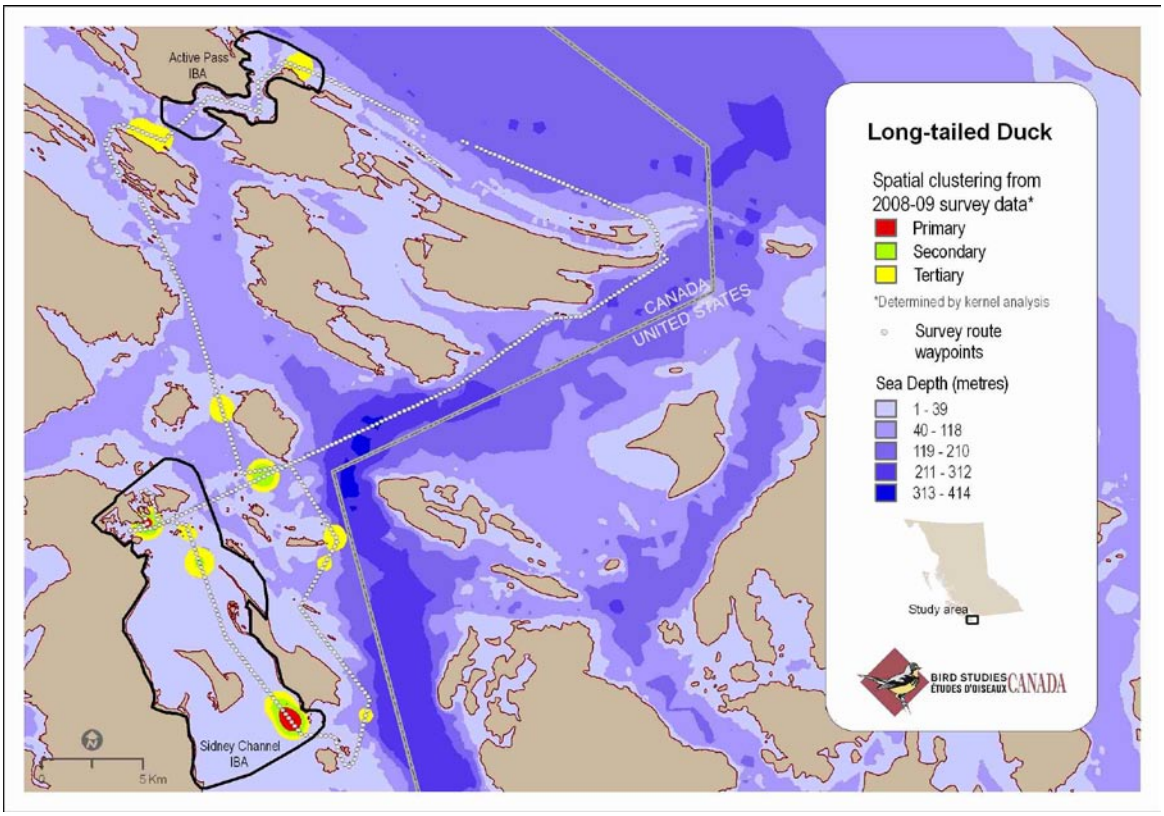


Fig 27. Spatial distribution (a) and seasonal abundance (b) of Harlequin Duck in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Long-tailed Duck *Clangula hyemalis*

Conservation Status	Not at risk nationally; currently assessed as "unknown" provincially, and assessed as the highest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	This charismatic sea duck typically inhabits sea areas >1km from shore, clouding interpretation of assessments of its population from shoreline-based surveys. Large declines have been reported from aerial, shoreline and boat-based surveys in Puget Sound in Washington between the late 1970s and early 2000s (Bower 2009), and there is a longer-term international declining trend; for example, Christmas Bird Count data from 1959 to 1988 show an annual decline of ~5%. The BC Coastal Waterbird Survey trend appears to be stable over the past decade (1999-2009; BSC unpublished data).
Southern Gulf Islands Status	A non-breeding visitor to the Southern Gulf Islands, but only infrequently recorded from land. Ganges Inner Harbour regularly supported a population of up to 50 during the winters of 1999-2001 (BSC unpublished BC Coastal Waterbird Survey data), but was not surveyed frequently thereafter.
Survey Records 2008-09	We tallied 28 waypoint-encounters with 111 individuals between October and April. Records were widely spread throughout the area, with most encounters comprising small numbers in the wider channels, including Sidney, Swanson, Prevost Passage and Haro Strait. The largest flock recorded was 17 in Sidney Channel, and only two other flocks exceeded 10 birds. None were recorded by the BC Coastal Waterbird Survey during the period.
Conservation Issues	The major long-term declines are a cause for concern.
Recommendations	• Investigate reasons for declines and whether the effects are as strong locally in the Southern Gulf Islands. • Continue to monitor the local Southern Gulf Islands population and where possible other areas through boat-based surveys.

a)



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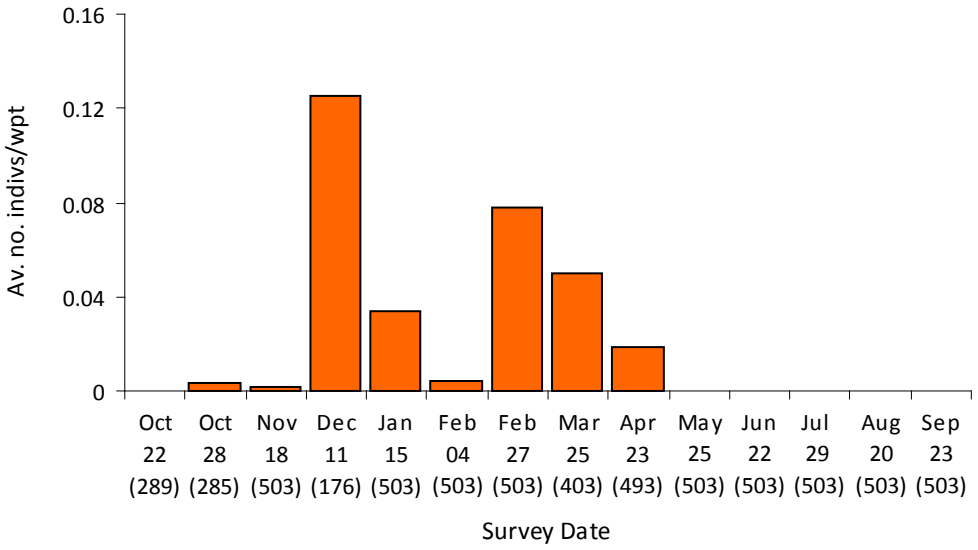
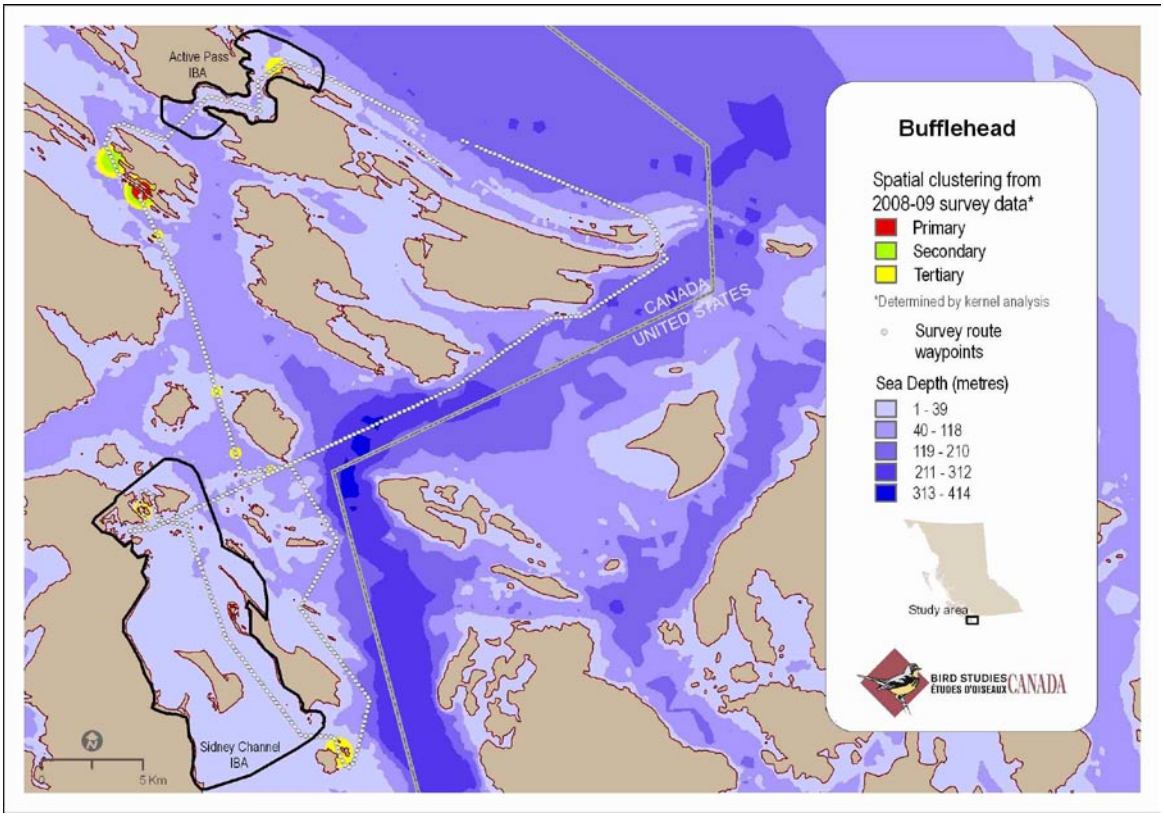


Fig 28. Spatial distribution (a) and seasonal abundance (b) of Long-tailed Duck in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Bufflehead *Bucephala albeola*

Conservation Status	Neither at risk nationally nor provincially, and assessed as low priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	This small, invertebrate-feeding diving duck shows no consistent trend pattern from the various regional surveys, with local declines indicated in some parts of Puget Sound (Anderson et al. 2009), and increases in other parts of Puget Sound (Bower 2009), and no apparent trend in the Georgia Basin, BC, over the 1999-2009 decadal period (BSC unpublished data). The impression is that this species regional population is generally stable.
Southern Gulf Islands Status	A common and widespread winter visitor to the Southern Gulf Islands, returning with extraordinary precision, on the 288th day of the year for most of the last 40 years, to Shoal Harbour Migratory Bird Sanctuary (Finley 2008a), and presumably the wider Southern Gulf Islands region. The timing of their autumn migrations does not appear to have changed in the last half of the twentieth century, consistent with evidence that freeze-up has not advanced. The Buffleheads' daily routines are equally precise, departing their coastal feeding areas for offshore roosting grounds in the Salish Sea and Gulf Islands very punctually after the onset of Civil Twilight Time (CTT), a phenomenon that may have evolved in response to predation pressure from Peregrine Falcons (Finley 2008b).
Survey Records 2008-09	We recorded 38 waypoint-encounters with 222 individuals, concentrated in and around the inlets on the west side of Prevost in late winter, mirroring Barrow's Goldeneye's pattern of occurrence. BC Coastal Waterbird Survey data show this area has supported concentrations in the past also, with peaks in abundance in February, and a high count in Annette Inlet of 248 in February 2000 (BSC unpublished BC Coastal Waterbird Survey data). Other key areas for the species in the Southern Gulf Islands are Village Bay – Bennett Bay on Mayne Island, where monthly counts of up to 90 are tallied most winters, and Lyall Harbour on Saturna. The coastline of the Saanich Peninsula supports a large wintering population (in the thousands), with Roberts Bay regularly supporting the largest site-counts, with an average peak of ~250 most winters (BSC unpublished BC Coastal Waterbird Survey data).
Conservation Issues	None known.
Recommendations	• Continue monitoring using existing surveys like the Coastal Waterbird Survey. • The Bufflehead appears on the Sidney coat of arms, and therefore has potential as a focus for outreach initiatives.

a)



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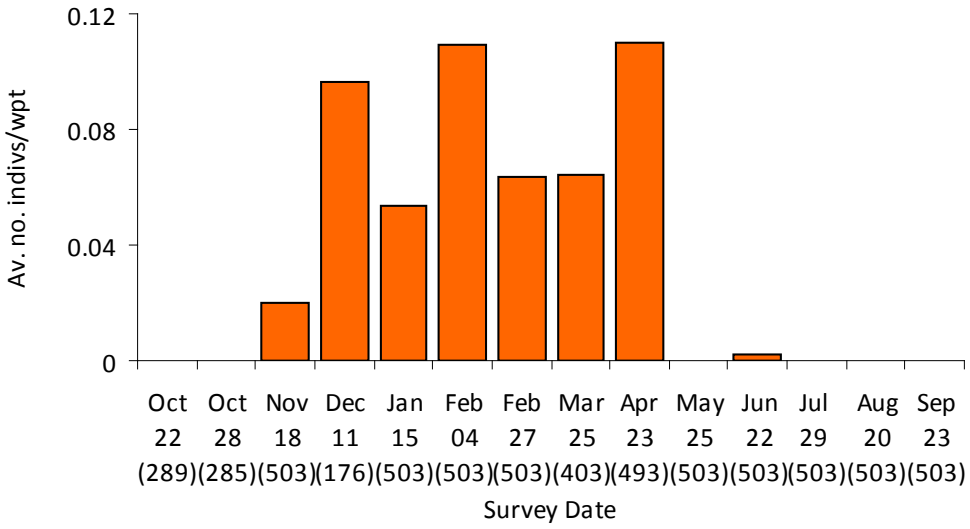


Fig 29. Spatial distribution (a) and seasonal abundance (b) of Bufflehead in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Surf Scoter *Melanitta perspicillata*

Conservation Status Not at risk nationally, but Blue-listed by the province of British Columbia; assessed as low-moderate priority by the BC Conservation Framework (BC MoE 2008).

Ecology and Regional Trends This shellfish feeder shows conflicting regional trends from different surveys. Declines have occurred in the more developed areas of Puget Sound since the 1970s and across the Puget Sound region as a whole (Bower 2009), but increases are apparent locally, e.g. in Padilla Bay (Anderson et al. 2009). The BC Coastal Waterbird Survey shows no trend over the 1999-2009 decadal period (BSC unpublished data).

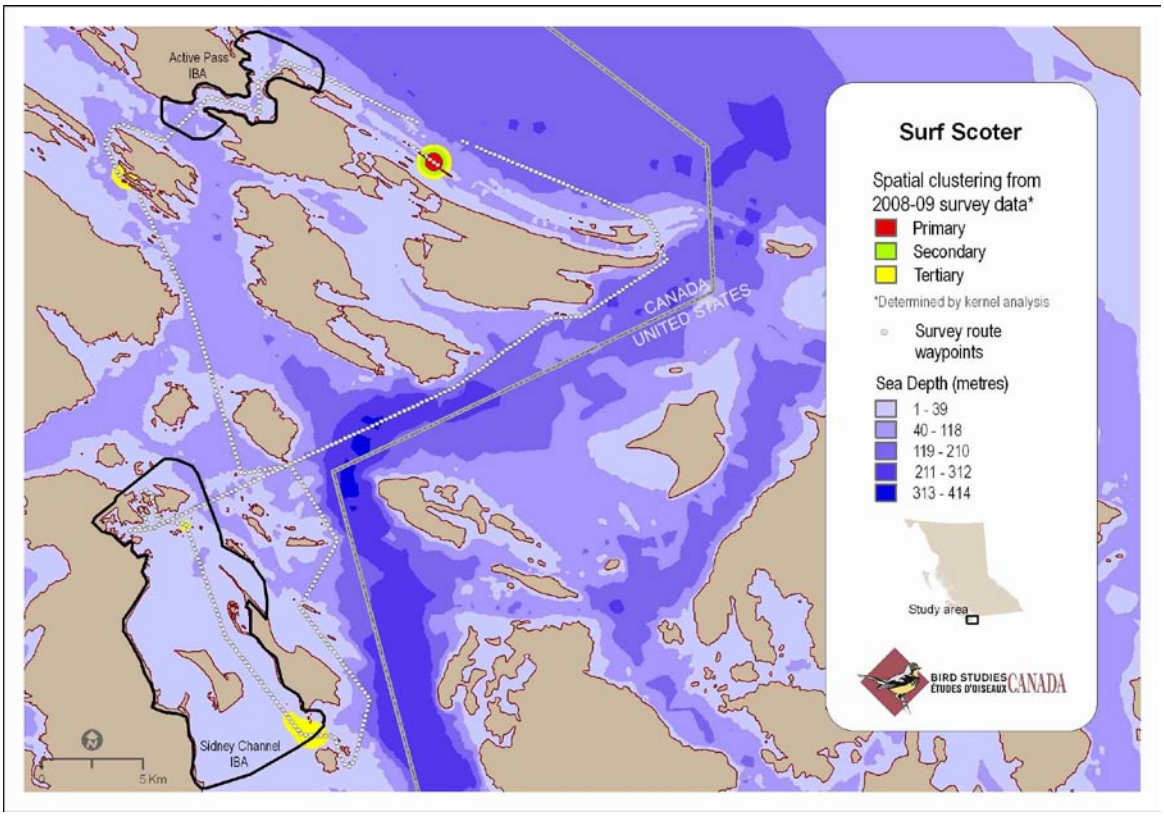
Southern Gulf Islands Status The Surf Scoter is one of several sea ducks that were historically abundant in the Gulf Islands. Scoters assemble in large flocks to feast on herring eggs each spring (Lok et al. 2008). A herring spawn event in Ganges Harbour in 1978 attracted 5,200 scoters (Carson and Howsam 1978 in Campbell et al. 1990) and 3,000 were counted at Thetis Island in 1979. In summer, small non-breeding flocks of 50 to 150 are present in the southern Gulf Islands and in winter flocks of 400 to 1,200 were reported in the late 1970s and early 1980s (Campbell et al. 1990). On 13 October 1997, an estimated 3,800 to 4,800 preying heavily on mussels along the east shore of Cabbage and Tumbo Islands, and observed flocks of <100 birds and once as many as 150 scoters on Sidney Island between March and May 1986 -1996 (RWB unpublished data).

Survey Records 2008-09 We recorded 54 waypoint-encounters with 1,146 individuals. Maximum survey counts were made in April (494) and October (264 on one date, although only five were recorded six days later), with no records between May and July. Most counts of >10 birds were made in Sidney Channel, but the highest count (450) was of a feeding flock around the Belle Chain Islets in April. The only other location supporting flocks of 20-40 was Captain Passage off north-west Prevost Island in January-February. The Mayne Island shoreline and Bedwell Harbour on Pender Island regularly support small numbers; a maximum 405 was tallied in November 2008 along Mayne's north-east shoreline (BSC unpublished BC Coastal Waterbird Survey data).

Conservation Issues The low counts on this survey were in part because we were offshore for much of the survey but it also reflects a decline in the local population. Aquaculture operations in other parts of the Strait of Georgia, in particular Baynes Sound, have attracted flocks of this sea duck (D. Esler, pers. comm.) and may possibly have contributed to local redistribution away from the Southern Gulf Islands.

Recommendations Continue to monitor the use of the Southern Gulf Islands population through expanding the BC Coastal Waterbird Survey to additional shorelines, and the Sidney Channel area using boat-based surveys.

a)



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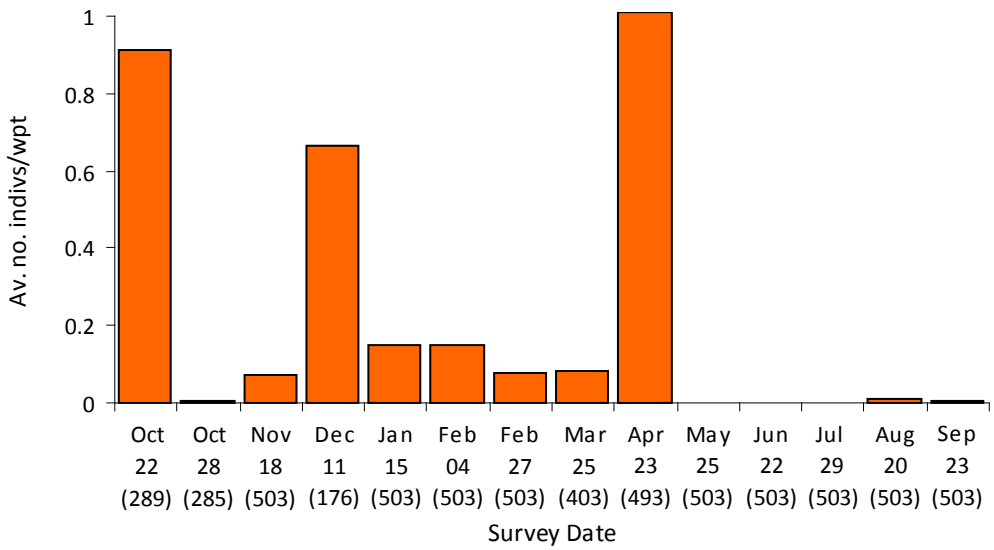
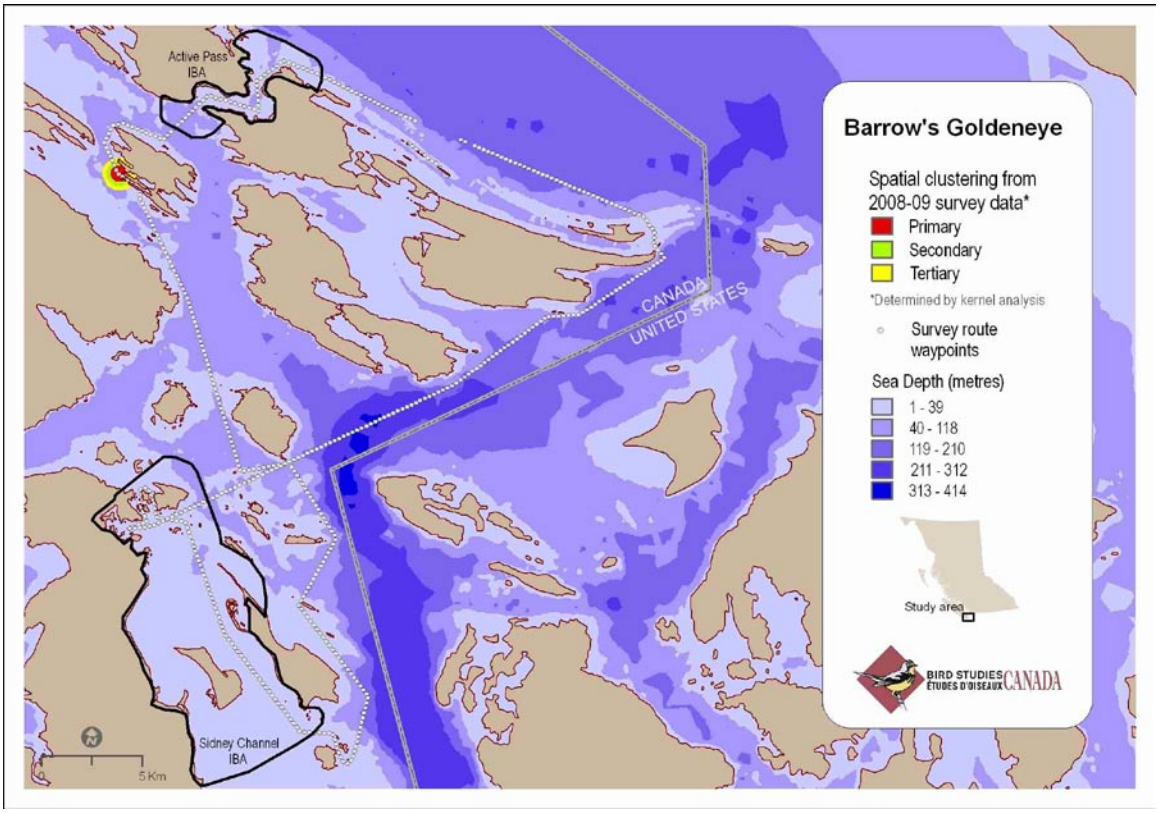


Fig 30. Spatial distribution (a) and seasonal abundance (b) of Surf Scoter in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Barrow's Goldeneye *Bucephala islandica*

Conservation Status	Neither at risk nationally nor provincially, but assessed as highest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	This sea duck is a non-breeding visitor to the coast, foraging on marine invertebrates. Vermeer (1982) and Savard (1989) showed that it is most numerous on the east shore of the Strait of Georgia, but why is not entirely clear. Ducks fitted with satellite transmitters on the BC south coast returned in subsequent years to the same stretch of coastline (S. Boyd pers. comm.) but why new areas are not occupied is unknown. Individuals marked on the south coast nested in the BC Cariboo region near Riske Creek (Savard 1989). An ~6% increase was reported between the 1975-84 and 1998-2007 periods, based on Christmas Bird Count data from the Salish Sea (Bower 2009), but a 23% decline was reported between 1978-80 and 2003-05 in Puget Sound (Bower 2009). The BC Coastal Waterbird Survey shows no trend for the Strait of Georgia between 1999-2009 (BSC unpublished data).
Southern Gulf Islands Status	A winter visitor, regularly frequenting specific locations each year. Mayne Island's north-east coast (Miner's Bay to Bennett Bay) has regularly supported 100-200 individuals each winter between November and March, with a maximum count of 306 in December 2006; Mayne's southern and western shoreline regularly supports a winter population of ~50 birds, and small numbers winter at widespread locations along the Pender and south-east Saltspring coasts (BSC unpublished BC Coastal Waterbird Survey data).
Survey Records 2008-09	Eleven waypoint-encounters with 443 individuals, all in mid-winter (January - February), and most in Captain Passage and the sheltered inlets (Secret Island and Annette) on the west side of Prevost Island. Birds were first recorded on 15 January (115), with a peak count of 320 in a single tight flock on 4 February; by late February all but two birds had apparently departed. Mayne Island's north-east coast (Miner's Bay to Bennett Bay) regularly supported up to 178 between November and March (BSC unpublished BC Coastal Waterbird Survey data).
Conservation Issues	None known.
Recommendations	A few winter censuses of the shoreline for this species would provide a better idea of the number and distribution of this species.

a)



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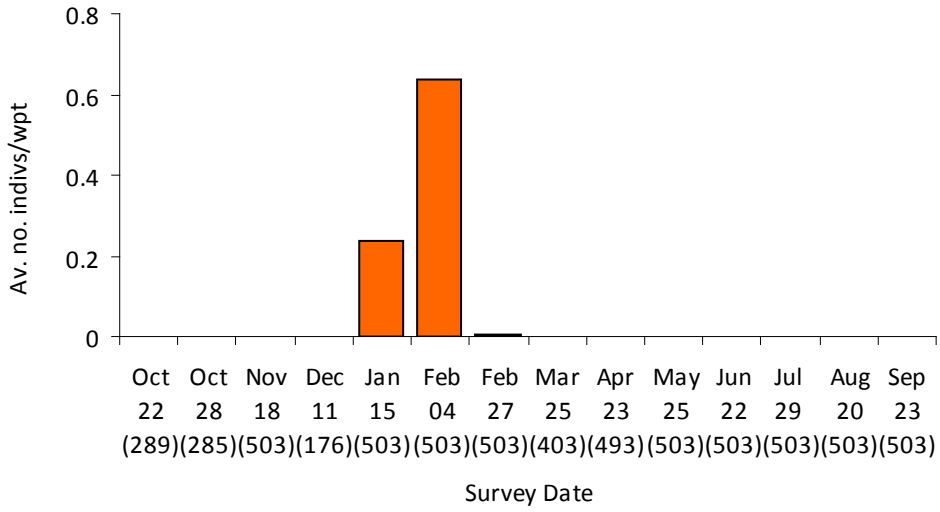
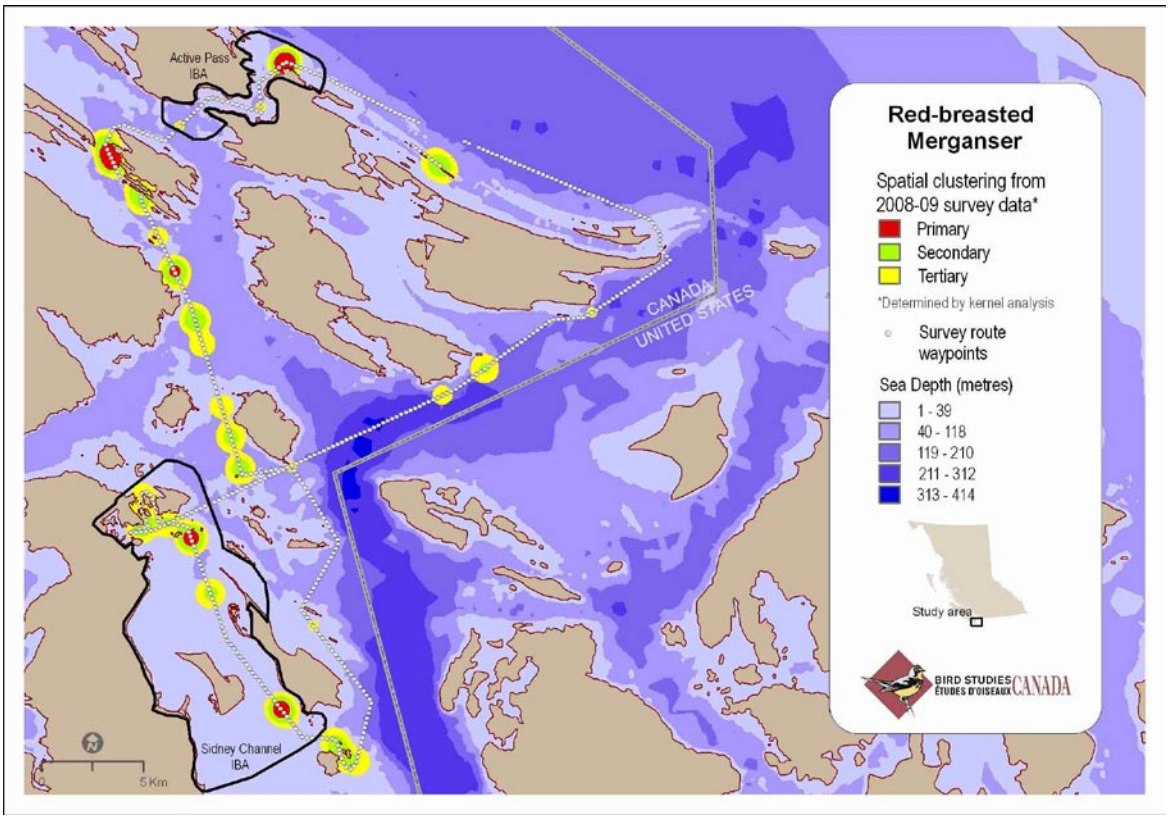


Fig 31. Spatial distribution (a) and seasonal abundance (b) of Barrow's Goldeneye in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Red-breasted Merganser *Mergus serrator*

Conservation Status	Neither at risk nationally nor provincially, and assessed as low-moderate priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	This piscivorous 'sawbill' is a widespread non-breeding visitor to the region. An ~18% decrease was reported between the 1975-84 and 1998-2007 periods, based on Christmas Bird Count data from the Salish Sea (Bower 2009), and a smaller decline (6%) was reported between 1978-80 and 2003-05 in Puget Sound (Bower 2009). The BC Coastal Waterbird Survey shows no trend for the Strait of Georgia between 1999-2009 (BSC unpublished data), and the local Padilla Bay (WA) trend is also stable for a similar period (Anderson et al. 2009).
Southern Gulf Islands Status	A widespread winter visitor to the region's more open marine waters and estuarine habitats, with up to 80 regularly recorded around the Mayne shoreline and 40-50 regularly wintering around the Pender coast (BSC unpublished BC Coastal Waterbird Survey data).
Survey Records 2008-09	The commonest of the merganser species, we tallied 55 waypoint-encounters with 274 individuals between November and April, with each total survey-count falling in the range of 34-67 individuals, with the exception of the incomplete December survey. Records were widely scattered, and maximum flock size recorded was 17 birds. The highest count of the period from the BC Coastal Waterbird Survey came from the north-east Mayne shoreline (37 birds in February); records from the survey were widespread.
Conservation Issues	This piscivore does not appear to be experiencing the same problems as forage-fish specialists, so is presumably able to exploit alternative prey.
Recommendations	No specific measures for this species.

a)



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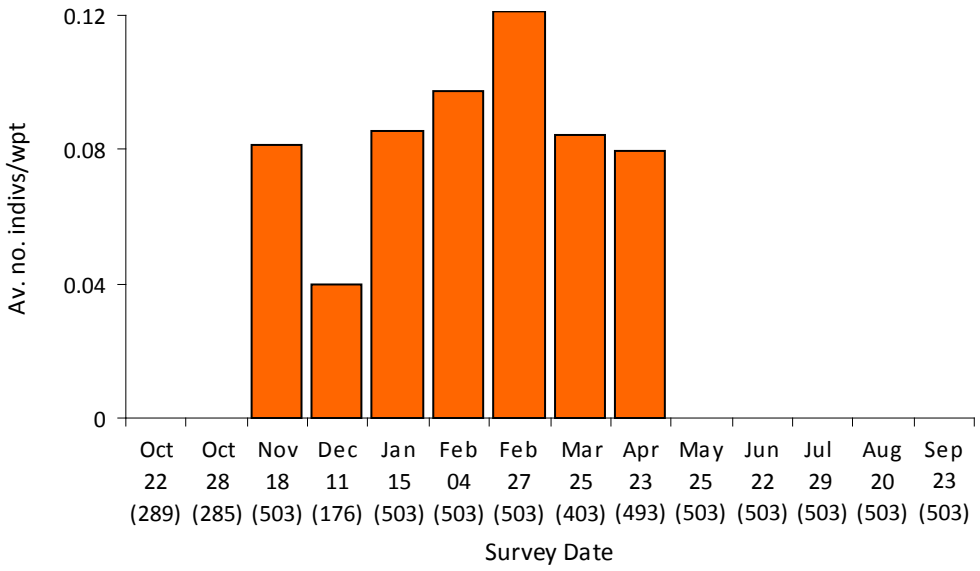


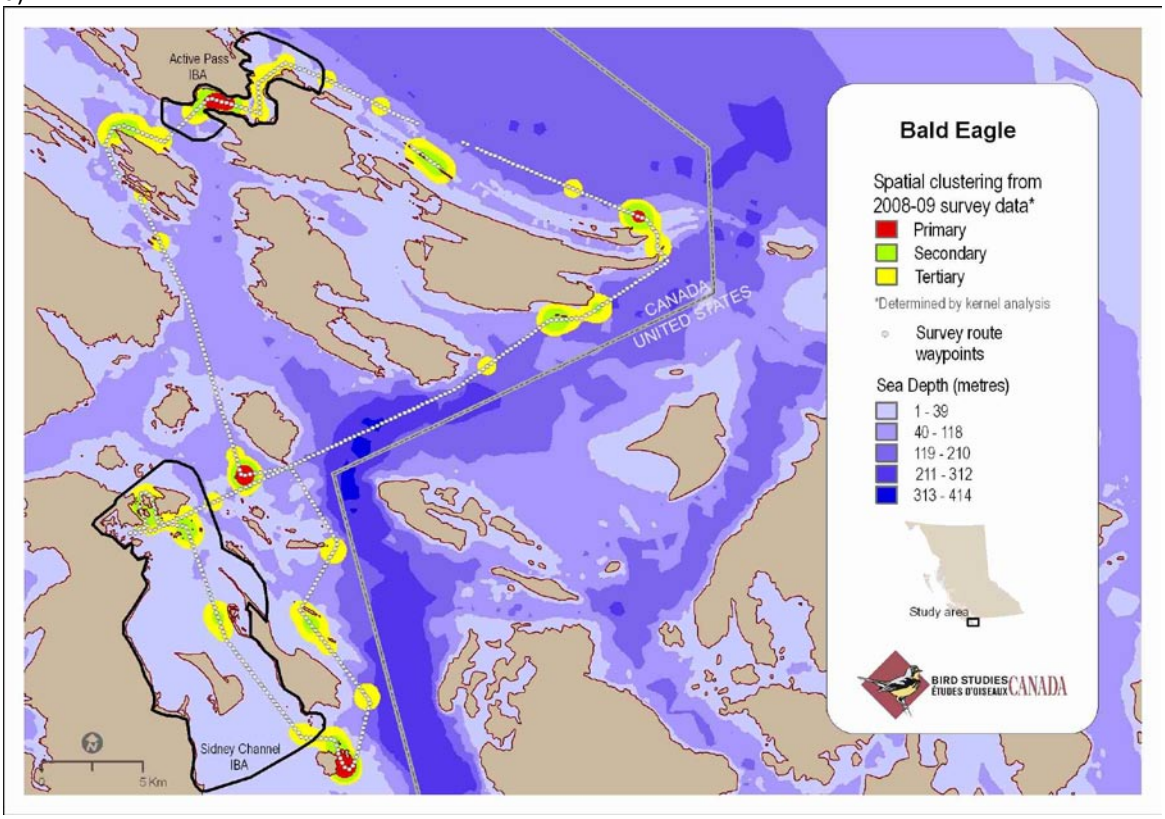
Fig. 32. Spatial distribution (a) and seasonal abundance (b) of Red-breasted Merganser in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Bald Eagle *Haliaeetus leucocephalus*

Conservation Status	Neither at risk nationally nor provincially, and assessed as lowest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	The eagle plays a key ecological role as a predator in the Strait of Georgia, including the Southern Gulf Islands. Eagles depredate upon many coastal and marine bird species, including ducks, grebes, herons, cormorants, gulls and alcids, as well as scavenge fish, marine mammals and birds for food. The threat implied by the presence of eagles can affect the distribution of bird prey. Tracking their populations will be important in interpreting data on bird and fish abundance. Whilst conventional wisdom clearly points to a significant long-term increase in Bald Eagles, the regional population may have reached a plateau, with no trend apparent from the past decade (1999-2009) of the BC Coastal Waterbird Survey (BSC unpublished data).
Southern Gulf Islands Status	The nesting population of eagles in the Gulf Islands has been surveyed since the 1960s (Vermeer et al. 1989). The most recent survey by Vermeer et al. (1989) tallied 97 occupied eagle nests in the Gulf Islands in the 1980s of which about 65 were south of southern Galiano Island. The high nesting density is augmented in winter by many immigrant adult and immature eagles that hunt along the shorelines. Vermeer et al.'s (1989) survey followed on similar eagle nest surveys in the 1970s and 1960s. A comprehensive survey of eagle nests has only been conducted on Pender and Mayne Islands in recent years.
Survey Records 2008-09	We recorded ~100 waypoint-encounters with 171 birds (averaging ~12 per survey), on all surveys except the September transect (most eagles vacate their southern British Columbian breeding territories in mid-late summer to exploit the salmon runs on North American streams and rivers further north). The majority of encounters were with single birds, often in flight, but groups of 9 (Imrie Island) and 12 (D'Arcy Islands) in January and April respectively were likely gathered to feed on seal carcasses. The peak in abundance on the BC Coastal Waterbird Survey around the Mayne, Pender and south-east Saltspring Island occurred in spring, with 24-28 individuals recorded in each monthly survey between March and May (BSC unpublished data).
Conservation Issues	Eagles play an important indirect effect on the distribution and abundance of many marine birds. Tracking their numbers periodically would be important in understanding the changes in distribution and abundance of several marine bird species in the Southern Gulf Islands.

Recommendations Continue to monitor local eagle populations and investigate effects on prey species, including an aerial survey of nesting eagles following the protocol in Vermeer et al. (1989).

a)



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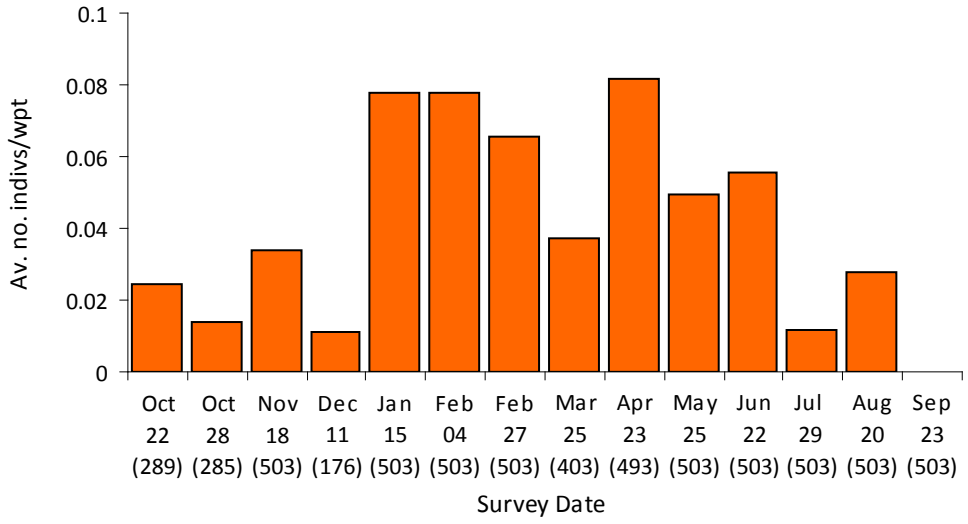


Fig. 33. Spatial distribution (a) and seasonal abundance (b) of Bald Eagle in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Black Oystercatcher *Haematopus bachmani*

Conservation Status Neither at risk nationally nor provincially, and assessed as lowest priority by the BC Conservation Framework (BC MoE 2008).

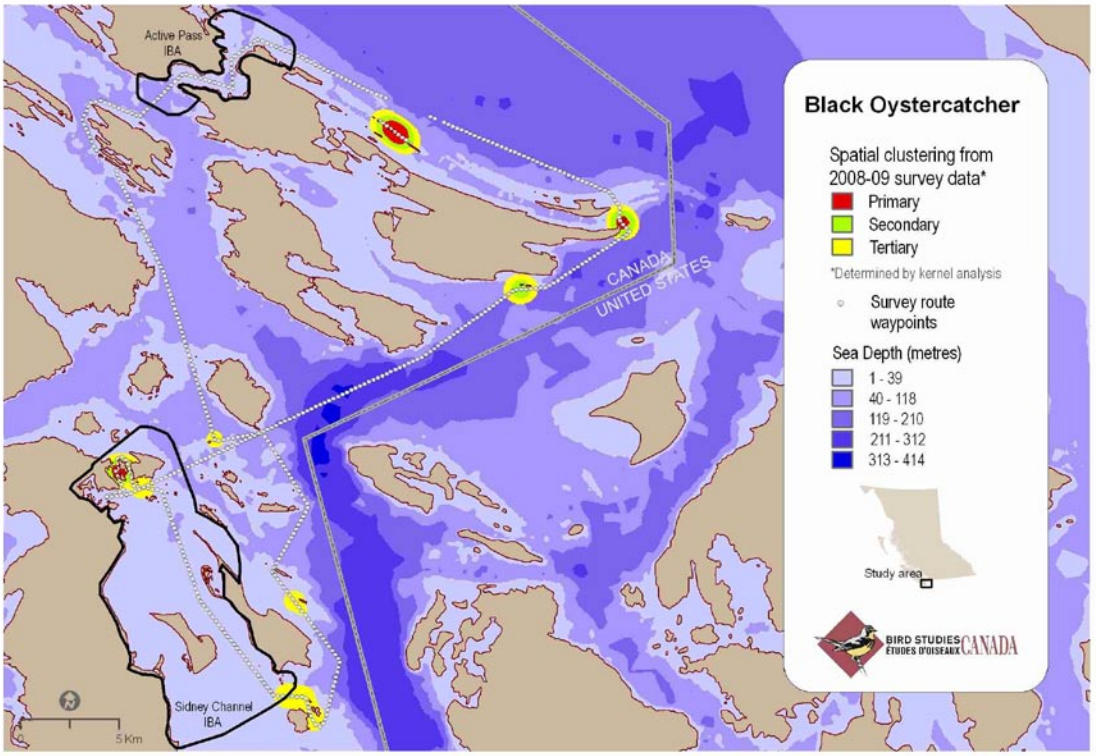
Ecology and Regional Trends An estimated 210 pairs bred in the Salish Sea in 2005-06 (Golumbia et al. 2009). Butler and Golumbia (2008) concluded that the population in the Strait of Georgia was either stable or slowly increasing The BC Coastal Waterbird Survey trend (for the wintering population) also appears to be stable (BSC unpublished data). The nesting success in the Strait of Georgia exceeds that of the west coast of Vancouver Island where waves take a toll on nests. The Gulf Islands population might be a source of recruits for the west coast population, including those in Pacific Rim National Park Reserve. The BC Coastal Waterbird Survey trend (for the wintering population) appears to be stable (BSC unpublished data).

Southern Gulf Islands Status Butler and Golumbia (2008) found about 45 pairs of oystercatchers nested in the Gulf Islands in 2005 and 2006 matching closely previous estimates by Vermeer et al. (1989). Lacking from our understanding of oystercatchers is where local breeders disperse during winter, and what proportion of the population is augmented by non-breeding visitors from other parts of the species' range. At least some and possibly all breeding oystercatchers spend the winter in the Gulf Islands.

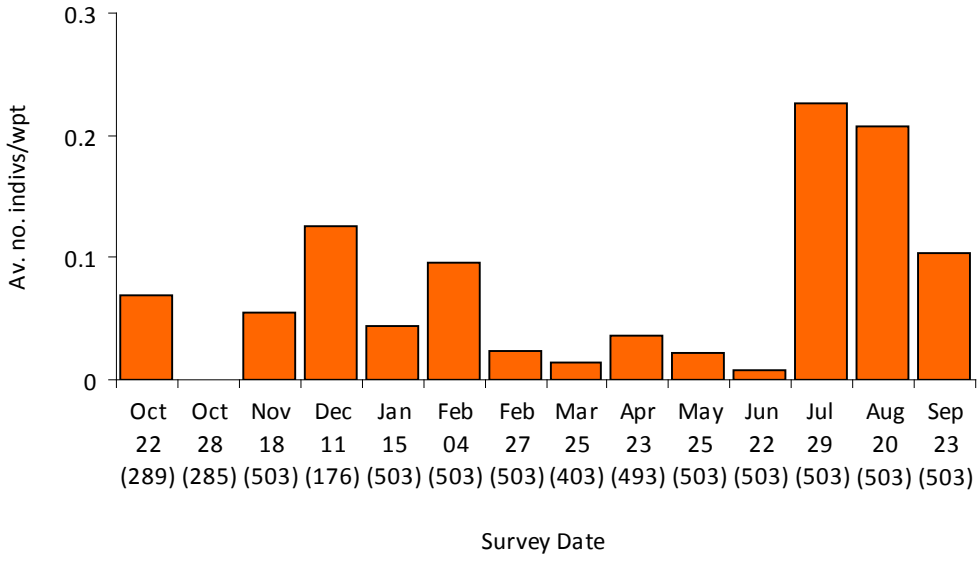
Survey Records 2008-09 We recorded 62 waypoint-encounters with 235 individuals, in all months, with the highest survey-counts made in July and August (57 and 52 respectively), when flocks comprised a significant proportion of juveniles. Clearly oystercatchers occur in the Southern Gulf Islands year round; our largest winter count was 24 on 4 February. Key locations for this rocky shore specialist were the Coal-Goudge-Kerr Island Groups, Halibut, Salas and the D'Arcy Islands, and the Belle Chain and Java Islets. In August, the Belle Chains supported 31 birds and East Point, Saturna held 17 (and 25 and 6 respectively in July). Other locations that occasionally supported small groups were Imrie Island and Fairfax Point. A few birds were occasionally seen on the nesting islands in winter but most did not occupy known nesting locations before late March. Regularly recorded from the Mayne shoreline, with a maximum count of 37 birds from the Miner's Bay to Bennett bay stretch of shoreline in January 2009 (BSC unpublished BC Coastal Waterbird Survey data).

Conservation Issues An oil spill in the region is a possibility with the tanker traffic to Cherry Point, WA and container ship traffic to Deltaport and Port of Vancouver. The oystercatcher's dependency on shorelines for food and nesting makes it vulnerable to oil spills. The species would make a good candidate on the effects of oil on wildlife and its recovery. Up to date information on populations in the Gulf Islands is critical.

Recommendations Adopt a standard survey protocol with Washington counterparts that combines visits and call playbacks (Golumbia et al. 2009). Periodic survey of all nesting islands in the Gulf Islands every 3 years would track changes in distribution and numbers of nesting pairs. Identifying the winter habitats in the Gulf Islands is a priority. Determine strength of linkages between Gulf Islands as a source of recruits for Pacific Rim NP.



a)



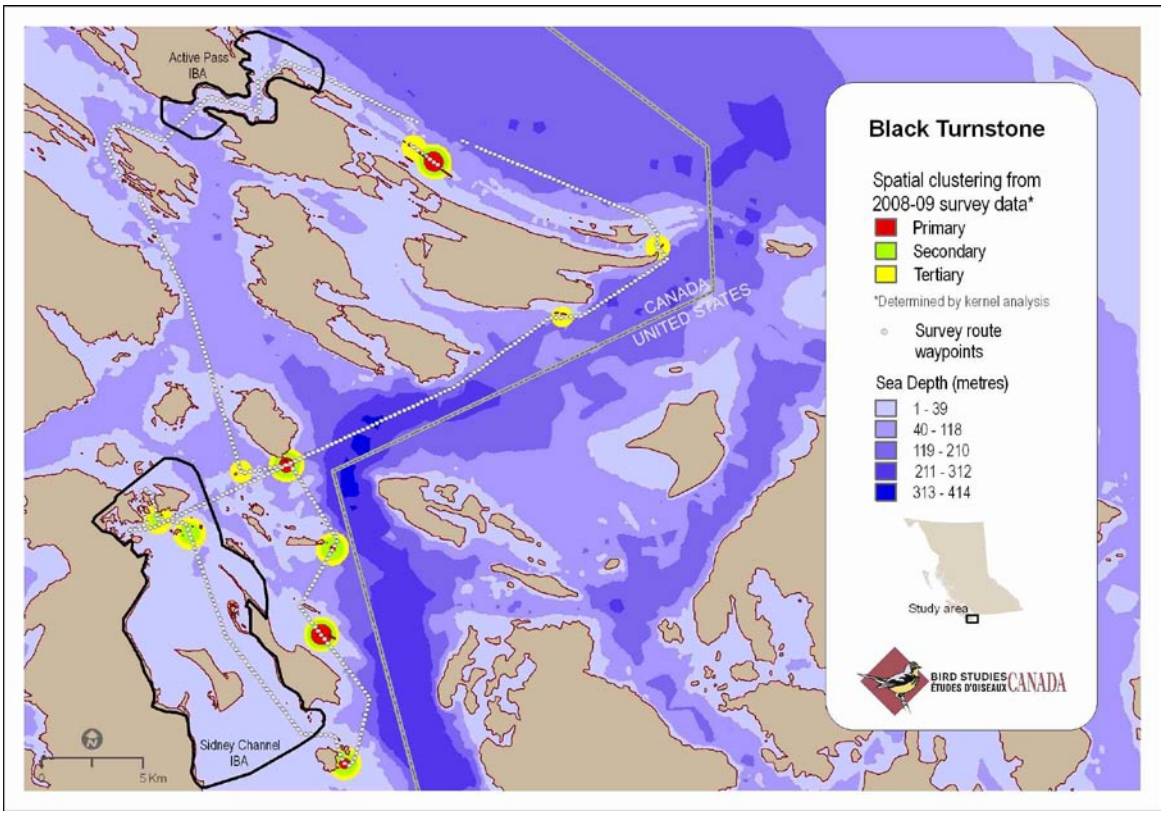
b)

Fig. 34. Spatial distribution (a) and seasonal abundance (b) of Black Oystercatcher in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Black Turnstone *Arenaria melanocephala*

Conservation Status	Neither at risk nationally nor provincially, but assessed as a high priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	This north Pacific endemic is a rocky shore specialist, and a non-breeding visitor to the region. The BC Coastal Waterbird Survey indicates an increasing trend of ~7% annually over the 1999-2009 period (BSC unpublished data).
Southern Gulf Islands Status	A non-breeding visitor to the area between July and April, chiefly as a winter visitor, perhaps augmented by migrant birds in spring and fall. A population of ~50 birds regularly winters along the north-east Mayne shoreline, which reached a maximum of 111 birds in January 2004 (BSC unpublished BC Coastal Waterbird Survey data). The species probably uses many small rocky islets that cannot be viewed from accessible shorelines, so the population may be much larger than shoreline-based observations suggest.
Survey Records 2008-09	We tallied 20 waypoint-encounters with 239 individuals, on 8/14 survey dates. We most consistently recorded the species on the Belle Chain Islets (maximum flock size 34 on 29 July). Other locations supporting the species included Java Islets (two records), Fairfax Point (three records), Boiling Reef off East Point, Saturna (two records), the Coal-Kerr Islands (three records), and the reef off the eastern tip of Gooch Island (two records), and Halibut Island (two records). This can be a cryptic bird to see, so a boat-based transect survey like this probably regularly misses the species (as do land-based surveys). Nonetheless these results provide a useful picture of important locations for the bird, almost all of which are also used by Black Oystercatchers, and some by Surfbirds.
Conservation Issues	The turnstone is likely susceptible to oil spills. Identifying the key sites and numbers of turnstones would be helpful data in the case of an oil spill.
Recommendations	A combination of rocky shoreline- and boat-based surveys of offshore islets, many of which are also used by other priority species, is the best means of inventory and monitoring this species population in the Southern Gulf Islands.

a)



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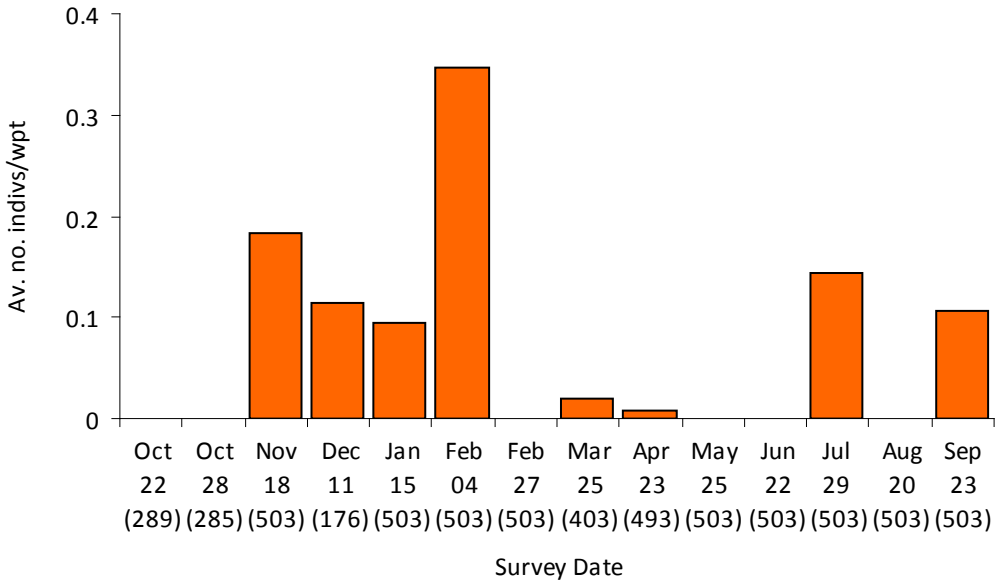
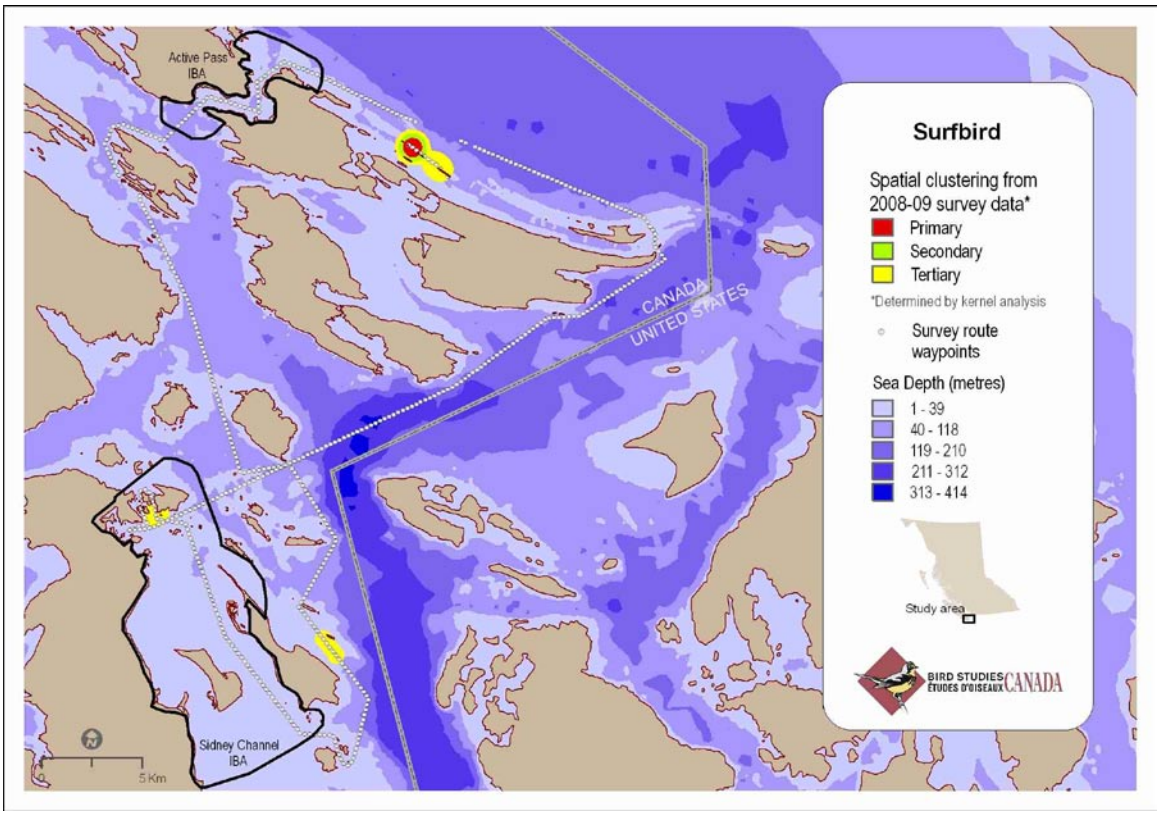


Fig. 35. Spatial distribution (a) and seasonal abundance (b) of Black Turnstone in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Surfbird *Aphriza virgata*

Conservation Status	Neither at risk nationally nor provincially, and assessed as lowest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	This north Pacific endemic is a rocky shore specialist, and a non-breeding visitor to the region. It occurs in flocks and forages on barnacles, amphipods and other intertidal invertebrates. Not much is known about its winter biology. The BC Coastal Waterbird Survey indicates a non-significant but apparently steeply declining trend over the 1999-2009 period (BSC unpublished data). There is little information from elsewhere to suggest how the species is faring regionally.
Southern Gulf Islands Status	Probably an uncommon but regular non-breeding visitor to specific locations within the Southern Gulf Islands. Regular observations from the BC Coastal Waterbird Survey come from two areas, the north-east shoreline of Mayne Island, which supports up to ~280 birds, and during the early 2000s (but not since), Brook's Point, Pender.
Survey Records 2008-09	Twelve waypoint-encounters yielded a total count of 468 birds, largely due to a flock of 360 on the Belle Chain Islets on 15 November 2008, and 40 in the same location on 23 September 2009; half the records came from the Belle Chain Islets. Other locations with odd records were rocky islets off Coal and Kerr Islands, Salas Island and the D'Arcy Islands, Halibut Island and Boiling Reef off East Point, Saturna. A very similar pattern of site-use emerges to that for Black Turnstone and Black Oystercatcher. There was just one BC Coastal Waterbird Survey record for the period, of a flock of 80 along the north-east shore of Mayne Island.
Conservation Issues	The potential decline suggested by BC Coastal Waterbird Survey data is a cause for concern, indicating that this is a bird to watch. The surfbird is likely susceptible to oil spills. Identifying the key sites and numbers would be helpful data in the case of an oil spill.
Recommendations	The Surfbird joins the Great Blue Heron, Harlequin Duck, Surf Scoter, Barrow's Goldeneye, Black Turnstone, Rock Sandpiper and Black Oystercatcher, which could all be better served by a coastline survey. A combination of rocky shoreline- and boat-based surveys of offshore islets, many of which are also used by other priority species, may be the best way of monitoring this species population in the Southern Gulf Islands.

a)



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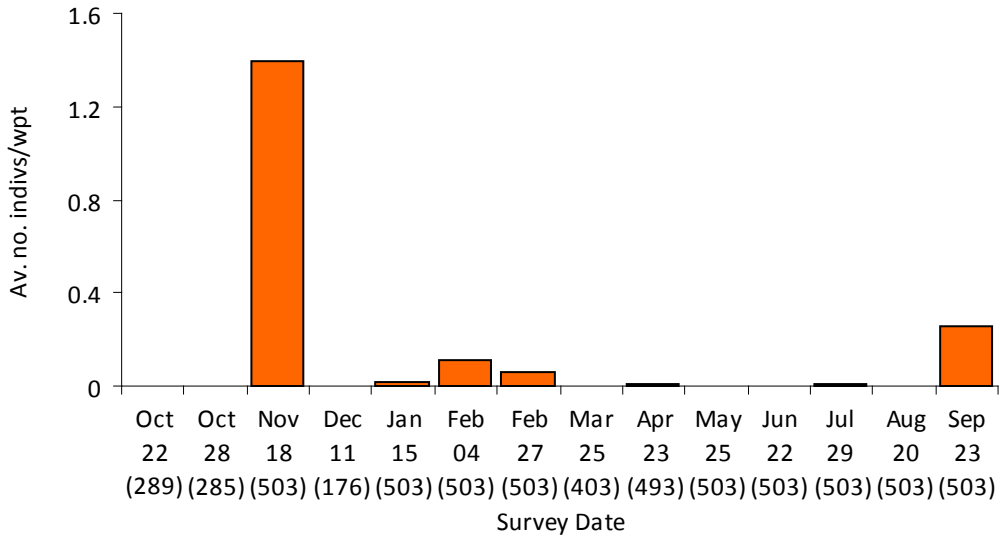


Fig. 36. Spatial distribution (a) and seasonal abundance (b) of Surfbird in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

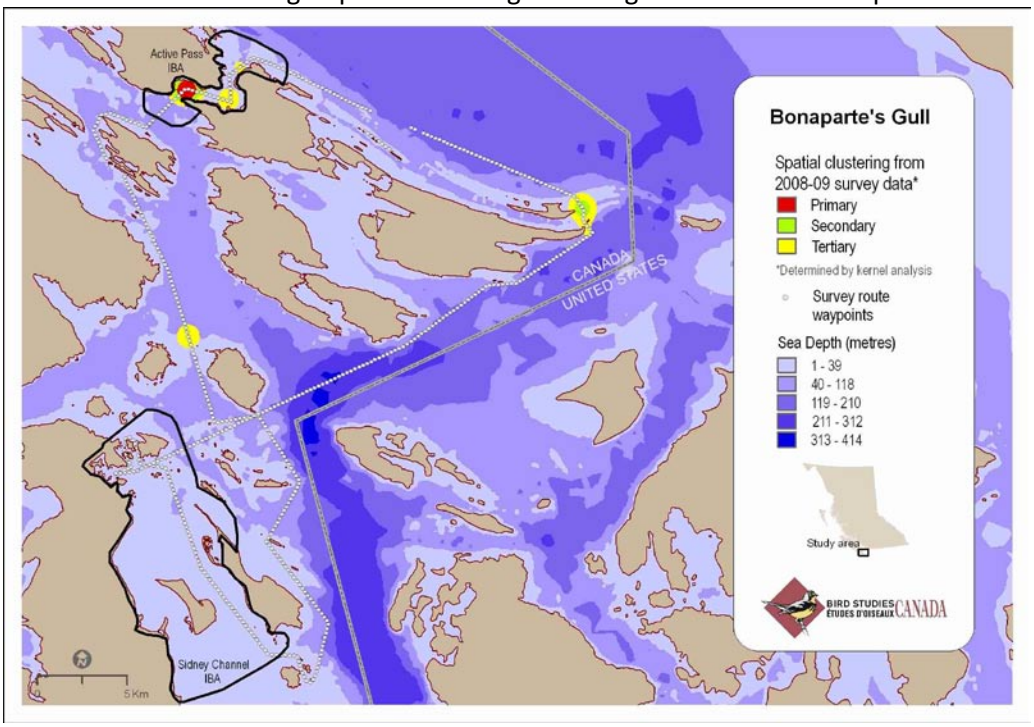
Bonaparte's Gull *Larus philadelphia*

Conservation Status	Neither at risk nationally nor provincially, and assessed as lowest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	This diminutive gull is chiefly a passage migrant along the British Columbian coast, with a small number over-wintering. Typically encountered in (often large) flocks migration, it forages on plankton (predominantly the euphausiid *Thysanoessa raschii* in spring, and two species of amphipod, *Parathemisto pacifica* and *Calliopius laeviusculus* in fall) upwelled to the surface in tidal channels (Vermeer et al. 1987). Outside the upwelling zones of tidal passages, it forages on fish, intertidal organisms, and zooplankton caught along tide lines (Vermeer et al. 1987), and roosts and feeds around kelp beds (RWB). Widespread and steep regional declines are reported by several sources: The BC Coastal Waterbird Survey suggests an 18% annual declining trend over the 1999-2009 period (BSC unpublished data); Christmas Bird Count data from the Salish Sea for the 1975-84 and 1998-2007 periods, and data from Puget Sound monitoring programs between 1978-80 and 2003-05 suggest declines of 72-89% (Bower 2009), and a significant decline in density was noted in Padilla Bay, WA, between 1978/79 and 2003-06 (Anderson et al. 2009).
Southern Gulf Islands Status	One of the most numerous birds in the area, Bonaparte's Gulls are strongly seasonal in their occurrence, passing through on spring and fall migration, with a small number overwintering in the area. Vermeer et al. (1987) showed that gull numbers in Active Pass correlated with times of maximum tidal upwelling that brought an abundance of zooplankton prey to the surface. On peak bird-days, Active Pass regularly supports 10,000 birds on spring and 7,500 birds on fall migrations. These counts exceed 1% of the global population, and led to the site being designated a global Important Bird Area (www.ibacanada.com).
Survey Records 2008-09	The most numerous species recorded on the surveys, with 58 waypoint-encounters totaling 14,624 birds, including a flocks of 6,795 in Georgeson Bay, 575 in Miners Bay (both Active Pass) and 1,500 off Boiling Reef on 23 April. Flocks were smaller and much more dispersed on the high-count fall survey days (22 October – 3,523, and 15 November – 1,348), when Swanson Channel and Prevost Passage supported large numbers in addition to Active Pass and Boiling Reef. These results indicate that similar-sized flocks of Bonaparte's Gulls are still using the Southern Gulf Islands as two to three decades ago, although gauging actual numbers of a bird as dynamic in its movements as this one is extremely difficult. This fact is well illustrated by the BC Coastal Waterbird Survey count for April 2009, which recorded 275 individuals.

Conservation Issues The widespread long-term declines reported from a variety of different surveys are a cause for concern, although it should be noted that no monitoring protocol is perfectly suited to this species, which moves through the region in large numbers over a short time period.

Recommendations
- Verify and investigate causes for the apparent steep regional declines, and devise a more rigorous means of monitoring this species in the Southern Gulf Islands, which act as a migration bottleneck for it.
- This gull may be an indicator of small fish and plankton distribution and abundance in the Gulf Islands. Regular counts would give an early warning of possible ecological changes to small fish and plankton.

a)



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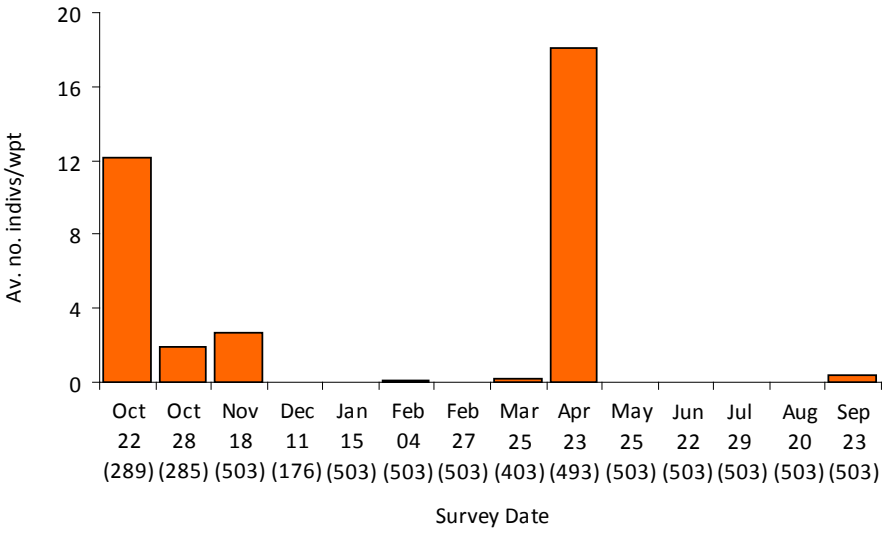

Fig. 37. Spatial distribution (a) and seasonal abundance (b) of Bonaparte's Gull in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Mew Gull *Larus canus*

Conservation Status	Neither at risk nationally nor provincially, and assessed as lowest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	A very large non-breeding population uses coastal and marine habitats throughout the region. Outside the plankton-rich upwelling zones of tidal passages, Mew Gulls forage on fish, intertidal organisms, and zooplankton caught along tide lines (Vermeer et al. 1987). BC Coastal Waterbird Survey data from 1999-2009 and Christmas Bird Count data from the Salish Sea for the 1975-84 and 1998-2007 periods suggest the population trend is stable based on the last decade of information (Bower 2009, BSC unpublished data), but data from Puget Sound monitoring programs between 1978-80 and 2003-05 suggest a 25% decline (Bower 2009). The local trend in density in Padilla Bay, WA, between 1978/79 and 2003-06 is stable (Anderson et al. 2009).
Southern Gulf Islands Status	A very common and widespread non-breeding visitor to the Southern Gulf Islands, with peaks in abundance in the fall (September-October) based on BC Coastal Waterbird Survey data, when large numbers (up to 750) congregate in Active Pass.
Survey Records 2008-09	The most numerous species after Bonaparte's Gull, with 238 waypoint-encounters tallying 12,915 individuals between September and April; there was just one survey record during May-August, a singleton in July. Major concentrations were regularly recorded off Boiling Reef, Saturna, in Active Pass, and in the wider passages, including Swanson Channel, Boundary Pass and Prevost Passage. Abundance fluctuated very significantly between surveys, suggesting that significant movements into and out of the area occur on a regular basis (monthly, perhaps as frequently as daily). It is not clear what might drive these movements; there was no apparent correlation with tidal amplitude, which may be a surrogate for food availability (upwelling events in the tidal passages).
Conservation Issues	None known.
Recommendations	Continue to monitor this species using methods proposed for other species, and ongoing surveys (e.g. BC Coastal Waterbird Survey).

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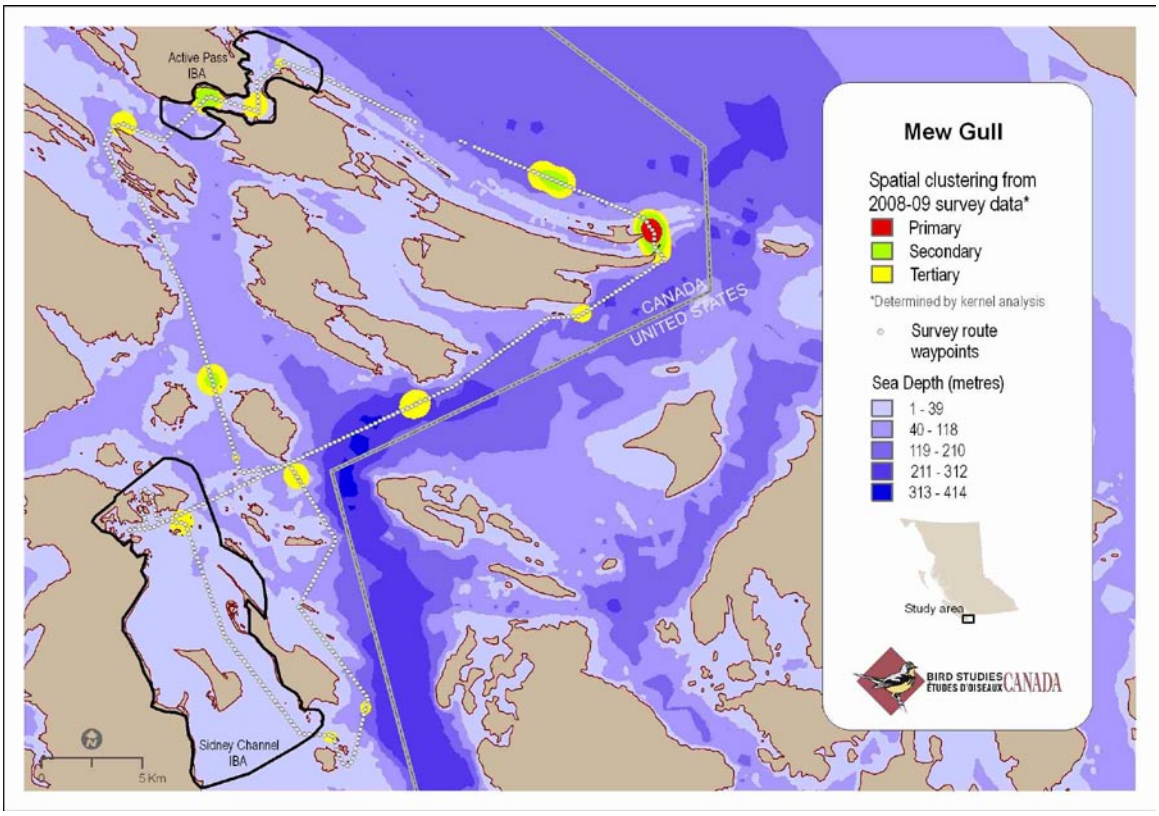

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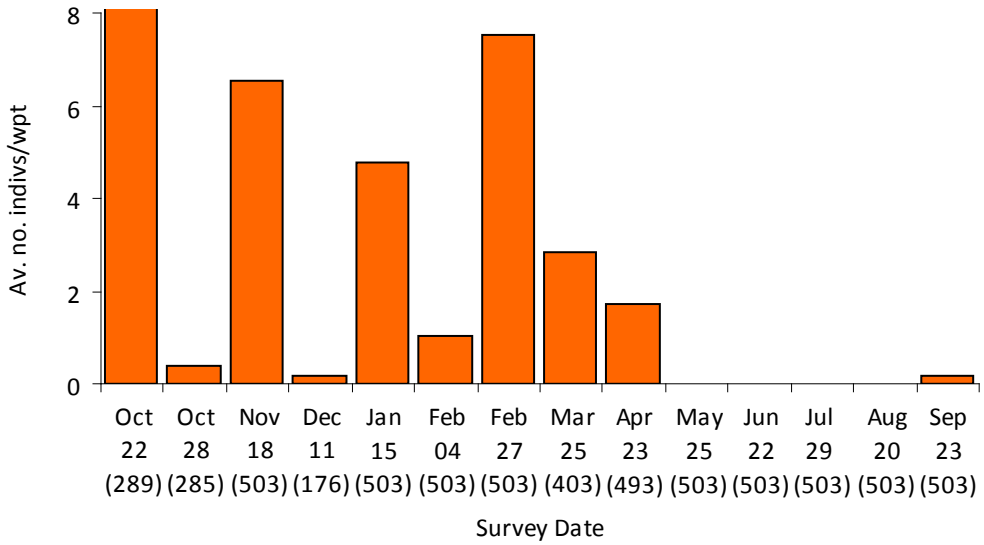
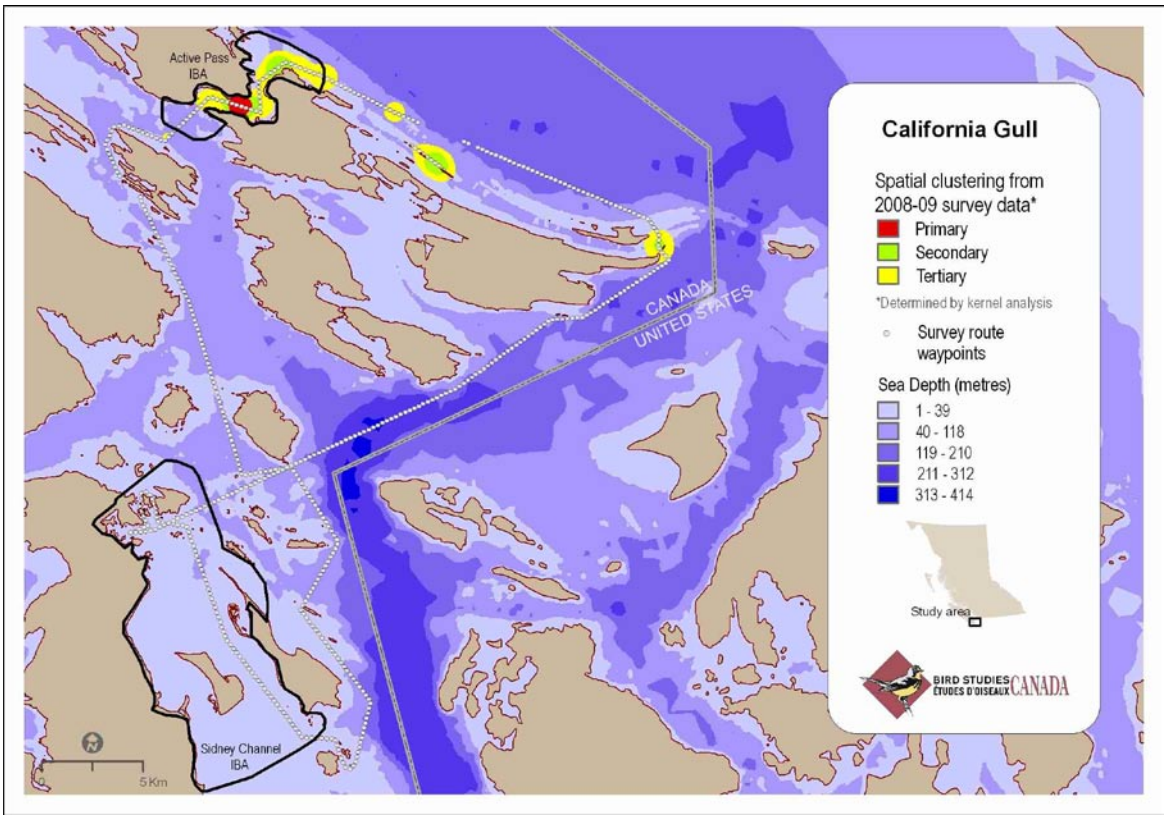


Fig 38. Spatial distribution (a) and seasonal abundance (b) of Mew Gull in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

California Gull *Larus californicus*

Conservation Status	Not at risk nationally, but provincially Blue-Listed, although it was recently assessed as a moderate-low priority for the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	California Gulls nest in the Canadian Prairies and spend the winter along the Pacific Coast. Large numbers migrate through the southern BC coast to winter quarters in the USA and Mexico (Campbell et al. 1990). The Conservation Data Centre consider the short-term trend to be increasing (BC MoE 2008). BC Coastal Waterbird Survey data suggest the population trend is stable based on the last decade of information (1999-2009; BSC unpublished data).
Southern Gulf Islands Status	The species is abundant in the Southern Gulf Islands from late July through the fall, with small numbers lingering through the winter. Active Pass concentrates the highest counts on the Coastal Waterbird Survey, with typical September-October number in the 300-500 birds range. RWB noted as many as 40 foraging and 240 roosting in Sidney Lagoon and 500 on the spit in July.
Survey Records 2008-09	We recorded 109 waypoint-encounters with 1,192 birds. August was the peak month of abundance, with 780 individuals recorded (65% of the total), and almost all birds occurred between July and October, when post-breeding dispersal occurs. Records of small numbers (1-5) were very widely and evenly scattered, but large feeding aggregations occurred in Active Pass and around Boiling Reef, Saturna, and roosting concentrations were found on the Belle Chain Islets. BC Coastal Waterbird Survey high counts of 435 and 116 were recorded in Active Pass in September and October 2008.
Conservation Issues	California Gulls eat small fish while in the GINPR and their abundance is likely reflected in the availability of sandlance and herring.
Recommendations	Continue to monitor this species using methods proposed for other species, and ongoing surveys (e.g. BC Coastal Waterbird Survey).

a)



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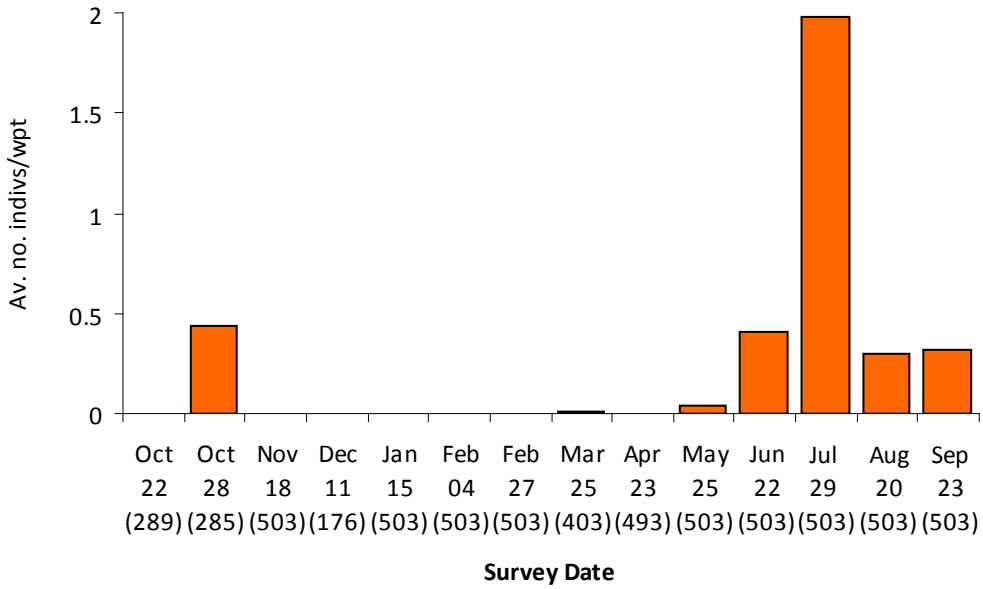

Fig. 39. Spatial distribution (a) and seasonal abundance (b) of California Gull in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Glaucous-winged Gull *Larus glaucescens*

Conservation Status	Neither at risk nationally nor provincially, and assessed as lowest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	The Glaucous-winged Gull is a Pacific Coast endemic that forms part of a complex of similar species circling the northern hemisphere. The Strait of Georgia holds large numbers of breeding gulls, mostly in colonies on Mandarte Island with about 2200 pairs and Mitlenatch Island with about 2100 pairs (Vermeer et al. 1989). Many of the small islands that had nesting gulls in the 1980s are abandoned (Sullivan et al. 2003). The declines coincide with an increase in Bald Eagles and burying of garbage at landfills. Widespread regional declines in non-breeding populations are reported from several different sources: The BC Coastal Waterbird Survey suggests a 4% annual declining trend over the 1999-2009 period (BSC unpublished data); Christmas Bird Count data from the Salish Sea for the 1975-84 and 1998-2007 periods, and data from Puget Sound monitoring programs between 1978-80 and 2003-05 suggest declines of 24-37% (Bower 2009), and a significant decline in density was noted in Padilla Bay, WA, between 1978/79 and 2003-06 (Anderson et al. 2009).
Southern Gulf Islands Status	A widespread and common resident of the Southern Gulf Islands, likely augmented by non-breeding visitors from other areas throughout the year. The Mandarte colony is the largest, and numbered about 2100 pairs during the 1980s (Vermeer et al. 1989). Vermeer et al. (1989) list all islands that had gulls in the 1980s. In the 1980-90s, RWB noted up to 300 feeding in Sidney Lagoon and 200 on the beaches in summer. As many as 200 roosted on Sidney Spit and hundreds roost on the west end of James Island during high tide. They gather with other gulls, Pelagic Cormorants, Rhinoceros Auklets, and Comon Murres to catch sandlance in Sidney Channel during summer. BC Coastal Waterbird Survey data show the bird to be widespread and common throughout the September-April period (site-counts vary from single figures to occasional maxima of ~100 birds, especially in tidally active channels like Active Pass).
Survey Records 2008-09	We made over 500 waypoint-encounters tallying >7,300 birds. The peak in abundance occurred during the summer months May-August, but particularly in June-July, driven by counts on the Mandarte breeding colony. Important feeding areas, where flocks were regularly observed, include Sidney Channel (especially the north end), Active Pass; the Belle Chain Islets and Boiling Reef were regular roosting sites for flocks of up to 270 birds. The species bred on Mandarte and Java during the survey.
Conservation Issues	Declines in the number of nesting sites and presumably the number of nesting pairs needs to be investigated.

Recommendations Colony counts have not been done for many years and a regular census of all known nesting islands to estimate the number of pairs and their nesting success in the Southern Gulf Islands would be helpful.

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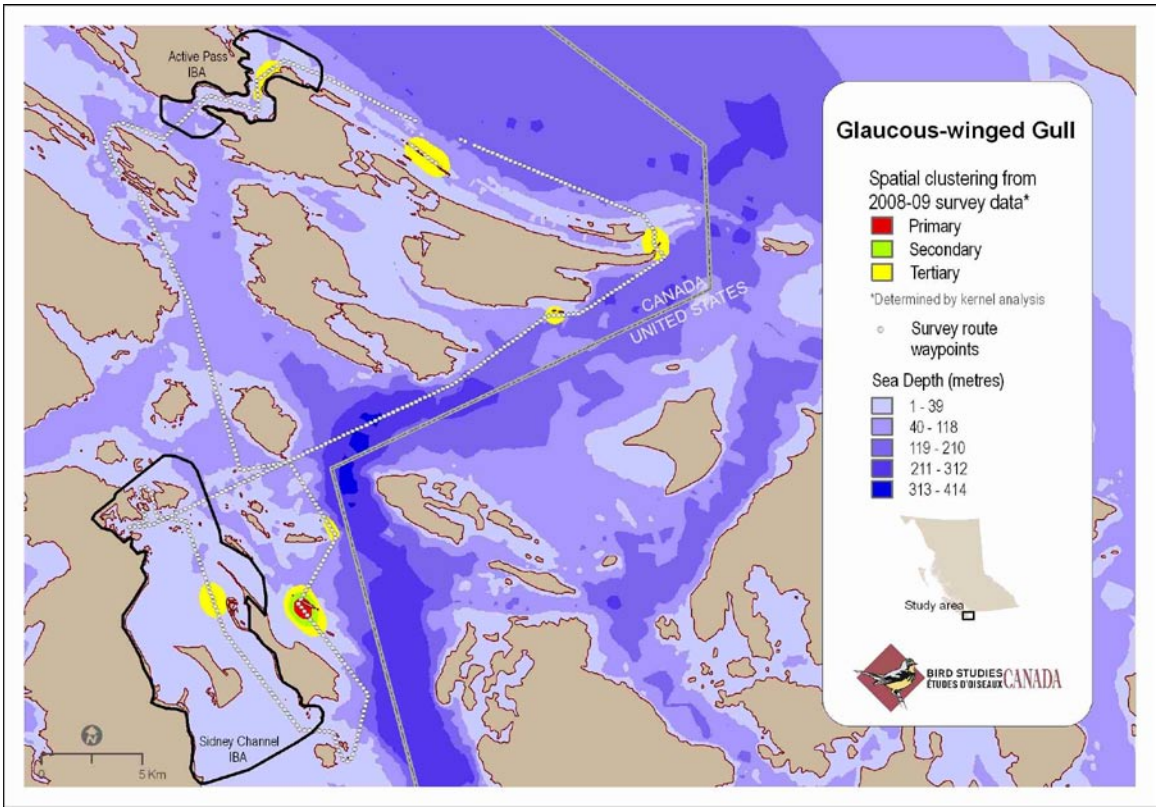
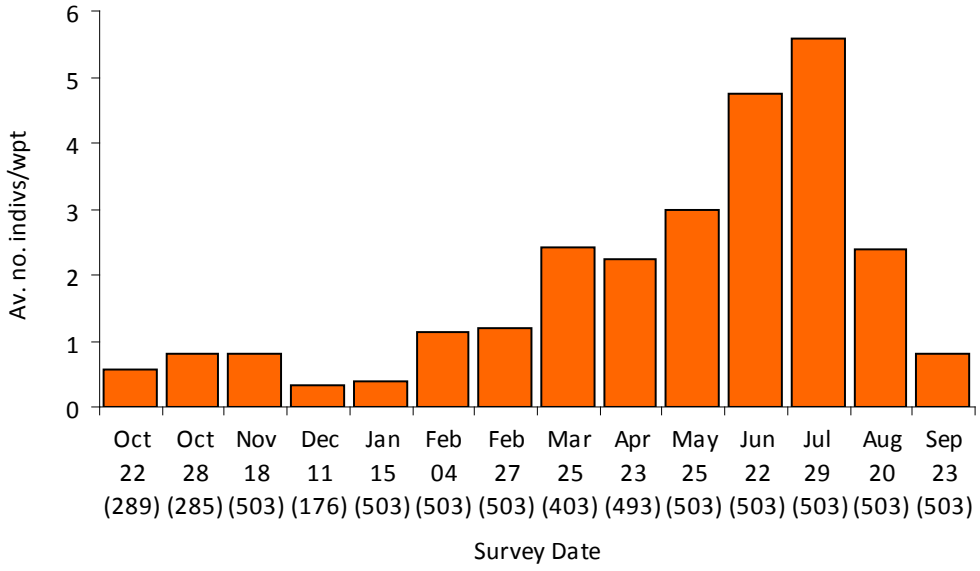




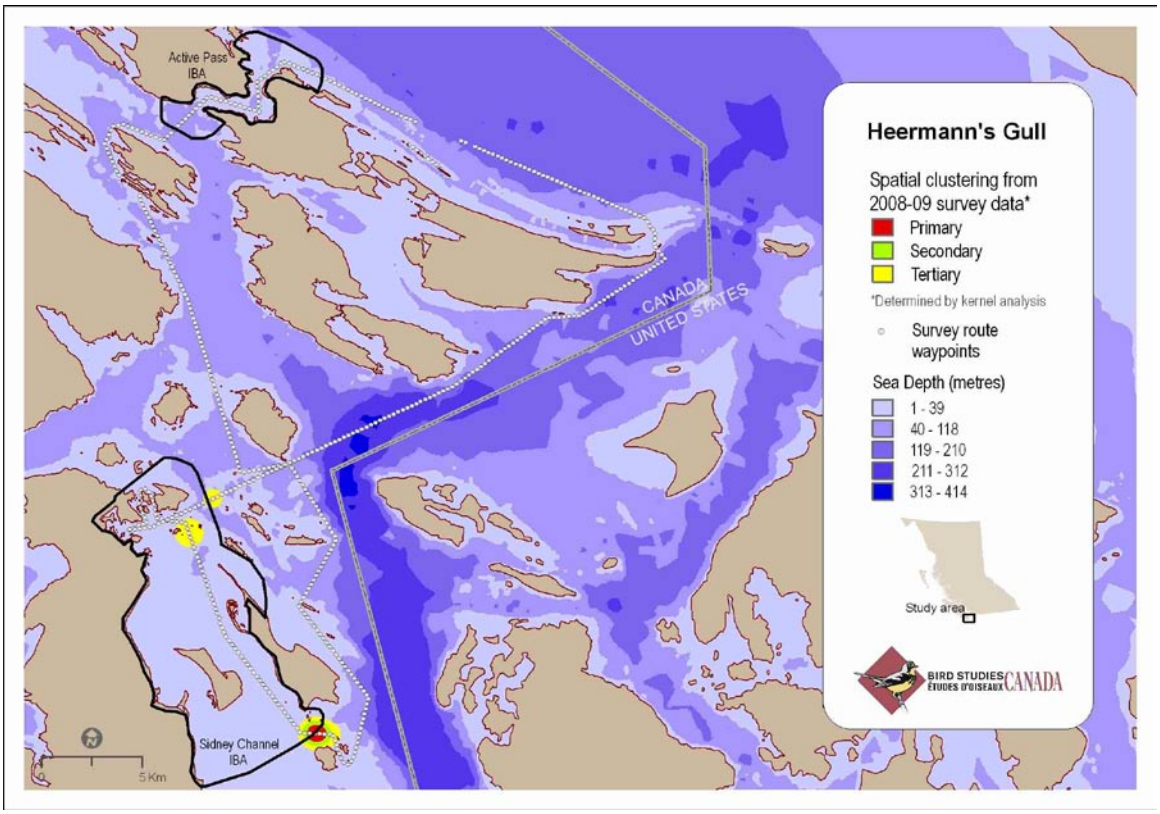
b)

Fig. 40. Spatial distribution (a) and seasonal abundance (b) of Glaucous-winged Gull in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Heerman's Gull *Larus heermani*

Conservation Status	Neither at risk nationally nor provincially, and assessed as lowest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	Heerman's Gulls nest in Mexico and California, and wander north as far as the southern coasts of Vancouver Island and the adjacent Gulf Islands in summer. The BC Coastal Waterbird Survey suggests a 21% annual declining trend over the 1999-2008 period (BSC unpublished data).
Southern Gulf Islands Status	A non-breeding visitor in summer and fall (July-November), most numerous in the southern part of the area, south of Boundary Pass and Swanson Channel. RWB noted 50-95 in July-August 1993, 1996, 1997, and 2000 on Sidney Island. BC Coastal Waterbird Survey seldom records the species from Mayne, Pender or Saltspring Islands, with the exception of Brook's Point at the south end of Pender, jutting out into Boundary Pass, where small numbers (up to 20) are regularly recorded in fall.
Survey Records 2008-09	We recorded 24 waypoint-encounters with 298 individuals, most (271) in July and August. Flocks of 90 and 25 roosted on Salas Rocks south of Sidney Island, and flocks of 28 and 75 were on rocky islets SE of Kerr Island in July and August respectively. The only other double-figure encounter was in Prevost Passage close to the Dock Island group, in July.
Conservation Issues	The potential decline suggested by BC Coastal Waterbird Survey data is a cause for concern, indicating that this may be a bird to watch.
Recommendations	A combination of rocky shoreline- and boat-based surveys of offshore islets, many of which are also used by other priority species, would be helpful and the best means of monitoring this species population in the Southern Gulf Islands.

a)



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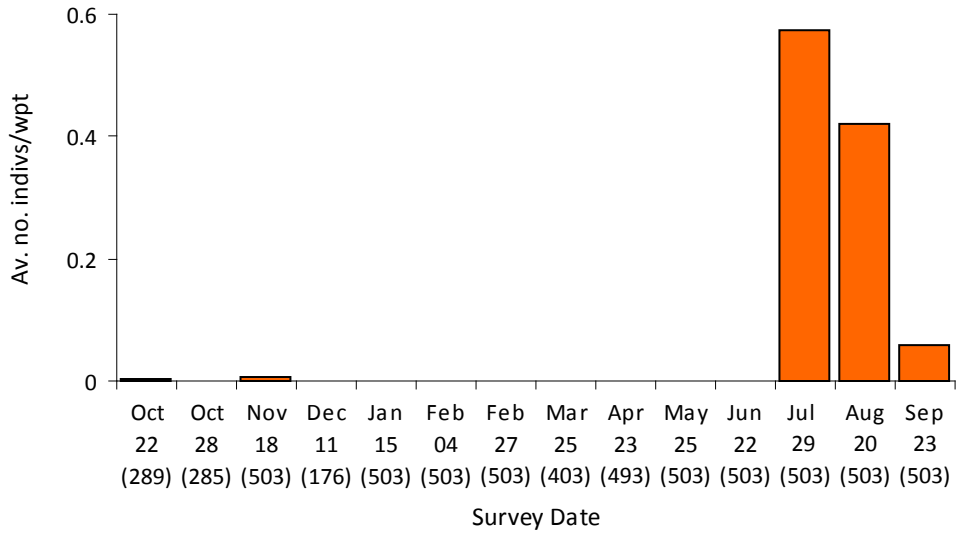
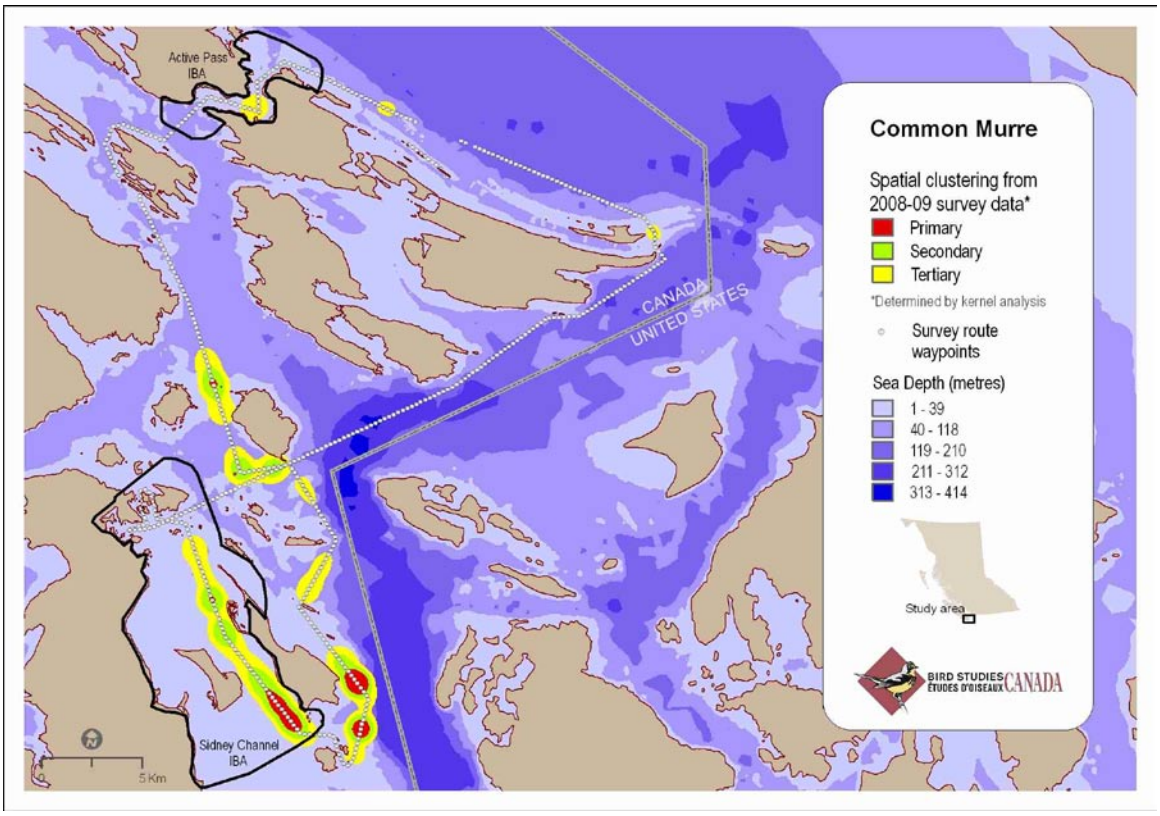


Fig. 41. Spatial distribution (a) and seasonal abundance (b) of Heerman's Gull in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Common Murre *Uria aalge*

Conservation Status	Not at risk nationally, but Red-Listed by the province of British Columbia, and assessed as a high priority by the Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	This large, fish-eating alcid breeds in colonies on the outer Pacific Coast from Alaska to Washington. Nearest breeding colonies are Tatoosh Island in Washington, and Triangle Island in British Columbia. At the latter, a 27% decline was noted between 1989 and 2003 (Hipfner 2005). Widespread, steep regional declines in non-breeding populations are reported from Christmas Bird Count data from the Salish Sea for the 1975-84 and 1998-2007 periods, and data from Puget Sound monitoring programs between 1978-80 and 2003-05, which suggest declines of 83-92% (Bower 2009). No trend was apparent from BC Coastal; Waterbird Survey data from the 1999-2009 period in the Strait of Georgia. It arrives in the Strait of Georgia in late summer where it undergoes a feather molt (Thomson et al. 1998).
Southern Gulf Islands Status	A non-breeding visitor to the area, most Common Murres enter the Gulf Islands waters in late summer and remain until spring. In 1988, RWB tallied 35, 30, 6, 4, and 1 in Sidney Channel on 17 March, 10, 22 and 27 April, and 10 May respectively; two were seen in June and as many as 50 in July and 90 in August some with young of the year. This alcid spends most time >1km from shorelines, and is not picked up regularly by BC Coastal Waterbird Surveyors.
Survey Records 2008-09	More than 200 waypoint-encounters recorded 961 birds, with a peak survey count of 292 in September, when most were aggregated in small feeding groups in Sidney Channel and Haro Strait. But for the odd non-breeding individual, the species largely vacated the area from March to August.
Conservation Issues	The steep declines reported from Puget Sound are very concerning. Within the Southern Gulf Islands, the increasing volume of shipping traffic using Haro Strait and Boundary Pass (to access Vancouver, Bellingham and Seattle port facilities) raises the risk of an oil (or chemical) spill, to which this flocking, dive-feeding alcid would be especially vulnerable. Gillnet by-catch is another potential threat to which this species is especially vulnerable given its behavioural and life history traits; there are documented by-catch cases from salmon gill net fisheries adjacent areas to the Southern Gulf Islands (Hamel et al. 2009, Thomson et al. 1998).
Recommendations	• Verify and investigate causes for the apparent steep regional declines. • A good estimate of the number and distribution of this species will be important in the event of an oil spill.

a)



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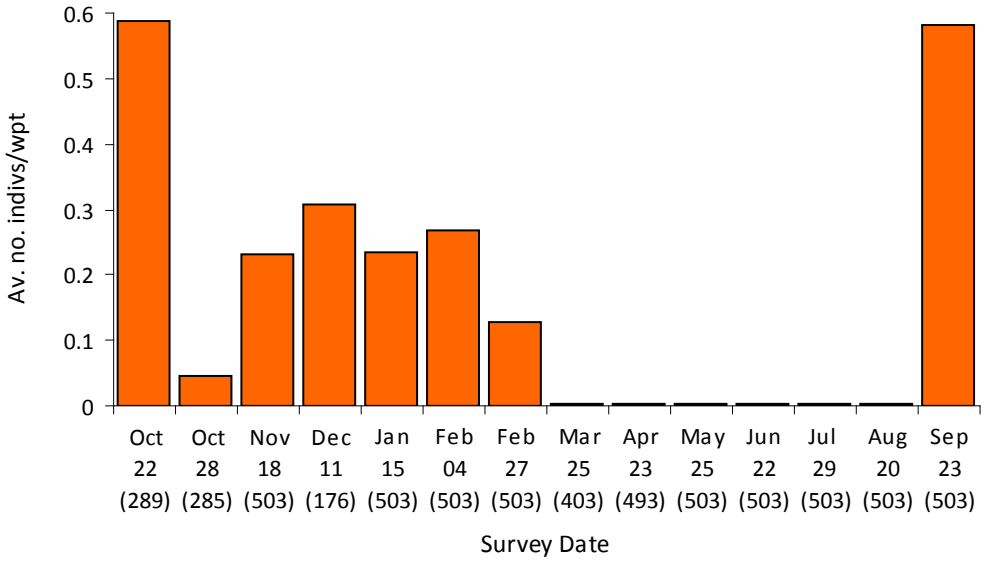


Fig. 42. Spatial distribution (a) and seasonal abundance (b) of Common Murre in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Pigeon Guillemot *Cepphus columba*

Conservation Status

Neither at risk nationally nor provincially, but assessed as a high priority by the BC Conservation Framework (BC MoE 2008).

Ecology and Regional Trends

This North Pacific endemic is a widespread breeder along the British Columbia coast. It feeds in near shore areas on benthic fish and invertebrates. Nests are built in rock crevices, beneath logs, and among pilings. Young are fed a benthic fish diet caught near the nest sites. Significant increasing non-breeding population trends are apparent from the BC Coastal Waterbird Survey (1999-2009; BSC unpublished data), Christmas Bird Count data from the Salish Sea for the 1975-84 and 1998-2007 periods, and data from Puget Sound monitoring programs between 1978-80 and 2003-05, which suggest increases of 15-110% (Bower 2009). Only one survey contradicts these trends, indicating a decline in Puget Sound (Nyeswander et al. 2005).

Southern Gulf Islands Status

The Gulf Islands supports a breeding population that is likely augmented by birds from elsewhere between August and March. Large numbers nest on Mandarte Island and Mitlenatch Island (Drent et al. 1964, Emms and Morgan 1989). Emms and Morgan (1989) list 14 breeding sites in the southern Gulf Islands holding a total of about 400 pairs. During the late 1980s-1990s, RWB saw small numbers of guillemots regularly and periodic large flocks such as 200 in Sidney Channel on 30 August 1994, and 45 from Sidney Spit on 16 August 1995. In the last 5 years (to 2009), very high numbers have been observed around the Victoria area, especially during fall (September-October). At Cordova Bay, a maximum of 674 was made in September 2007. Other locations where high counts occurred include Bazan Bay on the Saanich Penisula (200), Saanichton Bay (141), Island View Beach (114-165) and Queenswood to Gordon Head (91-113), all within the 2004-08 period (BSC unpublished BC Coastal Waterbird Survey data). These birds are very likely also using the adjacent habitats of the Southern Gulf Islands.

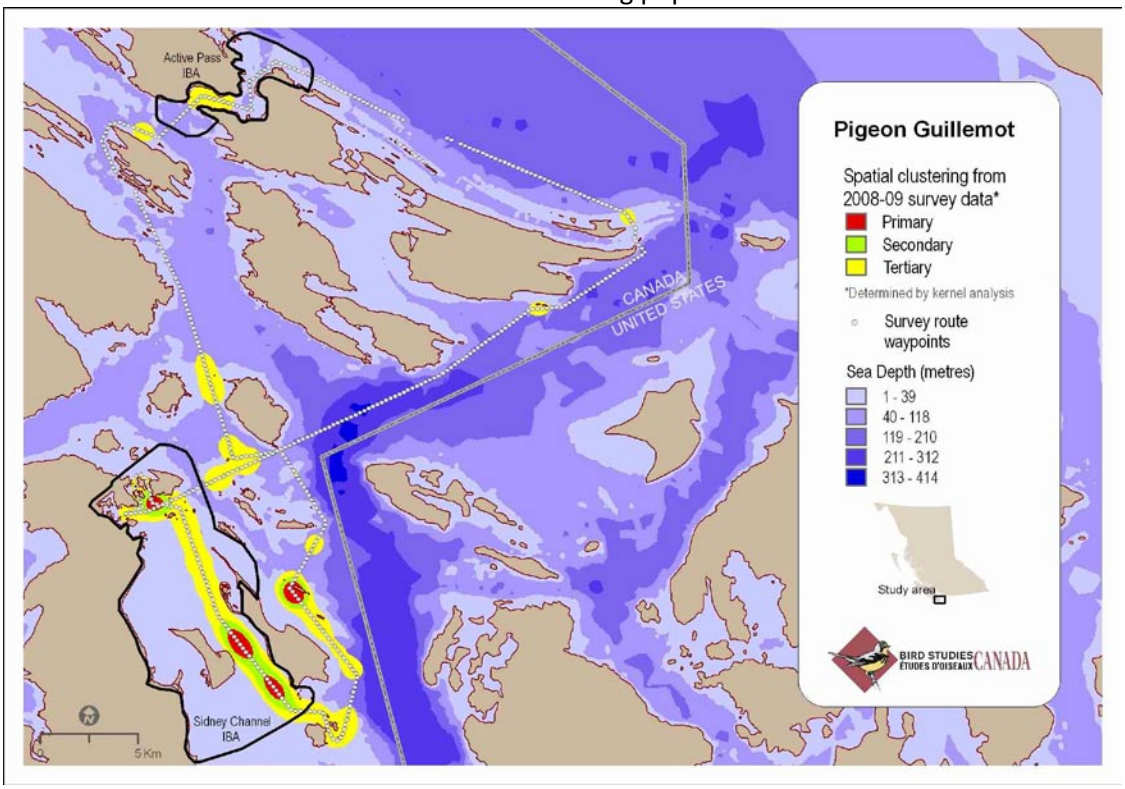
Survey Records 2008-09

The commonest species recorded on surveys in terms of the number of waypoint-encounters, with 590, tallying 3,569 individuals. The seasonal pattern of abundance showed a huge spike in September 2009, when 1,213 were recorded, almost all in Sidney Channel. Sidney Channel is the most important part of the survey area for this alcid, where it presumably congregates to feed on sandlance. Significant numbers also occur around the Coal-Kerr and Dock Islands. Breeding season survey records confirm that it nests on Mandarte in large numbers and as scattered pairs in Active Pass, and even at the Swartz Bay (and Tsawwassen) Ferry Terminals. The BC Coastal Waterbird Survey recorded widespread monthly counts of small numbers throughout the period, but did not note fall concentrations around Mayne, Pender or south-east Saltspring Islands.

Conservation Issues This appears to be one of the avian success stories of the region. The increasing volume of shipping traffic using the area raises the risk of an oil (or chemical) spill, to which this alcid would be vulnerable. Gillnet by-catch is another potential threat to which it is vulnerable.

Recommendations
- Investigate drivers of the apparent widespread increases, and continue to monitor the species, in particular in Sidney Channel/Haro Strait area.
- Identification of nesting sites other than on Mandarte would be useful to estimate the breeding population size in the Gulf Islands.

a)



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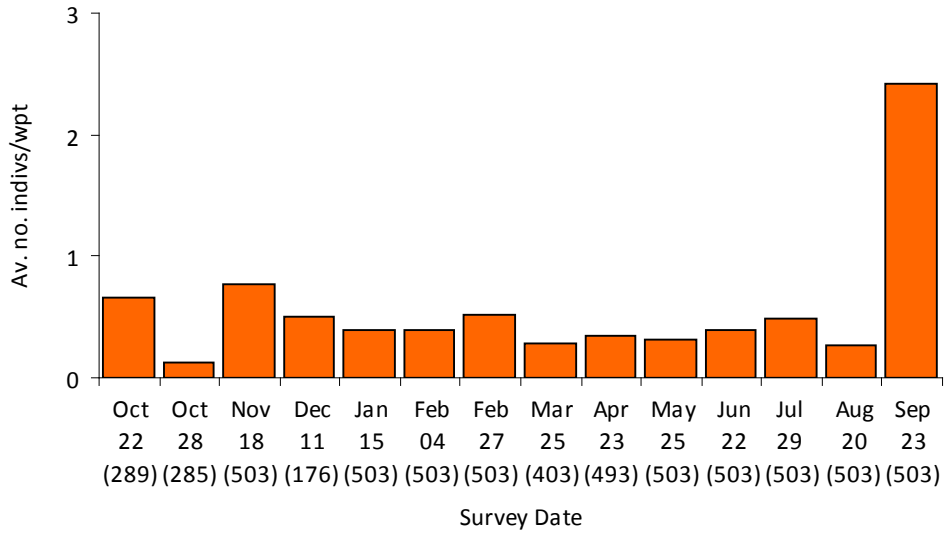
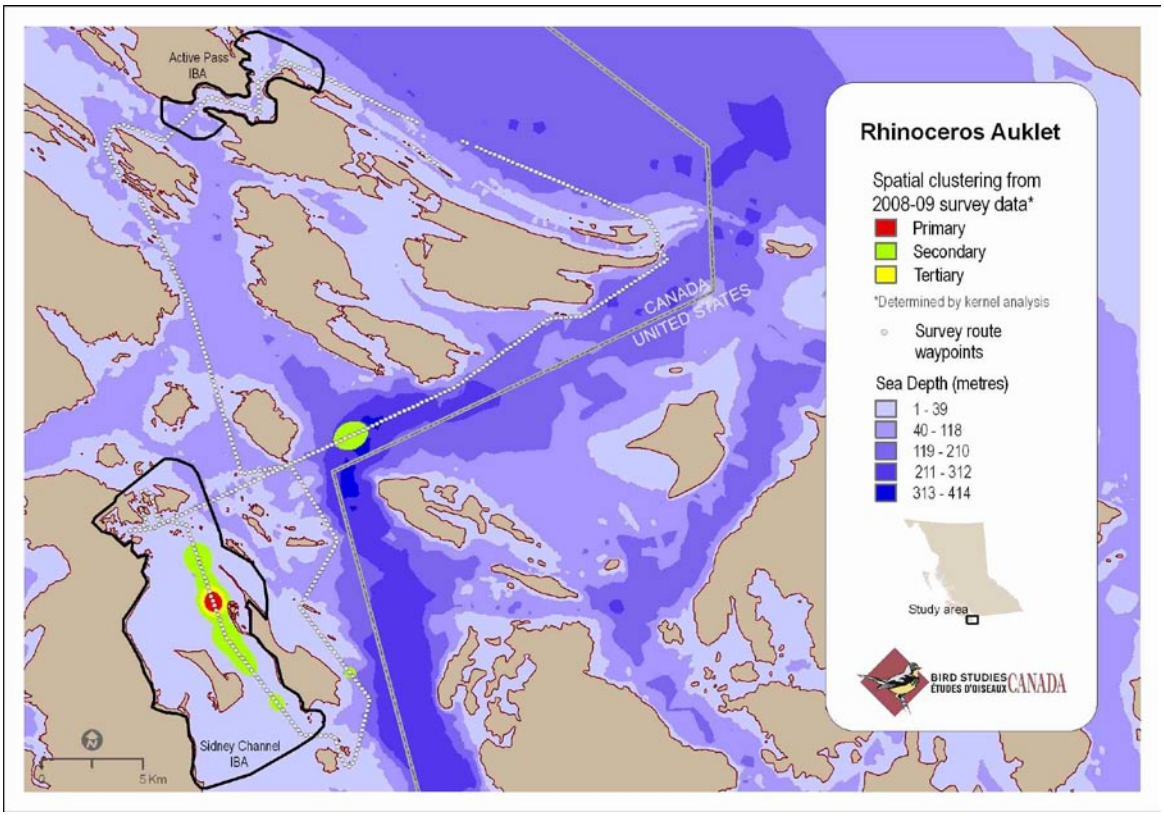


Fig. 43. Spatial distribution (a) and seasonal abundance (b) of Pigeon Guillemot in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Rhinoceros Auklet *Cerorhinca monocerata*

Conservation Status	Neither at risk nationally nor provincially, and assessed as a moderate-low priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	The rhinoceros auklet nests in large colonies on Smith and Protection islands in Washington State. The Conservation Data Centre considers its short-term trend in British Columbia to be increasing (BC MoE 2008). The BC Coastal Waterbird Survey indicates a steep decline from 1999-2009 (BSC unpublished data), although a shoreline-based survey is not the best monitor of an open marine water species like this one.
Southern Gulf Islands Status	Rhinoceros Auklets nest on Mandarte and Dock Islands, and forage in the surrounding waters (P. Arcese, pers. comm.). During the late 1980s and through the 1990s, RWB documented flocks of 100-1,200 in June and July foraging for sandlance in Sidney Channel, where they are often joined by gulls, cormorants and murres. The species feeds its young in June, July and August. Sidney Channel was an important feeding area for the Washington state colonies, with as many as 1,225 auklets entering the Channel daily (RWB unpublished data). Flock sizes entering the channel were generally small with fewer than 26 birds per flock but feeding flocks held up to 1,200 birds.
Survey Records 2008-09	We recorded 243 waypoint-encounters with 1,647 individuals, with a very distinct peak in abundance during the April-July breeding season, and only small numbers, typically 30 or less, recorded on surveys outside those months. Most often encountered in pairs, but we did encounter numerous feeding aggregations, chiefly in Sidney Channel, which is the primary foraging area for the species, and also at the west end of Boundary Pass/north end of Haro Strait, including flocks of 165 and 117 toward the north end of Sidney Channel in June and July respectively.
Conservation Issues	The water near the Discovery Islands, Cordova Channel, Sidney Channel, Active Pass, and southeast of Saturna island are important habitats for Pacific sandlance (C. Robinson, pers. comm.), which is a key prey species for this alcid.
Recommendations	• Continue boat-based monitoring of Sidney Channel and Haro Strait. • The ecological importance of sandlance in the diet to auklets is well known. Ecological studies to identify the breeding locations and biology of sandlance in the Gulf Islands will be key to understanding the presence of this auklet and other sandlance feeders.

a)



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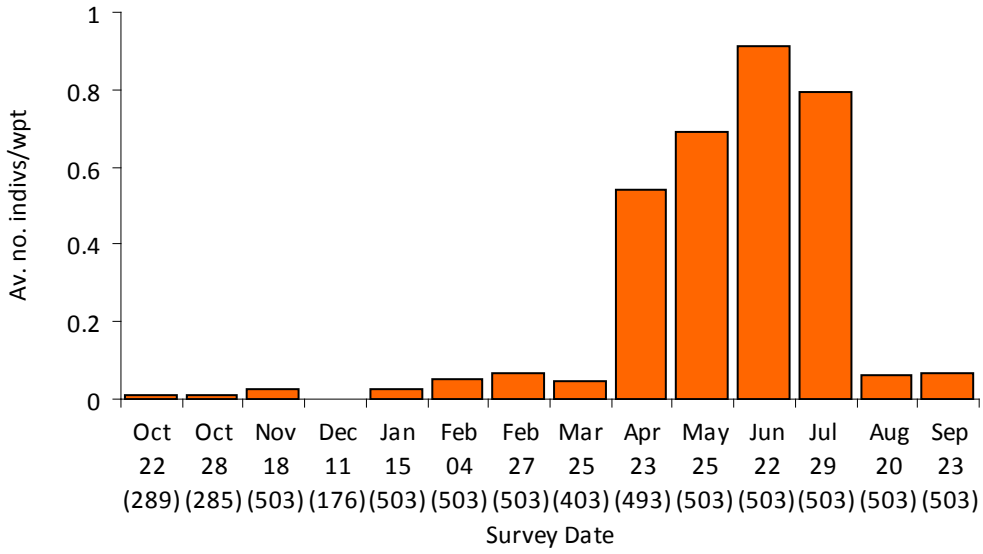
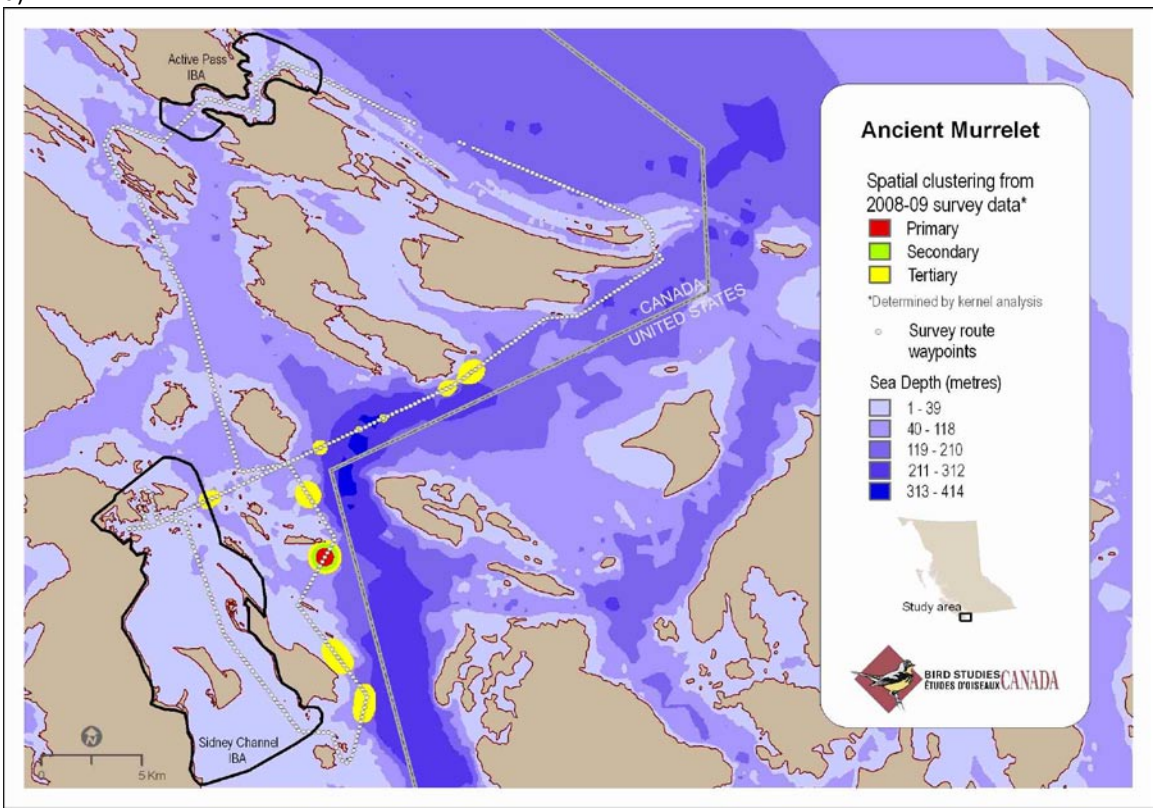


Fig. 44. Spatial distribution (a) and seasonal abundance (b) of Rhinoceros Auklet in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Ancient Murrelet *Synthliboramphus antiquus*

Conservation Status	SARA-COSEWIC – Special Concern; Blue-listed by the province of British Columbia and assessed as very high priority by the BC Conservation Framework (BC MoE 2008).
Ecology & Regional Trends	This small alcid feeds on zooplankton and fish. Fifty percent of the global population nests on the Queen Charlotte Islands. This population is declining (assessed as 10-30% over the short-term, and 50-75% over the long term; BC MoE 2008), chiefly due to introduced predators in nesting colonies (COSEWIC 2004). Outside the April-June breeding season, the species disperses to marine waters of the north-east Pacific and the inner waters of the Strait of Georgia, including Boundary Bay (Gaston 1992, Butler unpublished data), the Sunshine Coast and the Victoria coastline, where flocks of up to 2400 have been recorded in late fall/early winter (BSC unpublished data); November 2008 saw a spate of records from Victoria's coast, with several counts exceeding 100 birds.
Southern Gulf Islands Status	Campbell et al. (1990) indicated that large numbers of Ancient Murrelets use Haro Strait during late fall/early winter. Shoreline based observations of this open water alcid are rare; in ten years of monthly Coastal Waterbird Surveys in the Southern Gulf Islands, there are just two records, of three individuals, in December 1999 and November 2007, both from the north-eastern shore of Mayne Island.
Survey Records 2008-09	Sixty-two waypoint-encounters with 760 individuals were recorded, including 40 waypoint-encounters with 659 birds on 15 November. The main concentrations were in Haro Strait, both north and south of Mandarte Island, with smaller numbers in Boundary Pass and adjacent Swanson Channel and Prevost Passage. This appears to have been a short but major pulse in numbers (the birds were not present in late October, and numbers had dropped markedly by December). These data indicate that the Southern Gulf Island waters remain an important habitat for this Special Concern murrelet in early winter.

a)



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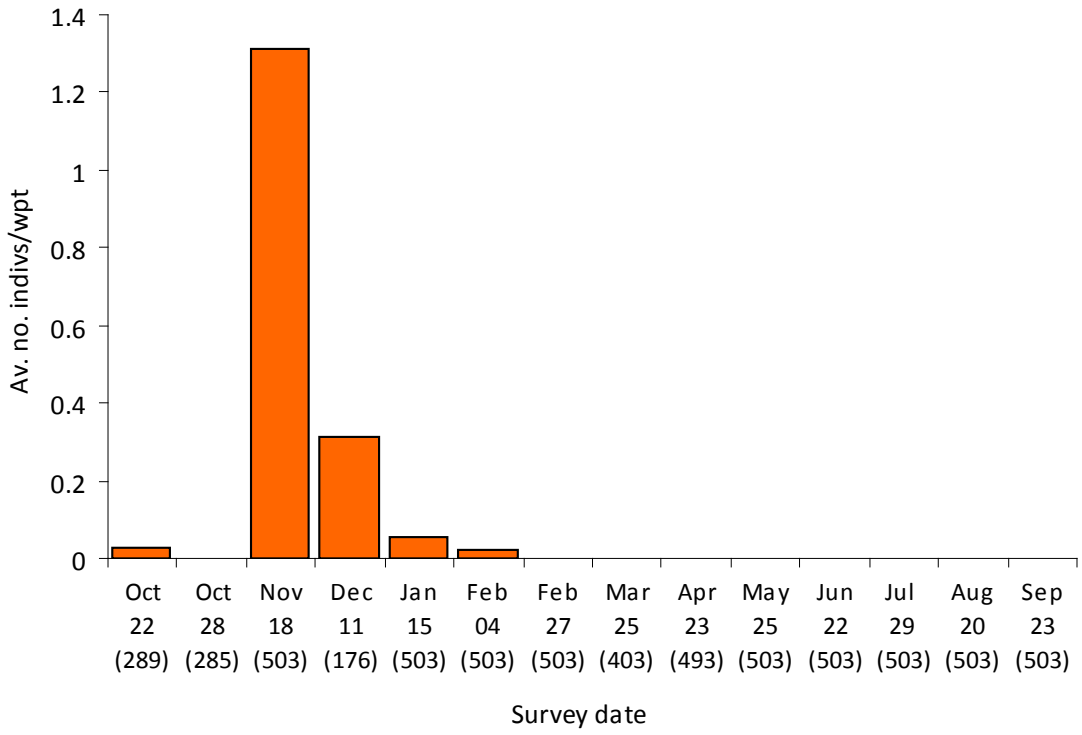


Fig. 45. Spatial distribution (a) and seasonal abundance (b) of Ancient Murrelet in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Conservation Issues

- This pulse of abundance was noted at a similar time of year in Boundary Bay in 2007, and may be an annual phenomenon tied to a specific food resource, in particular plankton.
- Within the Southern Gulf Islands, the increasing volume of shipping traffic using Haro Strait and Boundary Pass (to access Vancouver, Bellingham and Seattle port facilities) raises the risk of an oil (or chemical) spill, to which this flocking, dive-feeding alcid would be especially vulnerable.
- Gillnet by-catch is another potential threat to which this species is especially vulnerable given its behavioural and life history traits.

Recommendations

- Investigate whether this late fall pulse of abundance is an annual phenomenon tied to a specific food resource (e.g. the euphausid *Euphasia pacifica*, juvenile Herring – both major known components of the species diet in fall/winter – or another source) and what factors control the abundance of that food resource.
- Establish the geographic extent of this seasonal pulse of Ancient Murrelets (for example, high counts of up to 2400 have been made along the Sunshine Coast in Dec-Jan), and the relative use of Southern Gulf Islands waters compared to other areas.
- Investigate linkages between breeding populations in Gwaii Hanaas NP and the non-breeding population in the Gulf Islands National Park Reserve and proposed NMCA.

Fig. 46. Ancient Murrelets – listed as Special Concern under the Species at Risk Act, this survey recorded large numbers in the deeper water channels of Haro Strait and Boundary Pass in late fall and early winter, a pattern of seasonal occurrence shown elsewhere in the Strait of Georgia (Tom Middleton, Pacific Wildlife Foundation).

Fig. 47a. Pigeon Guillemots – a common resident of the Southern Gulf Islands, these striking alcids appear to be increasing in numbers in the Southern Gulf Islands and wide Salish Sea region, based on results from various trend analyses (Tom Middleton, Pacific Wildlife Foundation).

Fig.47b. Bonaparte's Gulls congregate to feed in very large numbers (many thousands) in spring and fall, especially in Active Pass and off Boiling Reef (Rob Butler, Bird Studies Canada/Pacific Wildlife Foundation)

Marbled Murrelet *Brachyrhamphus marmoratus*

Conservation Status — Globally Threatened – Vulnerable (IUCN 2009). SARA-COSEWIC – Threatened. Red-listed by the province of British Columbia and assessed as very high priority by the BC Conservation Framework (BC MoE 2008).

Ecology and Regional Trends — This old-growth forest nester feeds on small fish and zooplankton. The British Columbia population is declining (assessed as 10-30% over the short-term, and 25-75% over the long term; BC MoE 2008), in particular due to the loss of its old-growth forest nesting habitat (COSEWIC 2000). Major declines have been reported from Puget Sound, based on several different surveys (Bower 2009, Nyeswander 2005).

Southern Gulf Islands Status — A sudden decline began in this area in the 1960s, shown by Christmas Bird Count data. The species is present year-round in small numbers, with the peak in abundance during winter months. It is relatively widespread, but shows a preference for certain areas.

Survey Records 2008-09 — We tallied 136 waypoint-encounters with 345 birds over the 14 surveys, with just one survey (23 April) when the species was not recorded. Most encounters were with pairs. The highest survey-count was 86 on 15 Nov, the same date as the peak in abundance of Ancient Murrelets. Although Marbled Murrelet records were widely scattered, there were distinct core areas immediately south of Coal Island, around Ker Island and the Little Group, and immediately north-east of there in southern Prevost Passage, around Imrie Island and east to Fairfax Point. A total of 71 were recorded in this area on 15 November. Other important areas include the Strait of Georgia north and east of Tumbo Island, Sidney Channel, southern Haro Strait and the adjacent waters around the D'Arcy Island group, and southern Trincomali Channel. Perhaps noteworthy was a pair consistently recorded in the same place, between D'Arcy and Little D'Arcy, on three summer surveys. This murrelet's diminutive jizz makes it difficult to see if far from shore; consequently it is not regularly recorded from Southern Gulf Island survey sites of the BC Coastal Waterbird Survey. The 2008-09 period yielded just seven records, three from Saltspring Island (off Nose Point opposite Prevost), three off the north-east shoreline of Mayne and one in Boundary Pass off Pender. The former distribution of the murrelet was possibly much wider than what our surveys of the remnant population indicate.

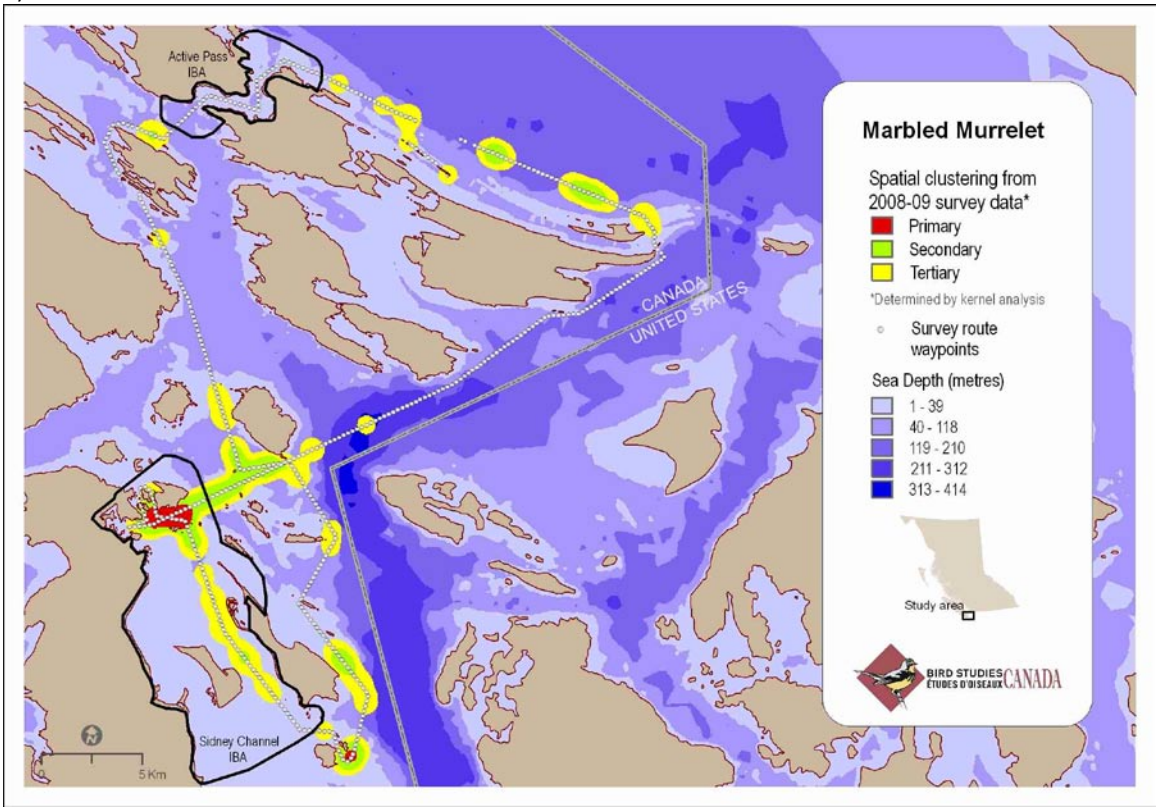
Conservation Issues — The marbled murrelet was a fairly numerous species in the Gulf Islands within the memory of people who live and work there. P. Arcese (pers. comm.) has noted a decline over the past few decades during a regular trip between Coal Harbour and Mandarte Island. The declines coincide with the forest cutting in the watersheds near Vancouver in the 1990s. Within the Southern Gulf Islands, the increasing volume of shipping

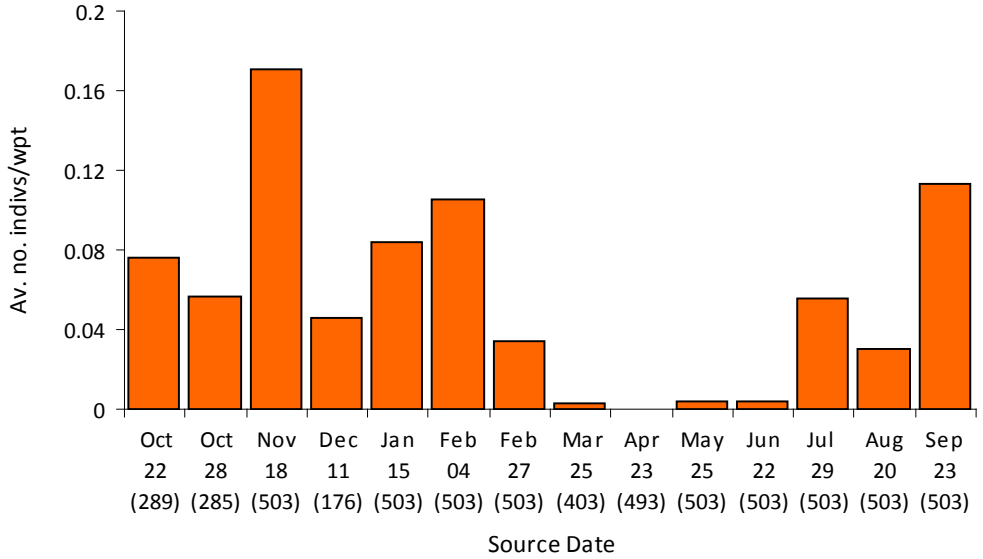
traffic raises the risk of an oil spill, to which this alcid is vulnerable, and gillnet by-catch is another potential threat.

Recommendations

- Investigate linkages between Gulf Island breeding populations with the Vancouver watersheds and Pacific Rim NPR, and the non-breeding population in the Gulf Islands National Park Reserve and proposed NMCA.

a)





b)

Fig. 48. Spatial distribution (a) and seasonal abundance (b) of Marbled Murrelet in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Appendix 3. Marine Mammal Species Recorded from Southern Gulf Islands

Name	Source (if unrecorded on this survey)
Harbour Seal *Phoca vitulina*	
Steller Sea Lion *Eumetopias jubatus*	
California Sea Lion *Zalophus californianus*	
Common Minke Whale *Balaenoptera acutorostrata*	
Killer Whale *Orcinus orca*	
Dall's Porpoise *Phocoenoides dalli*	
Harbour Porpoise *Phocoena phocoena*	
Northern River Otter *Lutra canadensis*	
Northern Elephant Seal *Mirounga angustirostris*	R.W.Butler unpublished data
Pacific White-sided Dolphin *Legnorhynchus obliquidens*	www.orcanetwork.org
Fin Whale *Balenoptera physalus*	Pike and MacAskie (1969)
Northern Right Whale *Eubalaena japonica*	Cresswell *et al*. (2007)
Humpback Whale *Megaptera novaeangliae*	www.orcanetwork.org
False Killer Whale *Pseudorca crassidens*	BC Cetacean sightings network
Gray Whale *Eschrichtius robustus*	www.orcanetwork.org

Table 5. Marine mammals recorded in the Southern Gulf Islands.

Appendix 4. Annotated List of Marine Mammals Species

The following accounts summarize the distribution and abundance of all marine mammal species recorded on the survey. Spatial distribution showing important (primary, secondary and tertiary) areas for each species based on kernel estimator modeling is presented in the figures, and temporal distribution is illustrated using seasonal abundance bar graphs showing the average number of individuals recorded per waypoint on each survey.

Humpback, Killer, Common Minke and Gray Whales were all present in the region during the survey period, although our records are few or absent (Table 6).

	Humpback whale		Killer whale		Minke whale		Gray whale	
Month	Region	Islands	Region	Islands	Region	Islands	Region	Islands
Oct	+		+	+	+		+	
Nov	+		+	+	+	+		
Dec			+	+	+			
Jan			+	+			+	
Feb			+	+			+	
Mar			+	+		+	+	
Apr			+	+	+		+	
May	+		+	+	+		+	
Jun	+		+	+	+		+	
Jul	+		+	+	+		+	
Aug	+		+	+	+		+	
Sep	+		+	+	+		+	

Table 6. Months in which one or more Humpback, Killer, Minke and Gray Whales were reported to Orcanet (www.orcanetwork.org) in the southern Strait of Georgia/Juan de Fuca/Puget Sound region and the Southern Gulf Islands during our survey period of October 2008-September 2009.

Northern River Otter *Lutra canadensis*

Conservation Status	Neither nationally nor provincially at risk, and assessed as a moderate-low priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	The otter is widespread along the British Columbia coast where it dens among logs, beneath tree roots and old buildings, in the ground and rock crevices. It marks its territory by depositing feces and scents on rocky promontories, islands, and docks.
Southern Gulf Islands Status	The otter is a widespread and relatively common resident in the Southern Gulf Islands, usually encountered close to shore.
Survey Records 2008-09	We recorded just two waypoint-encounters during transect surveys, one on Goudge Island in November and a family group of seven on the Belle Chain Islets in September. We also encountered two or three on the southern shore of Saturna in April, west of East Point. Butler (unpublished data) reported seeing singles and family groups on a regular basis on Sidney Island in the 1990s, and Davidson (unpublished data) recorded several individuals on Mayne, Pender, southern Galiano and south-east Saltspring between April 2008 and February 2009.
Conservation Issues	None known.
Recommendations	• In light of the species popular profile with the public, consideration could be given to featuring this charismatic marine mammal in outreach materials • Being a fairly numerous top predator, monitoring the Northern River Otter population within the GINPR would be worth considering

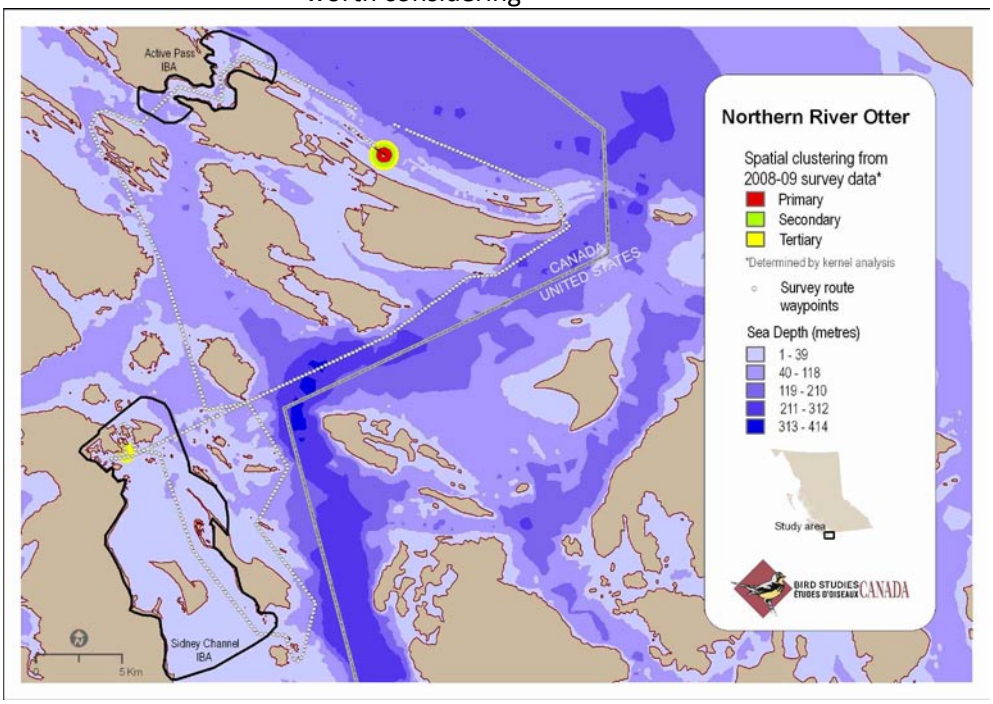
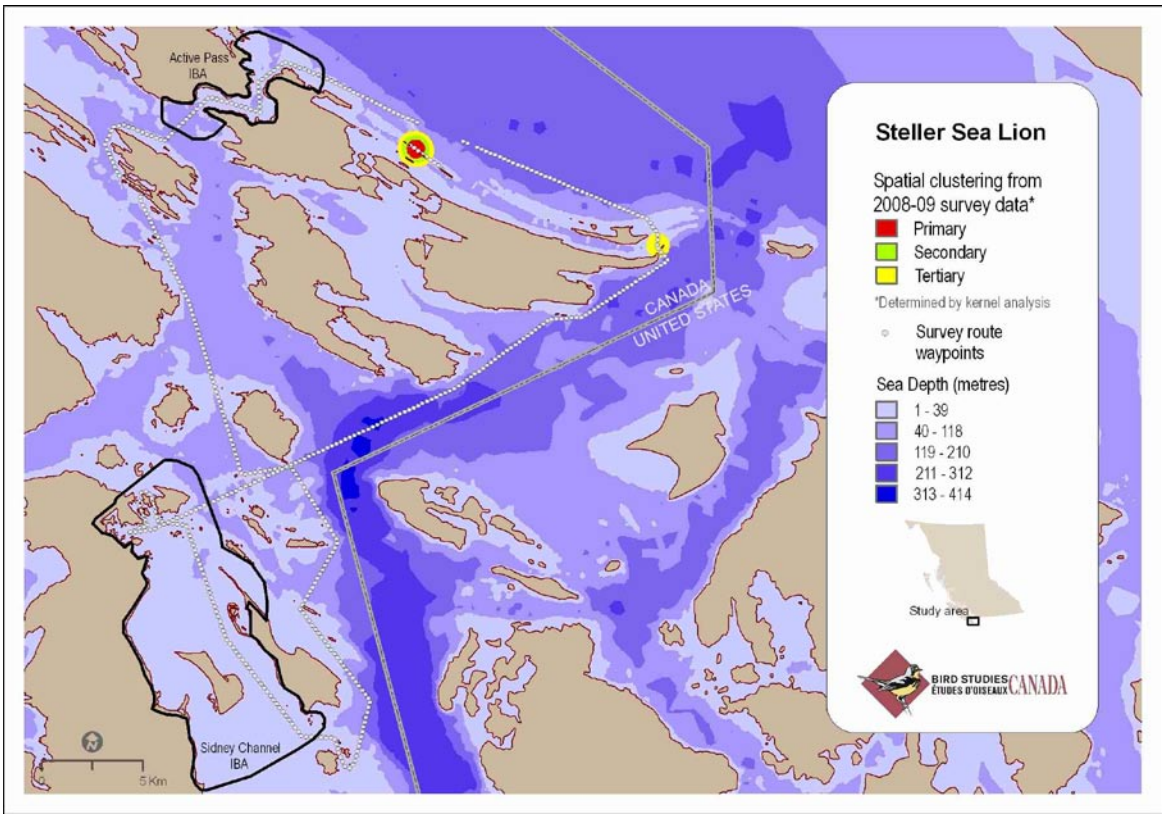


Fig. 49. Spatial distribution of Northern River Otter in the Southern Gulf Islands, British Columbia, October 2008 – September 2009.

Steller Sea Lion *Eumatopias jubatus*

Conservation Status	Globally Threatened – Endangered (IUCN 2009). SARA/COSEWIC – Special Concern (COSEWIC 2003); Blue-listed by the province of British Columbia and assessed as very high priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	The global population qualifies for Endangered (EN) status because of a global decline of 54% in the last three generations, for which the cause of has not yet been identified. British Columbia's population breeds in three rookeries north of Vancouver Island, which more than doubled (to 13,400-18,800 animals) between the early 1970s and 2002 (Pacific Biological Station Survey, 2002), although BC Ministry of Environment more recently assessed the short-term trend as declining by 10-30% (BC MoE 2008). The separate Alaskan population is declining significantly, perhaps due to a dietary switch to less nutritious fish as preferred oily species become less available.
Southern Gulf Islands Status	There are two known winter haul-outs in the Southern Gulf Islands, the Belle Chain Islets and Boiling Reef off East Point, Saturna.
Survey Records 2008-09	We regularly encountered this sea lion at its two haul-outs between October 2008 and May 2009. The Belle Chain Islets supported the highest numbers, with 40-60 animals on most visits, and maximum counts of 112 in April and 80 in November; the highest count on Boiling Reef was 19 in March (when the Belle Chain haul-out was not visited due to rough seas). Individuals were encountered occasionally away from these haul-outs, in Active Pass (foraging with Harbour Seals near the western entrance), between the Belle Chains and East Point, and in Haro Strait off Halibut Island.
Conservation Issues	Given the precarious global status of this pinniped, British Columbia has an increasingly important role to play in its conservation. More data are required on the type and level of haul-out use by Steller Sea Lions in British Columbia. Haul-outs and adjacent near-shore areas used by juveniles and pups are considered critical habitat in Alaska (Raum-Suryan *et. al.* 2004), and given the declines occurring in populations to the north-west, better understanding of haul-out use in BC is becoming more and more important.
Recommendations	• Regular monthly visits to the Belle Chain Islands and Boiling Reef haul-outs to photograph all animals and assess their sex and age class would contribute significantly to existing knowledge of haul-out use. Combine with data from W. Szaniszlo from Pacific Rim NP. • Investigate linkages between breeding populations and the non-breeding population in the Gulf Islands National Park Reserve and proposed NMCA. • Maintaining the Steller Sea Lion population in the Southern Gulf Islands should be a high priority for Parks Canada.

a)



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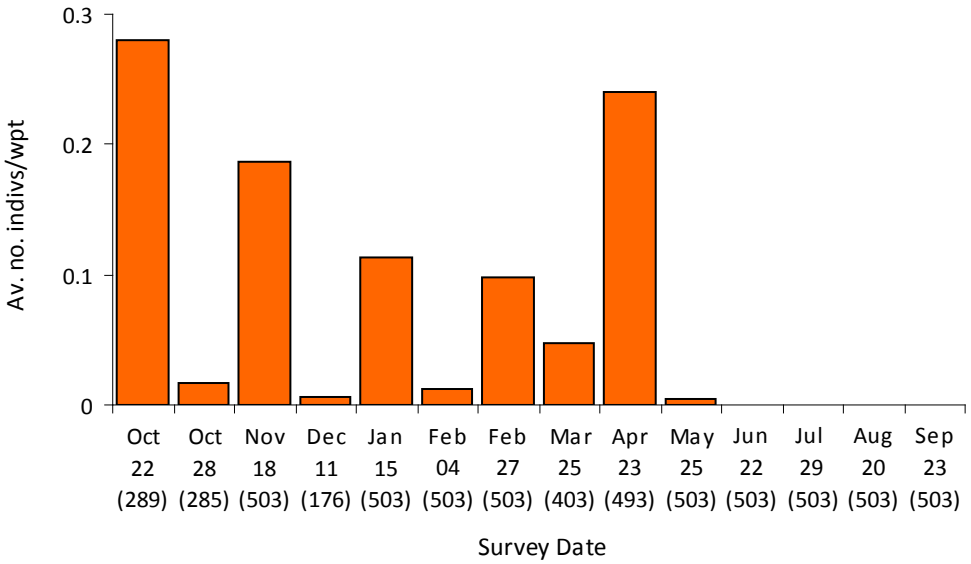


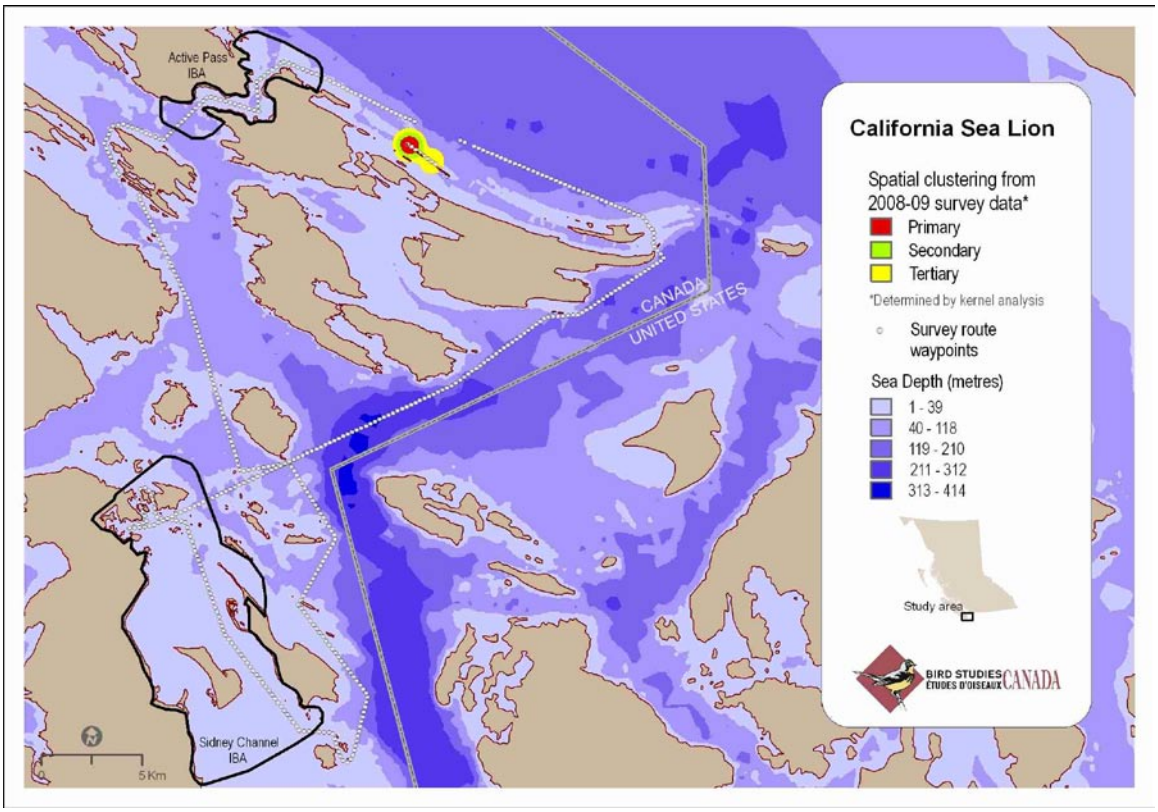
Fig. 50. Spatial distribution (a) and seasonal abundance (b) of Steller Sea Lion in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

California Sea Lion *Zalophus californianus*

Conservation Status	Neither nationally nor provincially at risk, and not assessed by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	Southern British Columbia represents the northern limit of this species range, to which it disperses after breeding in California and Baja California, Mexico. Numbers have dramatically increased in recent years. Females give birth to a single pup between May and June. Mostly sub-adult and adult males migrate north and are present in BC from September to May. The species occurs in large numbers at herring spawn sites where it hauls out on log booms.
Southern Gulf Islands Status	A non-breeding visitor outside the May-July breeding season, with regular haul-outs near Nanaimo. Frequently seen in small numbers, but probably less numerous than Steller Sea Lion.
Survey Records 2008-09	We recorded just three waypoint-encounters with five individuals, a single and two twos, in April, June and September respectively, all at the Steller Sea Lion haul-out on the Belle Chain Islets. Clearly the species uses the Southern Gulf Islands in smaller numbers than its congener.
Conservation Issues	None.
Recommendations	None.

Fig. 51. Steller and California Sea Lions at the Belle Chain Islets haul-out on 23 April 2009 (Tom Middleton, Pacific Wildlife Foundation). Note the warm rufescent to pale buff pelage of the Steller Sea Lions, compared to the dark brown fur of the two California Sea Lions (the nearest animals front left).

a)



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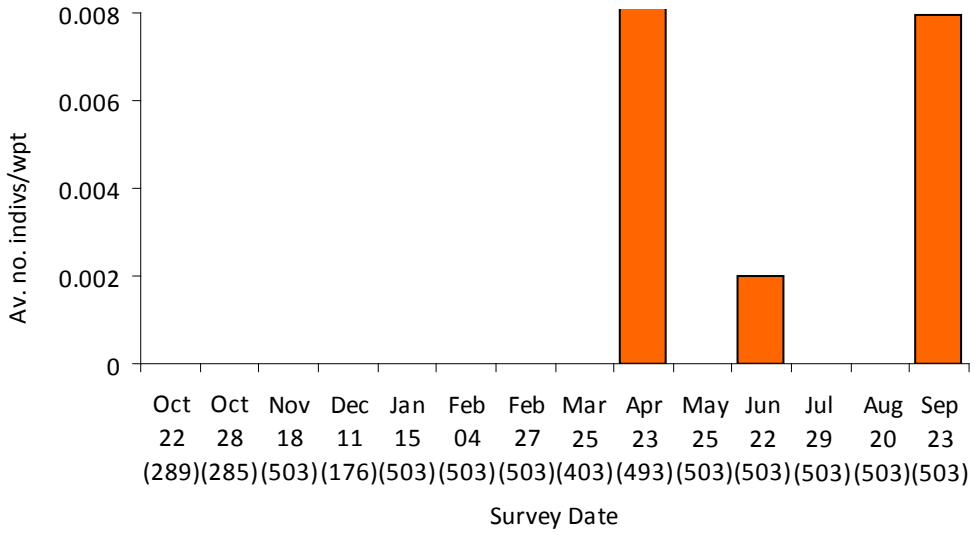


Fig. 52. Spatial distribution (a) and seasonal abundance (b) of California Sea Lion in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Harbour Seal *Phoca vitulina*

Conservation Status

Neither at risk nationally nor provincially, and not assessed by the BC Conservation Framework (BC MoE 2008).

Ecology and Regional Trends

The Harbour Seal has been increasing in the Strait of Georgia for many years and reached over 37,000 seals a decade ago (Olesiuk 1999). The California-Oregon-Washington-British Columbian population has increased significantly since it was afforded protection from commercial hunting 40 years ago, and despite declines in the Alaskan population over the past 20-30 years, the eastern North Pacific population was estimated to number 285,000 individuals (Cresswell et al. 2007).

Southern Gulf Islands Status

A widespread and common resident of the area.

Survey Records 2008-09

The most numerous marine mammal by a long stretch, with 512 waypoint encounters totaling 7,197 individuals. The majority were recorded at haul-out sites, which are grouped by island/islet group, and summarized in Table 3 below. Harbour seals were observed virtually everywhere in low density, but other than proximal to haul-out sites, were only encountered in groups of >10 in Active Pass, typically actively feeding during tidal floods and ebbs.

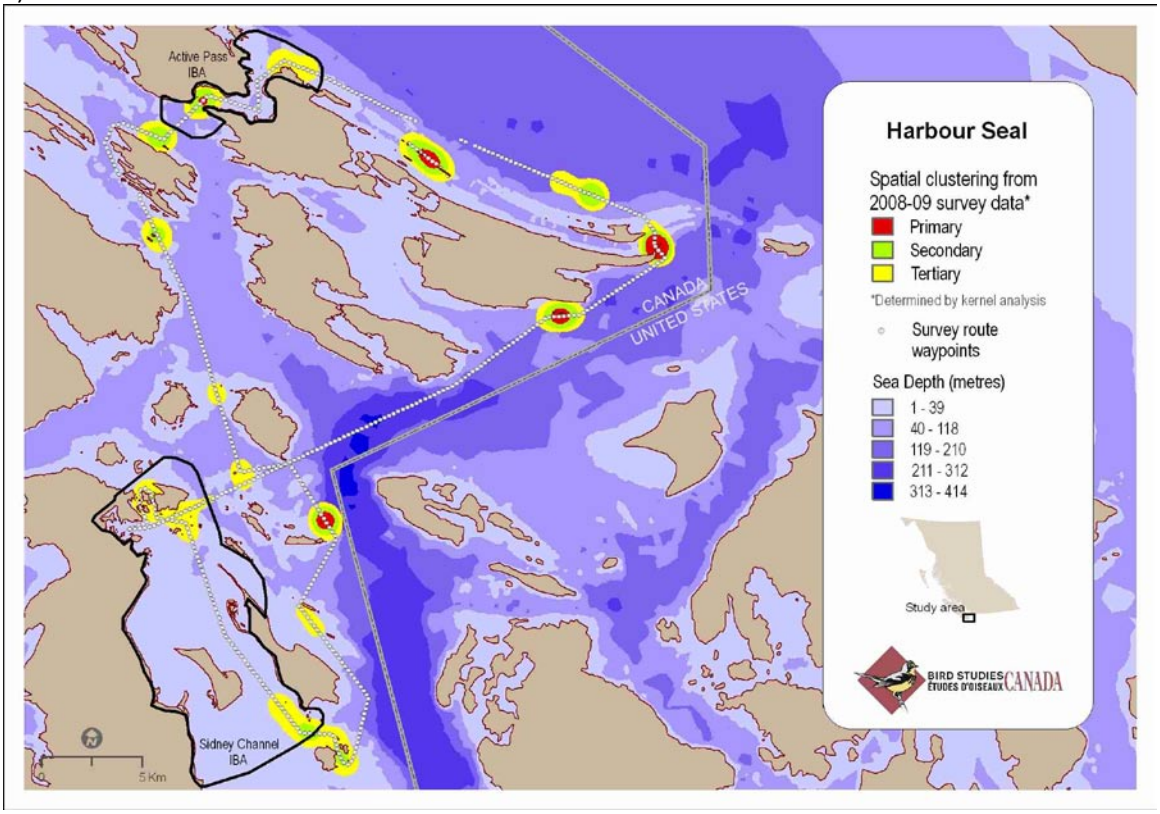
Haul-out Location	No. of surveys animals present	Mean waypoint count	+/- SE	Maximum Count
Java Islets	12	49.1	6.65	165
Boiling Reef	11	89.4	21.39	280
South Sidney islets	11	23.0	4.74	25
D'Arcy Islands	10	25.2	7.03	54
Belle Chain Islets	9	37.7	7.69	54
Coal Island	8	14.3	4.52	136
Hawkins Island	8	35.4	9.71	199
Channel Islands	6	30.1	6.02	200
Kerr-Dock Islands	6	21.0	6.45	26
Gooch (east and north)	5	82.7	32.06	18
Goudge Island	5	10.6	3.96	85
NE Mayne shoreline	4	27.8	7.60	80
Tumbo-Cabbage	4	35.7	12.54	116
Canoe Rock	3	15.0	4.32	52
Imrie Island	3	29.8	14.66	20
Mandarte and satellites	3	15.7	2.42	51
Georgeson Bay	2	96.7	46.75	93
Halibut Island	1	18.0	0	100

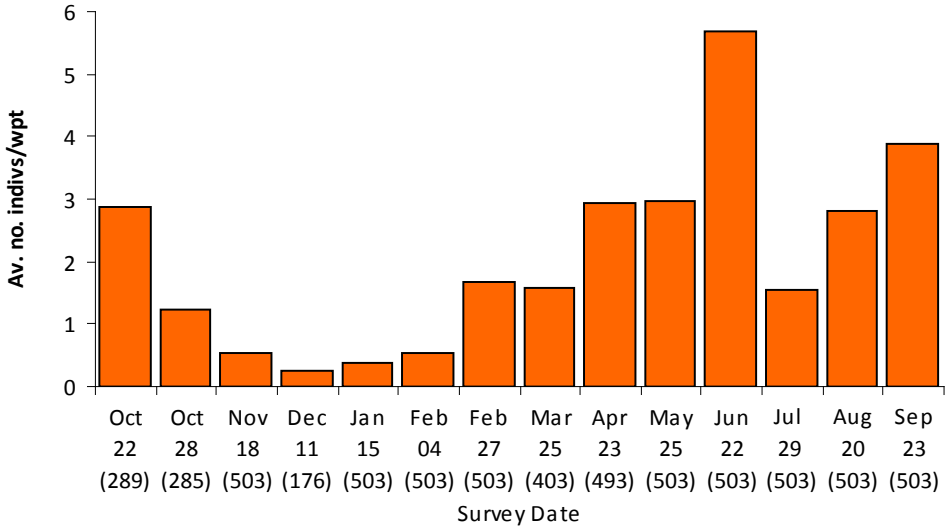
Table 7. Haul-out locations, number of surveys that seals were present, mean number encountered per waypoint, and maximum number of Harbour Seals counted during 2008-09.

Conservation Issues The abundance of Harbour Seals may be impacting on the prey base of other marine bird and mammal species, part of a complex ecosystem imbalance issue involving reduced predator populations (sharks and whales), fishing industry impacts and reduced fish recruitment.

Recommendations • Investigate trohpic linkages and possible impacts of the Harbour Seal population on forage fish abundance, hence indirect effects relating to the conservation of priority bird and mammal species.

a)





b)

Fig. 53. Spatial distribution (a) and seasonal abundance (b) of Harbour Seal in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Minke Whale *Balaenoptera acutorostrata*

Conservation Status	Neither at risk nationally nor provincially, and not assessed by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	The minke whale is a numerous species in the Pacific where it numbers in the millions. It is seen regularly in the Strait of Georgia, but local trends are not known.
Southern Gulf Islands Status	Minke whales are seen regularly in the region (Table 4) usually as solitary animals. One was killed by transient killer whales in Ganges Harbour in October 2002.
Survey Records 2008-09	Single Minke Whales were seen breaching (eight times!) in Boundary Pass on 22 October and traveling along the eastern shore of Sidney Island on 23 March. Orcanet reported sightings of Minke Whale from the adjacent San Juan Islands and Haro Strait (USA) Orcanet reported sightings of Minke Whale from the adjacent San Juan Islands and Haro Strait (USA) in most months (Table 4).
Conservation Issues	The distribution of this species in the Salish Sea is not well known at this time, making conservation issues and actions, if any, unclear.
Recommendations	• Work with Washington-based groups to track sightings of minke whales from Orcanet and whale watching companies in Canada to identify how the species uses the islands.

a)

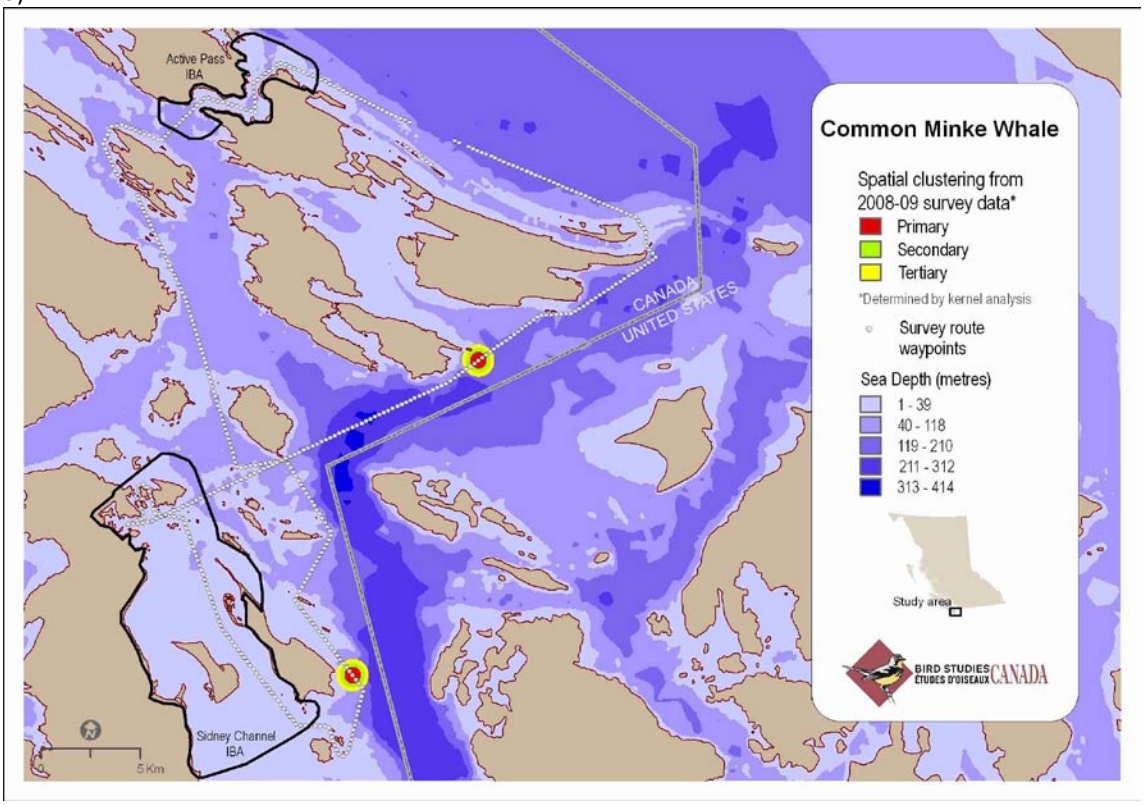


Fig. 54. Spatial distribution of two Minke Whale sightings in the Southern Gulf Islands, British Columbia, 22 October 2008 and 25 March 2009.

Fig. 55a. Killer Whales in the Strait of Georgia off East Point, Saturna (Tom Middleton, Pacific Wildlife Foundation). This Endangered, charismatic Species at Risk is a major source of revenue generation for the whale-watching industry, which is largely based out of Victoria and Richmond-Vancouver.

Fig. 55b. Harbour Seals at one of many regualr haul-outs in the Southern Gulf Islands (Tom Middleton, Pacific Wildlife Foundation). An abundant population of this pinniped occurs in the Southern Gulf Islands; Harbour Seals are a key food source for the transient population of Killer Whales.

Fig. 55c. Dall's Porpoise in Boundary Pass (Tom Middleton, Pacific Wildlife Foundation). This distinctive black-and-white porpoise is less common than its SARA-listed relative the Harbour Porpoise, with which it at least occasionally hybridises.

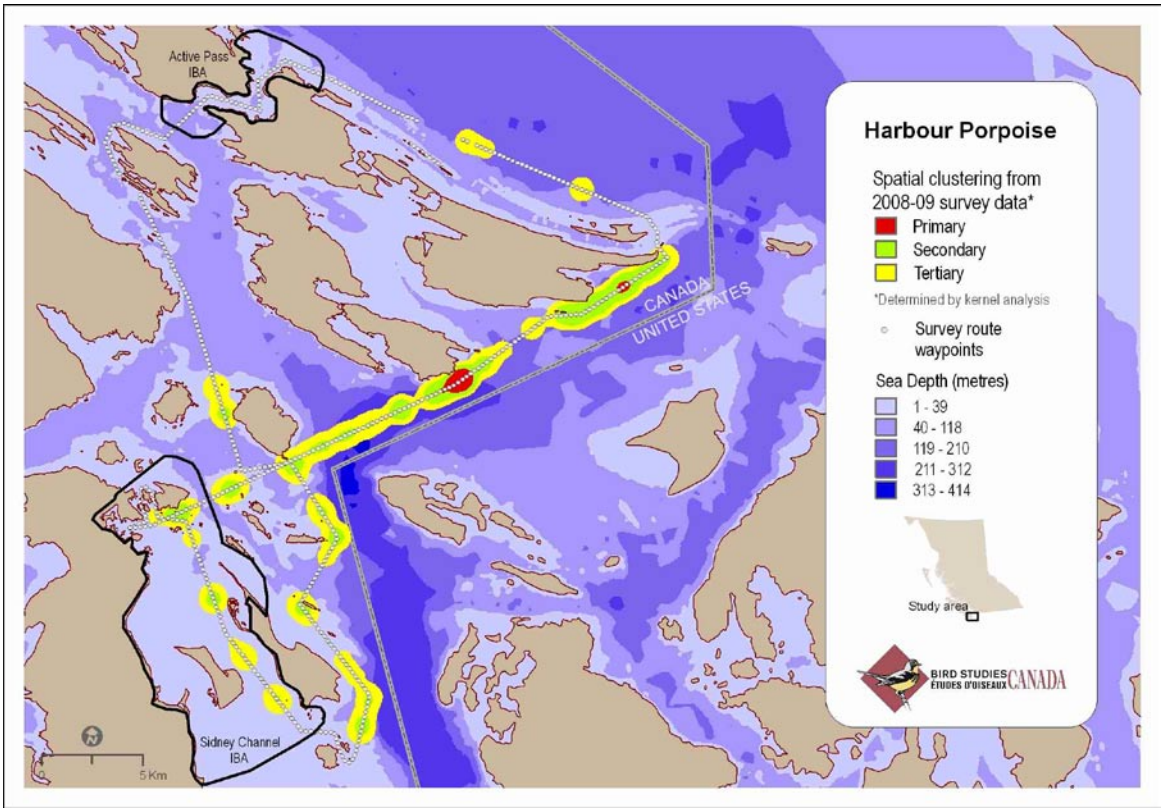
Harbour Porpoise *Phocoena phocoena*

Conservation Status	SARA/COSEWIC – Special Concern; Blue-listed by the province of British Columbia and assessed as moderate or low priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	This porpoise occurs throughout the Straits of Georgia and Juan de Fuca, and north through the central coast (frequently in mainland inlets) and the Queen Charlotte Basin (Williams and Thomas 2007). Seasonal abundance estimates for an 805km^2 area of water from Haro Strait to Race Rocks, ranged from a high of 673 for April-October to 208 for November-March (Hall 2004). No trend data are available.
Southern Gulf Islands Status	Harbour porpoise is the most widespread and numerous cetacean in the Southern Gulf Islands. It occurs year-round, with a peak in abundance in southern Haro Strait and the eastern end of the Juan de Fuca Strait during the summer months through to October (Hall 2004).
Survey Records 2008-09	Over the course of the 14 surveys we recorded 110 waypoint-encounters with an estimated 299 individuals. The maximum survey-count was 59 animals (21 encounters) on 23 June. Collectively, April-October surveys each tallied >20 animals, except August, when the sea state was Beaufort 2 or more throughout. Key areas for this cetacean are Boundary Pass, especially the section off the south-eastern headlands of Pender Island, between Blunden Islet and Tilly Points, and the vicinity of the Java Islets, also East Point, Saturna, Prevost Passage and Haro Strait. Land-based observations in Boundary Pass suggest that porpoises may come in to feed during slack tides. In sea states of Beaufort 3 or more, detectability of this subtle cetacean diminishes to almost zero, so we very likely missed animals during the December, late February and March surveys. These observations mirror the findings of Hall (2004), in terms of the peak in Harbour Porpoise abundance occurring between April and October. A pattern is emerging that indicates their use of habitats may be dictated by both season and stage of tidal cycle.
Conservation Issues	Haro Strait and Boundary Pass are major, busy transport lanes likely to experience increased shipping as Vancouver ports expand, which will increase a) risk of a major oil or chemical spill, b) noise in the marine environment, c) potential for collisions with cetaceans, all of which are potential threats. In addition, both Juan de Fuca and Haro Straits are used by high densities of recreational vessels and for military exercises. The impact of any spill event would be greatest between April and October, particularly if some proportion of the population uses the region for calving, nursery or mating. By-catch in fishing gear is another threat to this marine mammal.

Recommendations

- Refine the survey area and increase the survey frequency to better define the areas most of used by this species.

a)



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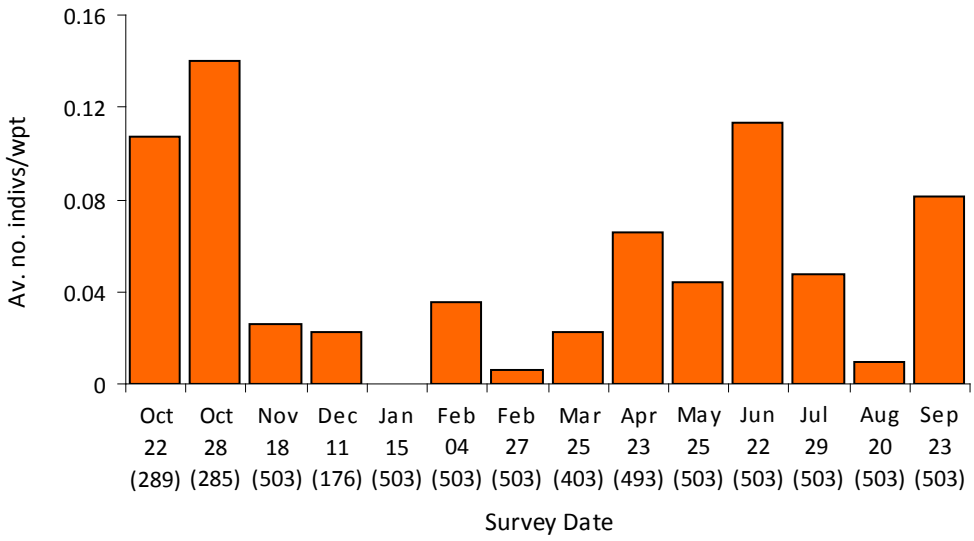
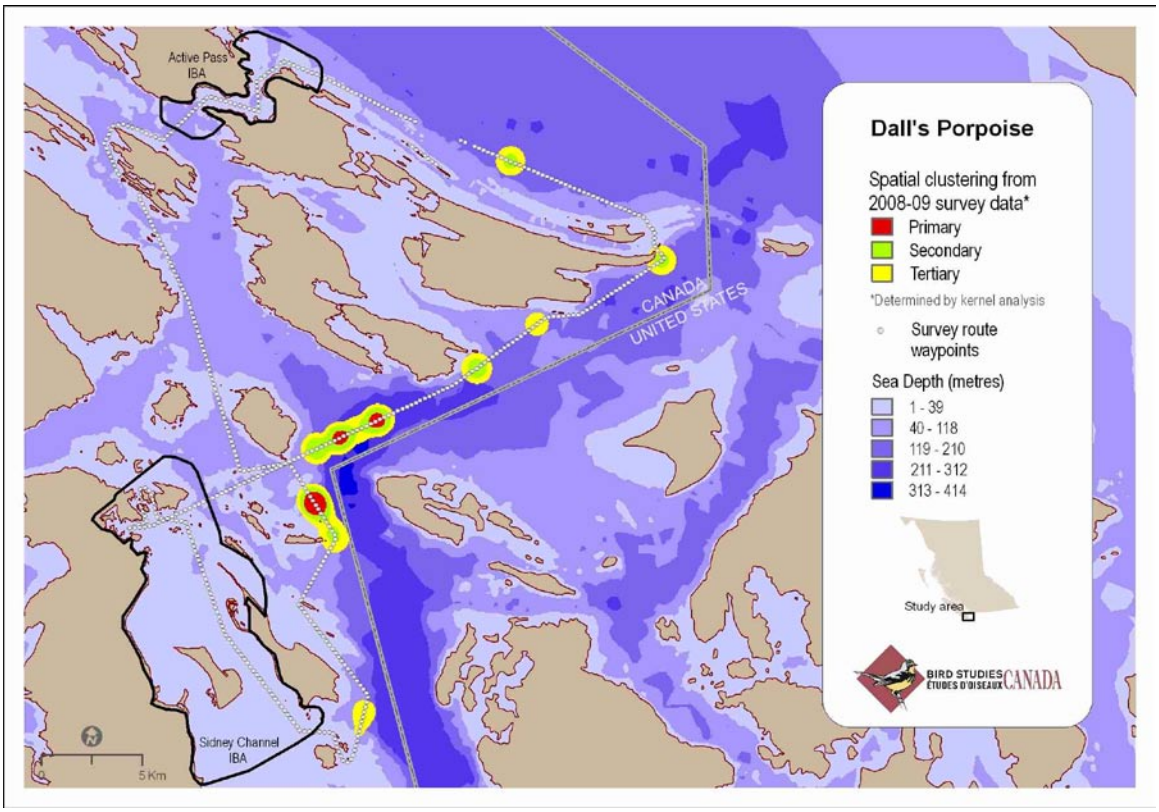


Fig. 56. Spatial distribution (a) and seasonal abundance (b) of Harbour Porpoise in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Dall's Porpoise *Phocoenoides dalli*

Conservation Status	Neither at risk nationally nor provincially, and not assessed by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	Dall's porpoises are widespread in nearshore and offshore waters of the north Pacific where surface water temperatures range between 37° and 64°F (3° -18°C (Cresswell et al. 2007). Two types of Dall's porpoise occur - the *truei* type is found in the western Pacific off Japan and the *dalli* type along the Pacific Coast of North America. It is one of the most abundant small cetaceans between Alaska and California (Cresswell et al. 2007). Estimates range from several hundred thousand to 1 million animals but there is not much certainty in these estimates. Dall's porpoise is often attracted to moving boats to ride the bow wave and schools of 2 to 12 animals are most common. Dall's porpoises eat deepwater fish and squid probably at night, and schooling fish such as herring, anchovy, hake and juvenile rockfish during the day. Orcas and sharks prey on porpoises. Baird et al. (1998) reported the first hybridization for the species. They found a 60-cm female fetus in a dead Dall's porpoise near Victoria that was fathered by a harbour porpoise (*Phocoena phocoena*).
Southern Gulf Islands Status	Regularly seen in Haro Strait and occasionally in the Strait of Georgia.
Survey Records 2008-09	Seventeen waypoint-encounters were recorded with this species, totaling 76 animals, with group size varying from 1-9 animals. All but one encounter were in Haro Strait and Boundary Pass, concentrated in the areas of deepest water at the north end of Haro Strait and west end of Boundary Pass. The one other encounter was in the Strait of Georgia east of the Belle Chain Islets. There was no clear temporal pattern to the survey records, but our records suggest the species may be less common in summer.
Conservation Issues	Not much is known about these animals in the Gulf Islands. The same issues potentially impacting Harbour Porpoises also apply to this species (see Harbour Porpoise species account).
Recommendations	• Collaborate with Washington groups to harmonise methods for counting this species, better understand its seasonal abundance in the area, and estimate the population of Dall's Porpoises in the shared waters of Haro Strait.

a)



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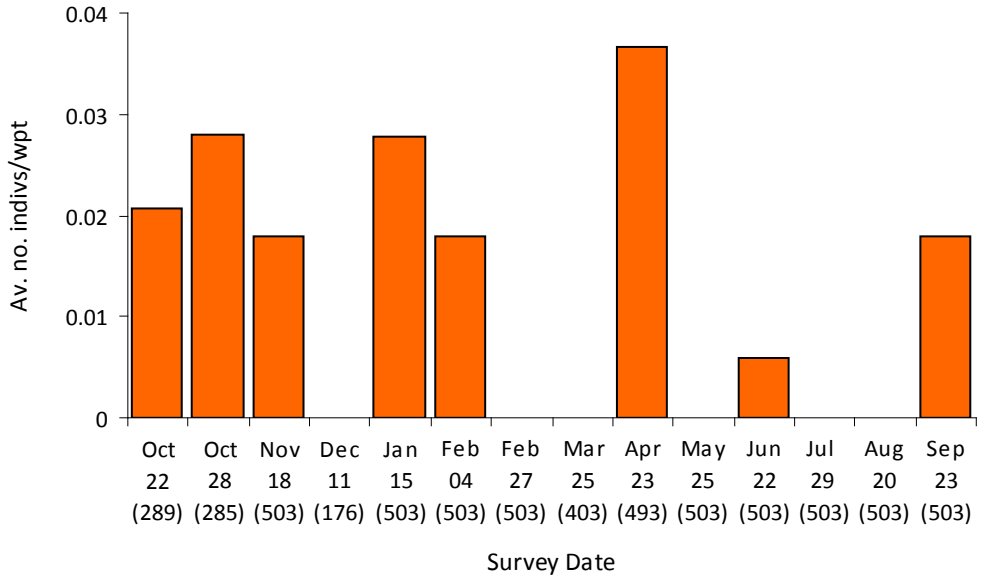

Fig. 57. Spatial distribution (a) and seasonal abundance (b) of Dall's Porpoise in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses).

Killer Whale *Orcinus orca*

Conservation Status	SARA-COSEWIC – Endangered (Southern residents); Threatened (West Coast transients); Both are Red-listed by the province of British Columbia and assessed as the highest priority by the BC Conservation Framework (BC MoE 2008).
Ecology and Regional Trends	COSEWIC considers the southern resident population to be small and declining. This population's growth is thought to be limited by the availability of Chinook Salmon, forecast to be continued low abundance. Southern residents are also thought to be threatened by increasing physical and acoust disturbance, oil spills and contaminants. The West Coast transient population is very small and subject to threats from contaminants, acoustic and physical disturbance, and potential oil spills. The population has been increasing since the mid-1970s when monitoring began, and its prey base of pinnipeds and cetaceans is likely stable or increasing (COSEWIC 2008). Between 80 and 90 residents whales live in three pods (J, K, and L) and feed mostly on Chinook salmon in the region outside the winter. In winter, they roam down the Pacific Coast. Transients feed mostly on marine mammals, in particular Harbour Seals and sea lions in the Strait of Georgia.
Southern Gulf Islands Status	Transient and Southern Resident Killer Whales occur year-round in the Southern Gulf islands and wider Salish Sea region, although Southern Residents are only occasional visitors during the winter and spring (to late May) (www.orcanetwork.org, Table 7).
Survey Records 2008-09	We only recorded three waypoint-encounters, two with six Transients, around Coal Island and off SE Saltspring Island, both on 25 May, and one with at least 13 Southern Residents in Boundary Pass, off East Point, Saturna, on 29 July. Incidental sightings and hydrophone records are regularly posted on Orca Network www.orcanetwork.org, however; 134 day-encounters were reported from the Southern Gulf Islands and the portion of Haro Strait in U.S. waters, during the October 2008 – September 2009 period. Southern Residents, chiefly J-pod, were reported were confirmed five times over the winter period (October-February), then returned to the region on 4 May 2009, with 15 day-encounters through the rest of May, and at least 20 day-encounters per month from June to September, including daily records in July. Observations were chiefly reported from Haro Strait, but frequent observations were also made in Boundary Pass, and occasional reports came from Swanson Channel, Active Pass, and even Swartz Bay. During June-August, the Southern Residents exhibited a regular daily pattern of travelling from the Fraser mouth area south to the southern Strait of Georgia, into Boundary Pass and Haro Strait, and then back north again via the Gulf Island channels or Boundary Pass

and the Strait of Georgia. Confirmed Transient Killer Whales were reported from the Southern Gulf Islands and Haro Strait (including US waters) in all months except January, with a range of 1-5 day-encounters per month.

Conservation Issues

Killer Whales are the backbone of a thriving whale watching industry around southern Vancouver Island and Vancouver. There has been some recent concern by NOAA that boating guidelines might allow boats to get too close to the whales in the US waters. They are recommending a 200m restriction that if adopted, could be called for in Canada.

Recommendations

- The methods used by Hauser (2006) of combining observational data from whale watching companies and naturalists to map the distribution of Transients could usefully be applied to delineate habitat use by both Southern Residents and Transients.
- Collaboration with whale-watching groups, in particular those feeding into the Orca Network information base (now a decade old) could yield important information on Killer Whale use of the region's waters, and the potential to combine with Vancouver Aquarium/DFO's BC Cetacean Sightings Network database should be investigated.

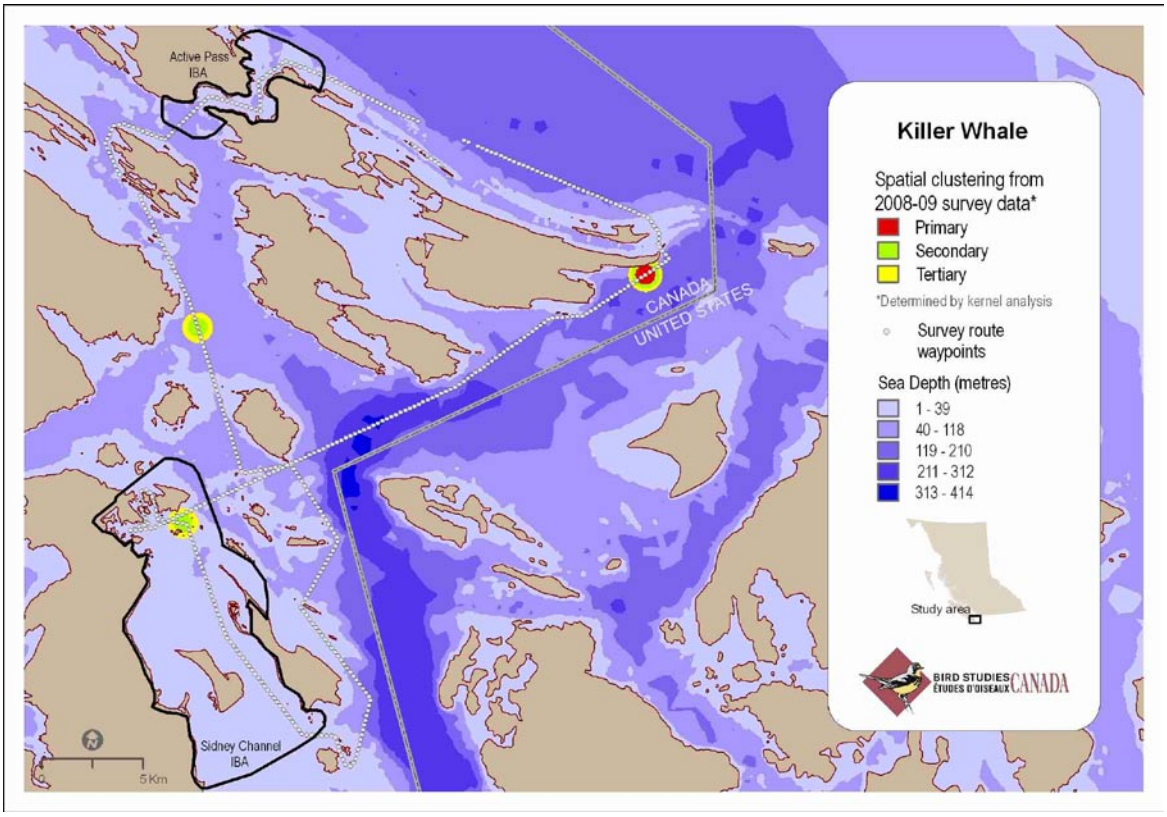

Fig. 58. Spatial distribution of Killer Whale encounters in the Southern Gulf Islands, British Columbia, October 2008 – September 2009 (number of waypoints in parentheses). Note, the many records from whale-watching and naturalist groups on Orca Network www.orcanetwork.org provide a much more complete picture of these animals' seasonal distributions.