COSEWIC
Assessment and Status Report

on the

Steller Sea Lion
Eumetopias jubatus

in Canada

SPECIAL CONCERN
2013

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

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COSEWIC
Assessment Summary

Assessment Summary – November 2013

Common name
Steller Sea Lion

Scientific name
Eumetopias jubatus

Status
Special Concern

Reason for designation
This species is restricted to only five breeding locations (consisting of 7 rookeries) in British Columbia that occupy less than 10 km², with approximately 70% of births occurring at a single location (Scott Islands). The population is increasing, but is sensitive to human disturbance while on land and is vulnerable to catastrophic events such as major oil spills due to its highly concentrated breeding aggregations. The species is near to qualifying for Threatened, but has recovered from historical culling and deliberate persecution.

Occurrence
British Columbia, Pacific Ocean

Status history
Designated Not at Risk in April 1987. Status re-examined and designated Special Concern in November 2003 and November 2013.

COSEWIC
Executive Summary

Steller Sea Lion
Eumetopias jubatus

Wildlife Species Description and Significance

The Steller or Northern Sea Lion (*Eumetopias jubatus*) is the largest member of the family Otariidae and is the only extant representative of its genus. Two subspecies are recognized based on patterns in morphology, demography and genetics: *E. j. jubatus* (Asia, Aleutian Islands, and Gulf of Alaska) and *E. j. monteriensis* (Southeast Alaska, British Columbia, Washington, Oregon and California). Only *E. j. monteriensis* occurs in Canada. The two subspecies are commonly referred to as the western and eastern populations of Steller Sea Lions.

The Steller Sea Lion is the largest species of sea lion and exhibits significant sexual dimorphism. Adult females average 2.1-2.4 m in length and weigh 200-300 kg; and adult males are 2.7-3.1 m and weigh 400-800 kg. Pups are born from late May to early July and weigh 16-23 kg at birth.

The Steller Sea Lion is the only otariid that breeds and resides year-round in Canadian waters. The world's largest rookery (breeding aggregation) of Steller Sea Lions occurs in British Columbia at Triangle Island. Steller Sea Lions contribute to the tourism industry and may be important indicators of coastal ecosystem health given their wide distribution, long lifespan, and position near the top of the food chain.

Distribution

Steller Sea Lions inhabit the cool-temperate and subarctic coastal waters of the North Pacific Ocean from southern California, north to the Bering Strait, and south along the Asian coast to Japan. They are typically found within about 15 km of shore during summer, but can range over 200 km from shore in winter. They are non-migratory, but may disperse considerable distances from rookeries.

Habitat

The terrestrial sites used by Steller Sea Lions include: 1) rookeries where animals congregate during May-August to give birth, mate, and nurse young pups; 2) year-round haulouts that are usually occupied continuously and where mating can occur; and 3) winter haulouts that are used less regularly and primarily during the winter months. In Canada, Steller Sea Lions occur at over 40 resting sites (haulouts), but only five breeding sites (rookeries)—two of which were established since 2008. These five highly concentrated breeding aggregations cover <10 km^2 of land. Sea lions haul out on a regular basis throughout the year between feeding trips, and are highly gregarious while on land. While at sea, most Steller Sea Lions feed over the continental shelf and along the shelf break in water depths < 400 m.

Biology

Steller Sea Lions are polygynous breeders. Females become sexually mature at 3-6 years and give birth to a single pup, usually annually, which they typically nurse for just under a year—and occasionally for up to 2-4 years. Longevity is about 14 years for males and 22 years for females, and average age of breeding animals (males and females) is 10-11 years old. Preferred prey in British Columbia include Pacific Herring, Pacific Hake, Pacific Sand Lance, Salmon, Spiny Dogfish, Eulachon, Pacific Sardine, Rockfish, Flounder, Skate, Squid and Octopus.

Population Sizes and Trends

In 2010, 5,485 pups were counted in British Columbia. The total BC population (including pups) was ~32,000 individuals during the breeding season and increased to ~48,000 during winter with the arrival of animals dispersing from Southeast Alaska and Oregon. The number of sexually mature individuals during summer was ~11,400 (~40% of the population). Approximately 60% of the sea lions occur on rookeries during the summer (including pups) and the remaining 40% occur on haulouts.

Population increases have been observed since Steller Sea Lions were protected in 1970, but most of this increase occurred since 1990. Numbers of non-pups on rookeries and haulouts were stable from 1971-1983, but increased at a mean rate of 4.7% since the mid-1980s. In contrast, pups increased slowly at an annual rate of 1.7% per year from 1971-1994, and at 7.3% per year since the mid-1990s. This has resulted in a 4-5 fold increase in the size of the population in British Columbia since the 1970s—and the natural establishment of two new rookeries, and a more than doubling in numbers of year-round haulout sites. The population in 2010 appeared to be slightly larger than it was before harvesting and predator-control programs began in the early 1900s.

Threats and Limiting Factors

There are no known actual or imminent threats to the population at this time. Steller Sea Lions may be killed or injured by shooting, incidental take in fishing gear, entanglement in debris, acute oil spills, environmental contaminants, and displacement or degradation of their habitat. They are also affected by disease, fluctuating prey populations, and predation by Killer Whales. There are proposals to increase tanker traffic through the Sea Lions' primary habitat, and acute oil spills have the potential to kill large numbers of Sea Lions near their five breeding areas (the Scott Islands, Cape St. James, Garcin Rocks, Banks Island and Virgin Rocks), as well as their haulouts.

Protection, Status, and Ranks

Since 1970, Steller Sea Lions have been protected by various regulations enacted under the *Fisheries Act* and enforced by the Department of Fisheries and Oceans. One of the five British Columbia breeding areas (Cape St. James) is protected under the *National Parks Act*, and another (Scott Islands) is part of a British Columbia Ecological Reserve. Originally assessed by COSEWIC in 1987 as Not at Risk, the species was re-examined and designated Special Concern in November 2003, and is protected under SARA as a Special Concern species. COSEWIC re-assessed this species in November 2013 as Special Concern. The Steller Sea Lion is blue-listed by the B.C. provincial government Conservation Data Centre.

TECHNICAL SUMMARY

Eumetopias jubatus
Steller Sea Lion Otarie de Steller
Range of occurrence in Canada: Pacific Ocean (British Columbia)

Demographic Information

Generation time (calculated using a life table for the growing Steller Sea Lion population in SE Alaska and assuming breeding males are 9-13 y old and females are 4-20 y old)	10-11 y (females); 10-11 y (males)
Is there an observed continuing decline in number of mature individuals?	No
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	No decline occurring
Estimated percent increase in total number of mature individuals over the last 3 generations. (Inferred from changes in numbers of pups born between 1977-2010.)	>450% over past 33 years (1977-2010)
Projected percent increase in total number of mature individuals over the next 10 years [, or 3 generations].	unknown
Estimated percent increase in total number of mature individuals over 3 generations, over a time period including both the past and the future. (Inferred from changes in pups born—1977-2010.)	>450% over past 33 years (1977-2010)
Are the causes of the decline clearly reversible and understood and ceased?	No decline is occurring
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated extent of occurrence (Area of occurrence is based on sea lions occurring over most of the continental shelf and shelf break areas of British Columbia.)	~65,000 km²
Index of area of occupancy (IAO) (The summed land area of the 5 breeding areas—7 rookeries.) It should be noted that the breeding area of each of the 7 islands and rocks is smaller than the minimum grid size (2x2 km) used by COSEWIC to calculate the Areas of Occupancy. In addition, the sea lions are unable to use most of the surface of the islands and rocks that form their rookeries because of the steepness of the terrain. Thus, the actual area used by the sea lions for breeding (<10 km2) is much smaller than the calculated Area of Occupancy.	28 km^2
Is the population severely fragmented?	No
Number of locations	5 main breeding areas (some have >1 rookery)
Is there an observed continuing decline in extent of occurrence?	No
Is there an observed continuing decline in index of area of occupancy?	No
Is there an observed continuing decline in number of populations?	No
Is there an observed continuing decline in number of locations?	No
Is there an observed continuing decline in extent and quality of habitat?	No

Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	No. Mature Individuals
40% of Canadian (breeding) population present in 2010. (Note that actual number would be lower if not all bulls hold territories.)	~11,400 (range 10,800 – 11,800)

Quantitative Analysis

Probability of extinction in the wild is at least	unknown

Threats (actual or imminent, to populations or habitats)

There is potential for acute oil spills to kill large numbers of sea lions near rookeries and haulouts.

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? • USA (SE Alaska, WA, OR, CA)	Increasing
Is immigration known or possible?	Yes
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Probably
Is rescue from outside populations likely?	Probably

Data-Sensitive Species

Is this a data-sensitive species?	No

Status History

COSEWIC:
Designated Not at Risk in April 1987. Status re-examined and designated Special Concern in November 2003 and November 2013.

Status and Reasons for Designation:

Status:	**Alpha-numeric code:**
Special Concern	Not applicable

Reasons for designation:
This species is restricted to only five breeding locations (consisting of 7 rookeries) in British Columbia that occupy less than 10 km², with approximately 70% of births occurring at a single location (Scott Islands). The population is increasing, but is sensitive to human disturbance while on land and is vulnerable to catastrophic events such as major oil spills due to its highly concentrated breeding aggregations. The species is near to qualifying for Threatened, but has recovered from historical culling and deliberate persecution.

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. No decline.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable. No decline or fluctuation.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. No continuing decline.
Criterion D (Very Small or Restricted Population): Not applicable. Comes close to meeting Threatened under D2 based on restricted IAO (breeding areas in Canada) <10 km²; 5 locations (breeding areas in Canada) with ~70% of pups born at one location; and the highly concentrated breeding aggregations are potentially affected by catastrophic events such as oil spills, although it is unlikely that all of these would be affected simultaneously.
Criterion E (Quantitative Analysis): No applicable analysis.

PREFACE

The Steller Sea Lion was assessed by COSEWIC as a species of Special Concern in 2003. It met criteria for Threatened because there were only three breeding locations in British Columbia, but was designated as Special Concern because the population was increasing and there was a possible rescue effect.

The population has continued to increase since the last assessment. In addition, two new rookeries have been established bringing the number of breeding locations of Steller Sea Lions in British Columbia to five. Steller Sea Lion populations are also increasing in Southeast Alaska, Washington, Oregon and California.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2013)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

on the

Steller Sea Lion

Eumetopias jubatus

in Canada

2013

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

The Steller Sea Lion (*Eumetopias jubatus* Schreber 1776; Figure 1) is the largest member of the family Otariidae (order–Carnivora, suborder–Pinnipedia; Kenyon and Scheffer 1955; Jefferson *et al.* 1994; Rice 1998). It is the only extant representative of its genus, and was named after the German naturalist George Wilhelm Steller who described the species in 1742 (Miller and Miller 1848). Other common names are Steller's Sea Lion, Northern Sea Lion, Otarie de Steller (Fr), Lion de Mer de Steller (Fr), Sivuch (Ru), Todo (Jp), Lobo Marino de Steller (Sp), Qawax (pronounced ka-wa by Aleut natives), and Wiinaq (Alutiiq). Its scientific name means having a well-developed broad forehead (*Eumetopias*–Greek) and a mane (*jubatus*–Latin).

Figure 1. A mature male (bull) among a group of female Steller Sea Lions (photo: A.W. Trites).

Two subspecies are recognized based on patterns in morphology, demography and genetics: *E. j. jubatus* (Schreber 1776 — Asia, Aleutian Islands, and Gulf of Alaska) and *E. j. monteriensis* (Gray 1859 — Southeast Alaska, British Columbia, Washington, Oregon and California (Phillips *et al.* 2009a; Phillips *et al.* 2011; Committee on Taxonomy 2012)). Only *E. j. monteriensis* occurs in Canada (Figure 2). The two subspecies are often referred to as the western (*E. j. jubatus*) and eastern (*E. j. monteriensis*) populations of Steller Sea Lions.

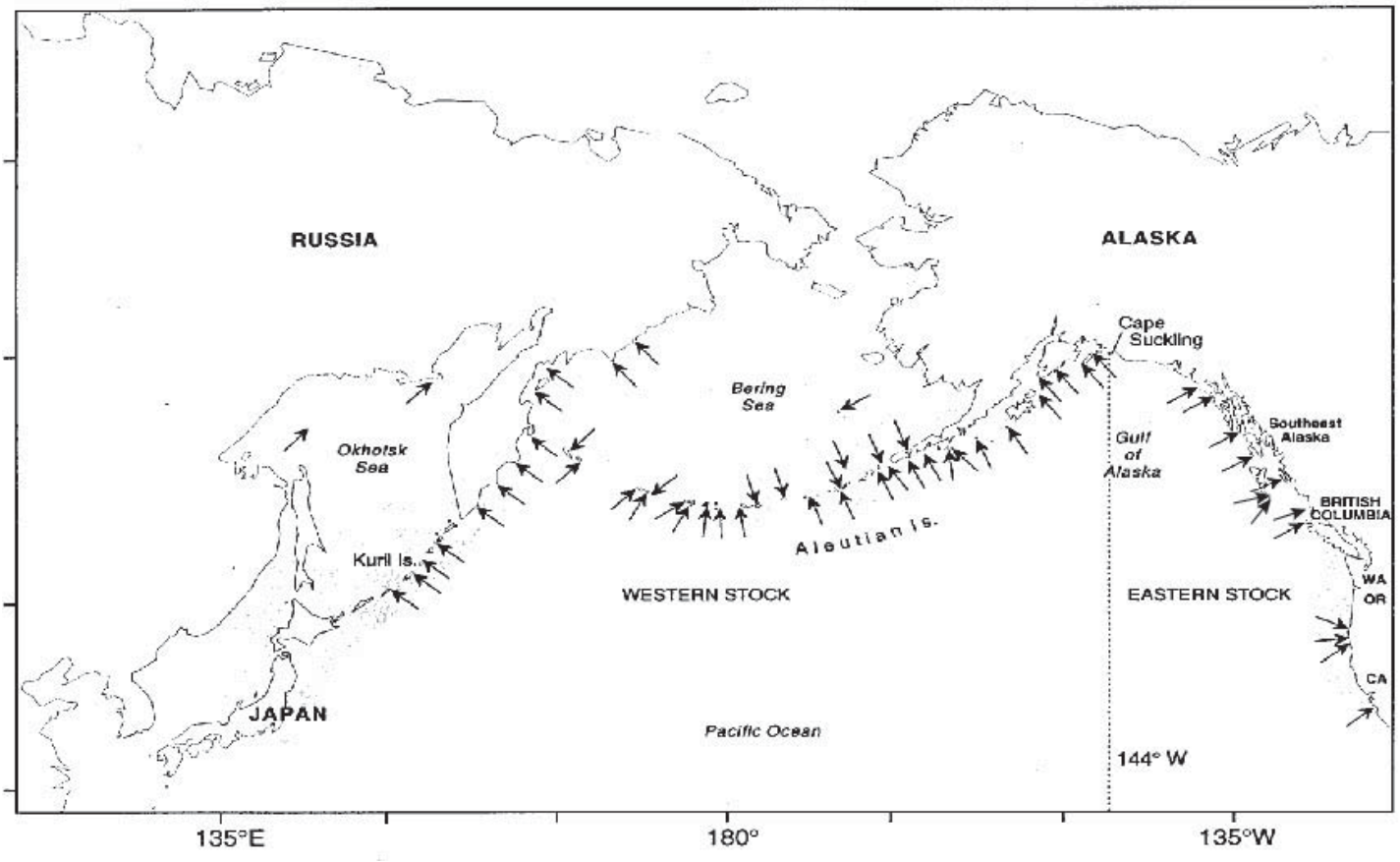

Figure 2. Worldwide range of Steller Sea Lions. Arrows denote breeding rookeries and the dashed line shows the separation between the two subspecies of Steller Sea Lions. (modified from Loughlin 1997 and Sease *et al.* 1999).

Morphological Description

Steller Sea Lions are sexually dimorphic (Fiscus 1961; Calkins and Pitcher 1982; Winship *et al.* 2001). Adult females average 2.1-2.4 m and 200-300 kg. Adult males (bulls) are larger, attaining a length of 2.7-3.1 m and weighing 400-800 kg, although they can weigh over 1,100 kg as they fatten prior to the breeding season. Mature males develop a prominent 'mane' of coarse hair on their large muscular neck and chest. The shape of their heads tends to be more robust with a flatter snout than that of females.

Pups weigh 16-23 kg at birth, with newborn males weighing about 2 kg more on average than females (Merrick *et al.* 1995; Brandon *et al.* 1996; Winship *et al.* 2001). They are born with a thick blackish-brown lanugo that is moulted at an age of 3-5 months (Scheffer 1964; Vania 1972; Daniel 2003).

Dry juveniles and adults are pale yellow to light tan, darkening to chocolate brown on their undersides and near their flippers (which are black and bare-skinned). When wet, Steller Sea Lions appear greyish white. Pelage of both sexes is composed of short coarse hairs (Scheffer 1964). Steller Sea Lions undergo an annual moult, shedding their entire pelage but not the epidermis. Juveniles (ages 1-2 y) are the first to moult (starting in June) followed by adult females (starting in August), bulls, and pups (starting in September) (Vania 1972; Calkins and Pitcher 1982; Daniel 2003). Duration of the moult is about 45 days (Daniel 2003).

Adult vocalizations in air consist of deep-throated bellows and roars. Territorial males wheeze as part of their threat displays (Orr and Poulter 1967; Gentry 1970), and produce a loud guttural sound both in the air and underwater (Schusterman *et al.* 1970). Newborns tend to bleat like sheep.

As with other members of the Otariidae, Steller Sea Lions can prop themselves on their fore flippers and rotate their hind flippers forward, rendering them agile on land.

Population Spatial Structure and Variability

There are no current geographical or ecological barriers to movement that might create genetic structure or strong demographic isolation of Steller Sea Lions within the Canadian part of their range or between populations outside Canada (Figures 2, 3 and 4). However, sea lions generally return to their natal rookeries to reproduce. This has resulted in animals from each rookery tending to be genetically distinct from animals in other rookeries although there is some movement between rookeries (Bickham *et al.* 1996; Baker *et al.* 2005; O'Corry-Crowe *et al.* 2006; Phillips *et al.* 2009b; Phillips *et al.* 2011).

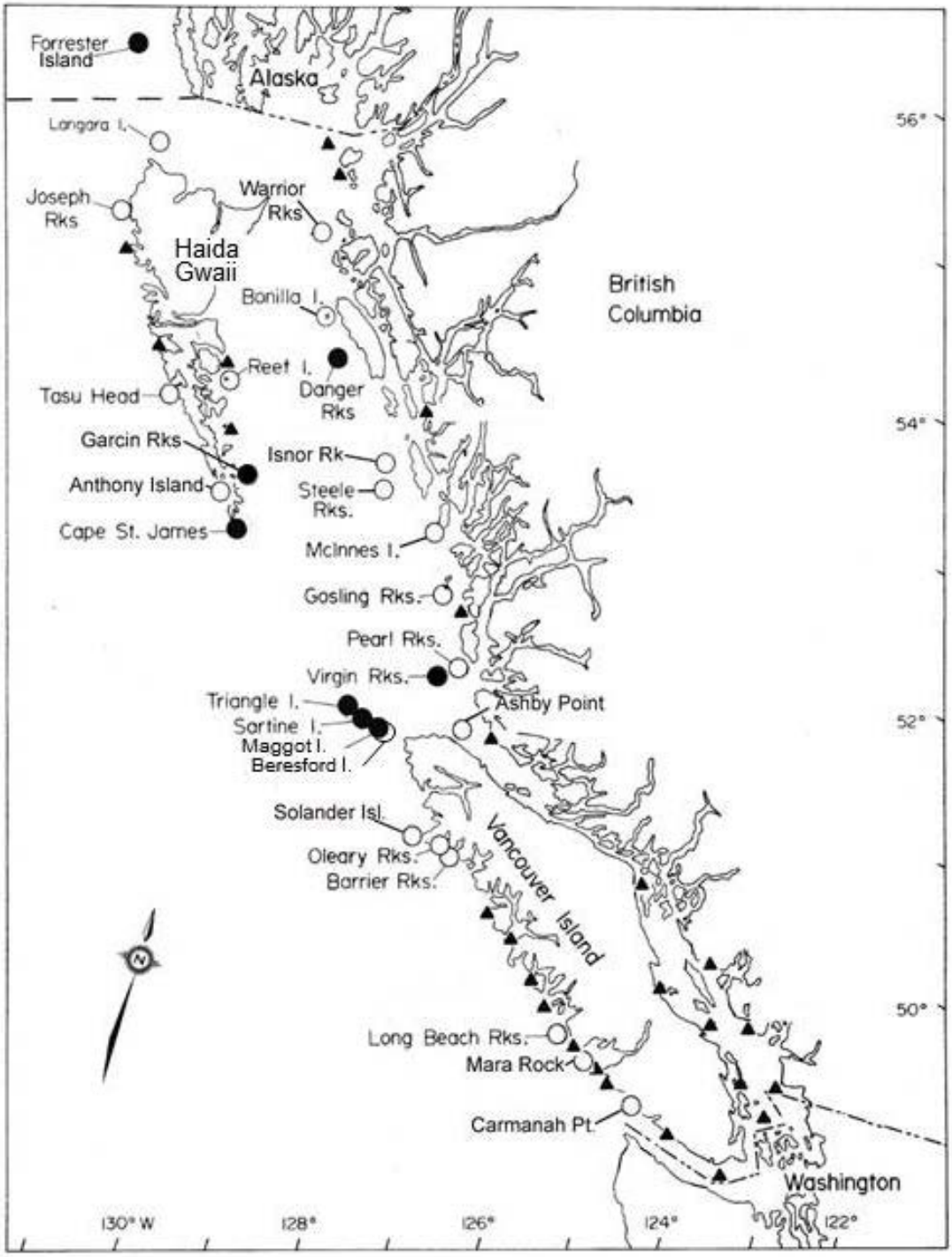

Figure 3. Geographic location of Steller Sea Lion rookeries (●), year-round haulout sites (○) and major winter haulout sites (▲) in British Columbia (and Forrester Island, Alaska). Updated from Bigg (1985).

Designatable Units

There is only one designatable unit that applies to Steller Sea Lions in Canada.

Special Significance

Once considered vermin, the Steller Sea Lion is one of the most intensively studied marine mammals in the North Pacific, and is viewed by many as a symbol of a healthy marine ecosystem. It is the largest species of otariid and the only one that breeds and resides year-round in Canadian waters. With the recent population declines in the Aleutian Islands and Gulf of Alaska, the British Columbia rookeries at the Scott Islands constitute the largest breeding aggregation in the world (as of 2010), and those at Cape St. James constitute the fifth largest (NMFS2008; Olesiuk 2011; NMFS2012).

Based on pups counted at rookeries in 2009 and 2010, British Columbia accounts for more than 35% of the *E. j. monteriensis* subspecies (eastern population)—and provides habitat for other sea lions breeding in Oregon and Alaska (Olesiuk 2011). As much as 70% of the subspecies may winter in British Columbia (based on winter surveys). The Steller Sea Lion is widely regarded as an important component of the coastal marine ecosystem, and contributes to a growing tourism industry. However, the role and therefore importance of seals and sea lions in marine ecosystems remains poorly understood (Beverton 1985; Bowen 1997; Merrick 1997; Trites 1997).

Steller Sea Lions have long been perceived as harmful to fisheries. Over 50,000 were killed in BC (1913-1970), and the breeding population at the Sea Otter Group was eradicated to protect the commercial salmon fishery (Figure 5). Recovery of sea lion populations since they were protected under the *Fisheries Act* in 1970 (Figures 6 and 7) has led to renewed concern about their impacts on fish stocks and to resumed lobbying for control programs. However, there is little evidence that Steller Sea Lion control programs had any beneficial effect on fisheries as salmon catches did not increase noticeably following the reduction of sea lion numbers on the Scott Islands (Spalding 1964).

The Steller Sea Lion may serve as an indicator of the general status of inshore marine ecosystems. It is widely distributed in coastal waters, has a long lifespan, congregates on terrestrial sites where breeding populations can be readily assessed, and occupies a position near the top of the marine food chain.

DISTRIBUTION

Global range

Steller Sea Lions inhabit the cool-temperate and subarctic coastal waters of the North Pacific Ocean from the Channel Islands off southern California, north to the Bering Strait, and south along the Asian coast to Hokkaido, Japan (Figure 2, Kenyon and Rice 1961; Loughlin *et al.* 1984; Loughlin *et al.* 1992). They give birth on 55-60 rookeries and rest at >300 haulouts. Steller Sea Lions are non-migratory, but may disperse considerable distances from breeding sites (Rowley 1929; Fisher 1981; Calkins and Pitcher 1982; Loughlin 1997; Raum-Suryan *et al.* 2002).

Canadian range

Within Canada (Figures 2 and 3), Steller Sea Lions occur at five main breeding areas in British Columbia: 1) the Scott Islands off the northwestern tip of Vancouver Island, with rookeries situated on Triangle, Sartine and Maggot Islands; 2) Cape St. James off the southern tip of Haida Gwaii (Queen Charlotte Islands), with rookeries situated on the Kerouard Islands; 3) Garcin Rocks off the east coast of South Moresby Island in Haida Gwaii, 4) off Banks Island on the northern mainland coast, with rookeries situated on North Danger Rocks, and 5) Virgin Rocks (part of the Sea Otter Group located in Queen Charlotte Sound off the central mainland near Calvert Island).

Of the five breeding areas, two did not exist when the species was last assessed in 2003. The first is a natural re-establishment of breeding animals on Virgin Rocks in 2006—a breeding aggregation that was extirpated following predator control programs during the 1920s and 1930s (Figures 5 and 6, Bigg 1985). The second new rookery was established at Garcin Rocks in 2008. Both sites were previously considered to be haulouts (resting sites where pups were not born) until small numbers of pups were observed (Appendix 1 and 2; Trites unpubl. Data; Olesiuk 2011). The sites were reclassified as rookeries (Olesiuk 2011) as numbers of bulls and pups increased, and numbers of immature animals using the sites declined. A small number of other haulouts in British Columbia may be reclassified as rookeries in the coming years (Pitcher *et al.* 2007).

In addition to the five breeding sites, there are about 30 haulout sites (Appendix 1) distributed mainly along the exposed outer coast that are used throughout the year, as well as additional winter sites used primarily during winter (Figures 3 and 4).

The at-sea distribution of Steller Sea Lions is not well known. In general, most Steller Sea Lions feed within about 15 km of shore during summer (Hui 2011), and can range over 200 km from shore in winter (Kenyon and Rice 1961; Merrick and Loughlin 1997). They feed primarily over the continental shelf and along the shelf break (Kajimura and Loughlin 1988; Gregr and Trites 2008; Hui 2011).

Extent of Occurrence and Area of Occupancy

Based on the size and distribution of breeding and haulout sites (Figures 3 and 4), the extent of occurrence for Steller Sea Lions in Canada is estimated to be ~65,000 km^2, and the index of area of occupancy is 28 km^2. The extent of occurrence is based on sea lions occurring over most of the continental shelf and shelf break areas of British Columbia, whereas the biological area of occupancy is based on the terrestrial space actually used by sea lions to breed (i.e., the surface area of the 5 breeding sites—rookeries). In British Columbia, these highly concentrated breeding aggregations use <10 km^2 of land. . It should be noted that the breeding area of each of the 7 islands and rocks is smaller than the minimum grid size (2x2 km) used by COSEWIC to calculate the Index of Areas of Occupancy. In addition, the sea lions are unable to use most of the surface of the islands and rocks that form their rookeries because of the steepness of the terrain. Thus, the actual area used by the sea lions for breeding (<10 km^2) is much smaller than the calculated Area of Occupancy (28 km^2)."

Search Effort

The distribution and abundance of Steller Sea Lions have been assessed regularly in Canadian waters since 1971 (Figure 4 and Appendices 1 and 2). Systematic aerial surveys have been conducted during the summer and winter (Bigg 1985, 1988; Olesiuk 2011). Steller Sea Lions are also regularly surveyed in US waters (Pitcher *et al.* 2007; NMFS 2008; NMSF 2012).

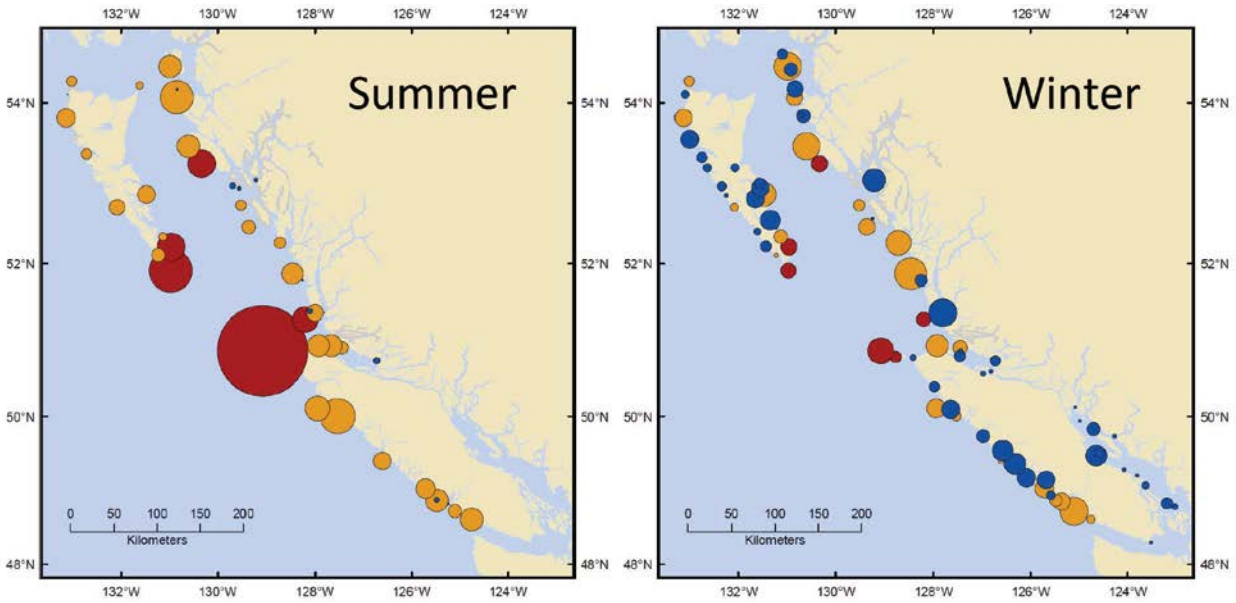

Figure 4. Seasonal distribution of Steller Sea Lions in British Columbia during summer (2010) and winter (2009-2010). Colours indicate rookeries (red), year-round haulouts (orange) and winter haulouts (blue), and circle sizes are proportional to the average site counts (from Olesiuk 2011).

HABITAT

Habitat Requirements

The terrestrial sites used by Steller Sea Lions generally fall into three distinct categories: 1) rookeries where animals congregate during May-August to give birth, mate, and nurse pups; 2) year-round haulouts that are usually continuously occupied; and 3) winter haulout sites that are used less regularly and primarily during the non-breeding season (Figures 3 and 4, Bigg 1985). Rookeries generally have associated peripheral haulout sites occupied mainly by non-breeding males and juveniles. In most cases, animals continue to use rookeries as haulout sites throughout the year, albeit in much reduced numbers.

Steller Sea Lions are extremely tenacious regarding the sites they use to give birth and mate. Females tend to return to their rookeries of birth, and will return faithfully to a single rookery each year (Raum-Suryan *et al.* 2002; Parker *et al.* 2008). Three of the five breeding areas currently used in British Columbia appear to have been well established in the early 20th century when the first sea lion survey was conducted (Newcombe and Newcombe 1914), and these three have been used continuously despite the disturbances caused by predator control programs and commercial hunts (Pike and Maxwell 1958; Bigg 1985; Olesiuk 2011). One breeding area was extirpated in the 1930s and was re-established almost 80 years later (in 2006 at Virgin Rocks in the Sea Otter Group), and the fifth breeding site (established in 2008 at Garcin Rocks) represents an expansion of the breeding range within Canada (Figures 4 and 5).

Steller Sea Lions are habitat specialists. They use rookeries that are remote and free of terrestrial predators such as wolves and bears. Most rookeries are isolated, barren outcroppings located in regions that have relatively high currents, high salinity, low surface temperatures and shallow waters—which presumably reflects high ocean productivity and hence optimum feeding (Ban *et al.* 2003). Essential haulout features seem to be relatively flat terrain, accessibility, and protection from swell and waves (Edie 1977; Ban and Trites 2007). Sea lions use protected areas during storms and wet areas during extremely hot weather (Edie 1977). Access to high ground is also important for giving birth, although older animals capable of going to sea will use lower and more exposed areas. The rookeries in British Columbia occur on solid rocky substrates, except in recent years when increasing numbers of animals began breeding on the gravel beaches along the eastern (leeward) side of Triangle Island.

The 30 year-round haulout sites in British Columbia are generally situated in exposed areas along the outer coast on rocky islets and ledges. Approximately half of the haulouts were noted during the first surveys in 1913 (Newcombe and Newcombe 1914), whereas about one-quarter appear to have been colonized since aerial surveys were initiated in the early 1970s. As populations have grown, some sites formerly used mainly during winter (see below) have been occupied more continuously, and have been re-classified as year-round haulouts (Olesiuk 2011).

Use of winter haulouts appears to be more fluid than year-round sites. Most winter haulouts are situated in protected areas, such as the Strait of Georgia, Strait of Juan de Fuca and Queen Charlotte Strait. In addition to natural substrates, winter haulouts include log booms, floats, jetties and docks. Animals can also rest (raft) in the water during storms or heavy swells when haulouts are awash, or when they are near concentrations of prey without suitable nearby haulouts (Kenyon and Rice 1961). In the southern part of British Columbia, winter haulouts are often shared with adult- and subadult-male California Sea Lions (*Zalophus californianus*) (Hancock 1970; Brenton 1977; Bigg 1985).

Understanding of how Steller Sea Lions use their aquatic habitat is poor. Animals are generally observed within 15 km of land and in water depths less than 400 m (Hui 2011), but may venture several hundred kilometres offshore and occur off the continental shelf (Kenyon and Rice 1961; Merrick and Loughlin 1997). Steller Sea Lions also occasionally venture into freshwater (Jameson and Kenyon 1977; Roffe and Mate 1984; Beach *et al.* 1985). In British Columbia, Steller and California sea lions often congregate in the lower Fraser River during the spring Eulachon (*Thaleichthys pacificus*) run (Bigg 1985), and are occasionally seen rafting as far as 35 km upriver (Olesiuk unpubl. data). Steller Sea Lions also congregate in estuaries during autumn to feed on pre-spawning salmon (Bigg *et al.* 1990).

Habitat Trends

The first rookery abandoned following the culls of 1913-1915 may have been Watch Rock where a dozen pups were counted in 1913 (Bigg 1985). By 1938, control programs had extirpated the populations using the two other rookeries in the Sea Otter Group—Virgin and Pearl Rocks (Figures 5 and 6). Pupping resumed on one of the eradicated rookeries (Virgin Rocks) in 2006, and a second site was colonized two years later at Garcin Rocks off the east coast of South Moresby Island. New haulouts were also established in British Columbia as numbers increased through the 2000s (Olesiuk 2011).

Steller Sea Lions also breed in Alaska, California and Oregon, but not in Washington. In Southeast Alaska, rookeries were not known to occur during the early 1900s. However, sea lions began breeding at Forrester Island just north of the British Columbia-Alaska border (Figure 3) shortly after control programs were initiated in British Columbia. Additional rookeries were established in Southeast Alaska at the Hazy Islands in about 1985 and White Sisters Island in 1992, and more recently at Graves and Baili Rocks (Trites and Larkin 1996; Calkins *et al.* 1999; Pitcher *et al.* 2003; NMFS 2012).

BIOLOGY

The earliest accounts of Steller Sea Lions were provided by Scammon (1874), Allen (1880), Elliot (1882) and Rowley (1929). More recent and extensive overviews of the biology of Steller Sea Lions are contained in Loughlin (1998, 2009) and NMFS (2008, 2012).

Life Cycle and Reproduction

Only sexually mature Steller Sea Lions return to rookeries (along with a few dependent young with their mothers). Bulls are the first to arrive in early May to compete with other mature males and establish territories (Gisiner 1985). Pregnant females begin arriving on rookeries during the latter half of May and give birth to a single pup within a few days of their arrival (Gentry 1970). Mothers will stay on shore with their pups for about 7-10 days before leaving on regular feeding trips that average 1 day and are followed by 1 day on shore (Higgins 1984; Merrick 1987; Hood and Ono 1997; Milette and Trites 2003; Maniscalco *et al.* 2006). Copulations usually occur prior to the first feeding trip.

Pups are precocious—they have open eyes and can crawl at birth. They begin to enter tide pools and inter-tidal areas at about 2 weeks of age, and swim in the open ocean starting at about 4 weeks of age when mothers begin moving their pups from the rookeries to nearby sites (Sandegren 1970; Gentry 1974). By the end of August, few animals remain on the rookeries.

Year-round haulouts are used by immature animals, non-pregnant adults and females nursing pups from previous summers that do not return to the rookeries. Some bulls also use haulouts during summer and establish territories, and occasionally breed with mature females (Trites and Coombs 2010). Outside of the summer breeding season, Steller Sea Lions use year-round haulouts as well as winter haulouts that may be considerable distances from their rookeries. Females with dependent young may stay at a single haulout or may move their pups to any number of haulouts. Average length of feeding trips by lactating females in winter is about 2 days, followed by 1 day on shore (Trites and Porter 2002; Maniscalco *et al.* 2006). Haulouts are not restricted to any single age or sex class during the non-breeding season. However, sea lions without dependent young may spend extended time at sea between visits to shore.

Steller Sea Lions regularly use haulouts throughout the year to rest between feeding trips. They can easily climb steep rocks and are often found on haulouts many metres above sea level. Sea lions tend to be highly gregarious while on land and generally pack close together with little or no separation between individuals.

Steller Sea Lions have a polygynous mating system that appears to be synchronized throughout the entire range (Bigg 1985). Males may begin producing sperm by 3-7 years of age (Calkins and Pitcher 1982), but only those holding territories are known to mate. Most territorial males are 9-13 years old (Thorsteinson and Lensink 1962) and may hold a territory for several years in succession (range 1-7 years) (Gisiner 1985). The ratio of adult females to territorial bulls averages ~7:1 (see below) and may be as high as 10-15:1 (Pike and Maxwell 1958; Merrick 1987). Successful males will usually maintain their territory for an average of 40 days (20-68 days) without feeding (Gentry 1970). The advantages of larger body size in acquiring and defending territories, and in providing energy and possibly water reserves during tenure, probably accounts for the sexual dimorphism in body size in Steller Sea Lions (Fisher 1958; Repenning 1976).

Females ovulate first at about 3-6 years of age. Following fertilization, embryonic development is suspended for about 3 months until implantation occurs in September or October (delayed implantation), resulting in a gestation period of about 8-9 months (Vania and Klinkhart 1967; Calkins and Pitcher 1982). Most mature females appear to conceive each year (Trites and Coombs 2010), but the rate of reproductive failure and abortion appears to be high. Pitcher *et al.* (1998) reported that 97% of females sampled in the Gulf of Alaska were pregnant early in the gestation season, but that pregnancy rates declined to 67% and 55% at the end of the gestation season in the 1970s and 1980s respectively. Pregnancy rates have not been estimated for Steller Sea Lions in British Columbia.

The lactation period of Steller Sea Lions is extremely long for a pinniped species. A few pups have stayed with their mothers for 3-4 years, although most are believed to be weaned just prior to their first birthday (Calkins and Pitcher 1982; Trites *et al.* 2006; York *et al.* 2008). Male Steller Sea Lions have been found to suckle longer than females, with a greater proportion of males than females suckling at one year (Marcotte 2006). Extending the nursing period by more than one year may ensure the survival of offspring during times when the nutritional quality of prey available to sea lions is low (Trites *et al.* 2007c; Bernard *et al.* 2011). In some cases, females on rookeries may nurse both a newborn and a yearling, or two newborns (Maniscalco *et al.* 2007).

Mortality of pups during the first month of life generally appears to be high and influenced by factors such as storms (Pike and Maxwell 1958; Orr and Poulter 1967). The principal cause of death for pups is drowning because they are not able to get back out of the water (Orr and Poulter 1967; Edie 1977). Being bitten, tossed or trampled by older animals takes a toll on pups, as does being abandoned or separated from their mothers (Orr and Poulter 1967; Gentry 1970; Sandegren 1970; Sandegren 1976). Average annual survival probability for pups in Southeast Alaska was 0.60 for males and 0.64 for females (Hastings *et al.* 2011), and is likely similar for sea lions in British Columbia.

Juvenile mortality is difficult to estimate, but appears to be fairly high for both sexes. Hastings *et al.* (2011) estimate that about 37% of males and 46% of females survive to 3 years of age. Mortality rates are significantly lower for adults (~11% for males and ~9% per year for females). Higher mortality rates for males result in a progressively skewed sex ratio favouring females. The growing population of Steller Sea Lions in Southeast Alaska consists of about 37% males and 63% females of all ages (Hastings *et al.* 2011). The sex ratio is probably similar in British Columbia.

The oldest animals aged from the wild were about 18 years for males and 30 years for females (Calkins and Pitcher 1982). However, longevity (defined at the 99th percentile of known aged individuals) is about 14 years for males and 22 years for females (Trites and Pauly 1998).

Life tables for Steller Sea Lions (Calkins and Pitcher 1982; Trites and Larkin 1992; York 1994; Hastings *et al.* 2011) indicate that the average age of sexually mature males and females (generation time) is about 10-11 years for both males and females, and that the number of mature individuals (males and females) capable of reproduction is about 40% of the total population (all ages, including pups). These generation times and proportion mature were calculated using life tables (Hastings *et al.* 2011) and assumed that only bulls aged 9-13 years breed, and that females give birth between the ages of 4-20 years old. Based on these life table calculations, there is a ratio of ~7 breeding females for each breeding male. Number of mature individuals in 2010 was ~11,400 (range 10,800–11,800) based on a total population estimate of 28,600 (range 27,100–29,500 calculated as a function of numbers of pups born; Olesiuk 2011).

Physiology and Adaptability

Food requirements vary with the type and quality of prey (Perez 1994; Rosen and Trites 1999, 2000b,c 2004; Rosen 2009). Captive sea lions fed a mixed diet of various fishes consume an average 10-12 kg per day for full-grown females and 20 kg per day for full-grown males (Kastelein *et al.* 1990; Perez *et al.* 1990). However, bioenergetic models predict that daily food requirements for Steller Sea Lions in the wild (which are more active, reproduce and tend to consume a lower quality diet) are closer to 15-20 kg for mature females, and 30-35 kg for mature males (Winship *et al.* 2002). For females, the amount of food needed to meet daily energy requirements on a mixed diet equates to ~14% of sea lion body weight for a 1 year old and 7% for a mature individual. Sea lions that consume higher proportions of low fat fishes such as gadids (Cod family species) require significantly more prey than those that consume fattier fishes such as Pacific Herring (*Clupea pallasii*) (Trites and Donnelly 2003; Winship and Trites 2003; Rosen 2009).

Steller Sea Lions are capable of diving to depths of at least 310 m (Andrews 1999) and staying submerged for over 8 minutes (Merrick and Loughlin 1997; Swain and Calkins 1997). However, most dives tend to be shallow (range of 15-50 m) and short (1.5-2.5 min) (Merrick and Loughlin 1997; Swain and Calkins 1997; Loughlin *et al.* 1998; Swain 1999; Andrews *et al.* 2002; Rehberg *et al.* 2009; Gerlinsky *et al.* 2013). Diving capabilities are developed during the first year of life. Pups aged less than one month dive to a maximum depth of 10 m, but this increases to nearly 100 m by 5 months of age, and to over 200 m by 10 months of age (Merrick and Loughlin 1997; Rehberg and Burns 2008).

Steller Sea Lions are likely adaptable to periodic changes in the quality and quantity of prey available based on their ability to consume wide groups of prey, ranging from bottom fish to mid-water schooling species (Sinclair and Zeppelin 2002; Trites *et al.* 2007a; McKenzie and Wynne 2008). However, they may be less adaptable in terms of the rookeries and haulouts they use. Steller Sea Lions do not appear to frequent alternative haulout and rookery sites after nearby abundances and types of prey have changed (Trites *et al.* 2007c).

Dispersal and Migration

Steller Sea Lions generally return to breed on their natal rookery, although there may be some exchange between neighbouring rookeries (Calkins and Pitcher 1982, 1996; Raum-Suryan *et al.* 2002; Parker *et al.* 2008). At least one animal branded as a pup on Forrester Island in Southeast Alaska was subsequently seen 400 km away with a newborn pup on the Cape St. James rookery (Raum-Suryan and Pitcher 2000). In some cases, rookeries are augmented by breeding females from other rookeries, as evident from the rapid expansion of new rookeries in Southeast Alaska and British Columbia (Calkins *et al.* 1999; Pitcher *et al.* 2003; Olesiuk 2011).

Steller Sea Lions are considered non-migratory, but generally have well-defined seasonal movements. Telemetry and branding studies have shown that animals may travel hundreds of kilometres and use many haulout sites over the course of a few weeks or months (Merrick and Loughlin 1997; Loughlin *et al*. 1998, 2003; Raum-Suryan *et al*. 2002). Numbers of animals using year-round haulout sites are fairly constant throughout the year, but decline during the May-August breeding season as animals move to rookeries (Figure 4, Bigg 1985; Olesiuk 2011). Following the breeding season, male Steller and California Sea Lions have been observed travelling north along the Oregon coast (Mate 1975), coinciding with a sharp increase in the number of animals wintering off southern Vancouver Island (Bigg 1985). These movements of animals during the non-breeding season (September-May) are likely related to the distribution of forage fish.

Prior to weaning, dependent young (ages 0-3 yrs) appear to stay relatively close to haulouts while their mothers forage at sea (Trites and Porter 2002; Marcotte 2006). Once weaned, young males tend to disperse more widely than females and have been seen many hundreds of kilometres from their natal rookeries (Raum-Suryan *et al.* 2002).

Interspecific Interactions

Steller Sea Lion eat over 50 species of fish and invertebrates (Wilke and Kenyon 1952; Pike 1958; Spalding 1964; Pitcher 1981; Sinclair and Zeppelin 2002; Trites *et al.* 2007a; Trites and Calkins 2008; Tollit *et al.* 2009; Olesiuk *et al.* 2011). The diet appears to vary according to which prey are locally and seasonally most abundant or accessible. Preferred prey appear to be small or medium-sized schooling fishes, which in British Columbia include species such as Pacific Herring, Pacific Hake (*Merluccius productus*), Pacific Sand Lance (*Ammodytes hexapterus*), Salmon (*Oncorhynchus* spp.), Spiny Dogfish (*Squalus suckleyi*), Eulachon and Pacific Sardine (*Sardinops sagax*) (Pike 1958; Spalding 1964; Olesiuk and Bigg 1988; Tollit *et al.* 2009; Olesiuk *et al.* 2011; Trites and Olesiuk unpubl. data). Bottom fish, such as Rockfish (*Sebastes* spp.), Arrowtooth Flounder (*Atheresthes stomias*) and Skate (Rajidae), can also be important dietary items as well as Squid and Octopus (Cephalopods). Steller Sea Lions have also been observed to prey on gulls (O'Daniel and Schneeweis 1992) and other pinnipeds, including neonate Northern Fur Seals (*Callorhinus ursinus*) (Gentry and Johnson 1981) and Harbour Seals (*Phoca vitulina*) (Pitcher and Fay 1982; Mathews and Adkison 2010).

A shift in diets from fatty fishes (i.e., Pacific Herring) to low-fat fishes (i.e., Walleye Pollock, *Theragra chalcogramma*) has been implicated in the decline of Steller Sea Lions in the Gulf of Alaska and Aleutian Islands (Alverson 1992; Alaska Sea Grant 1993; DeMaster and Atkinson 2002; Trites and Donnelly 2003; Trites *et al.* 2007c; Bernard *et al.* 2011). Large-scale shifts in climatic and oceanic conditions can affect the dynamics of marine organisms (Benson and Trites 2002), as can selective-fishing or over-fishing (Pauly *et al.* 1998), both of which could affect the quantity or quality of Steller Sea Lion prey. Controlled-feeding studies have shown that sea lions, particularly young animals, consuming large amounts of low-fat prey such as Walleye Pollock may be unable to maintain body mass (Rosen and Trites 2000b, 2004). Thus, interactions between climate, fisheries, and prey may significantly influence the nutritional status and survival of Steller Sea Lions (Trites *et al.* 2007c).

Besides Humans, the main predators of Steller Sea Lions are Killer Whales (*Orcinus orca*) (Morton 1990; Ford *et al.* 1998; Ghai and Insley 2011), which may selectively prey on young sea lions and significantly affect population numbers (Barrett-Lennard *et al.* 1995; Guénette *et al.* 2007; Horning and Mellish 2012). White Sharks (*Carcharodon carcharias*) are known to prey on Steller Sea Lions in the southern part of their range (California) and occasionally occur in British Columbia waters—however, White Sharks and the Pacific Sleeper Sharks (*Somniosus pacificus*) that occur further north are not considered to be a significant source of Steller Sea Lion mortality (Stroud 1978; Ainley *et al.* 1981; Klimley *et al.* 1992; Klimley *et al.* 2001; Martin 2004; Sigler *et al.* 2006; NMFS 2012). Bears have been observed on rookeries in Russia and may prey on pups (T. Loughlin, National Marine Mammal Laboratory, Seattle, WA, pers. comm.).

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

The abundance of Steller Sea Lions has been assessed in Canadian waters since 1971 by counting individuals seen in aerial photographs taken over rookeries and haulouts during summer and winter (Appendices 1 and 2; Bigg 1985, 1988; Olesiuk 2011). Typically, oblique 35 mm photographs are taken from a small fixed-wing aircraft as it circles a haulout or rookery. Aerial survey procedures for counting Steller Sea Lions were developed in the mid-1960s (Mathisen and Lopp 1963) and have been standardized since the early 1970s (Mate 1977; Withrow 1982; Bigg 1985; Olesiuk *et al.* 1993; Olesiuk 2011).

Counts consist of pups (during summer) and non-pups (>6 months old during summer and winter). A correction factor is applied to account for pups that are obscured (Olesiuk *et al.* 2008), but no correction factor is applied to non-pups to account for animals at sea during the surveys (Olesiuk 2011). They have been counted every 2 to 5 years since 1971.

The censuses provide an index of relative abundance because some animals are always foraging at sea and are missed. Surveys in British Columbia are conducted during the last week of June and first week of July, which represents the time by which most pups have been born, but most are still too young to have begun to disperse from rookeries (Olesiuk 2011). Steller Sea Lions are also occasionally counted during winter (Olesiuk 2011). In recent years, high-resolution vertical medium-format photography has been used, particularly to census pups (Snyder *et al.* 2001; Olesiuk *et al.* 2008). Life tables provide an estimate of the ratio of pups to older age-classes, and thereby a means to estimate the total population size (Calkins and Pitcher 1982; Loughlin *et al.* 1992; Trites and Larkin 1996; Sease *et al.* 1999; Olesiuk 2011).

Abundance

Between the late 1950s and 1970s, overall abundance of Steller Sea Lions in the North Pacific (range-wide: California to Japan) was believed to have been stable at about 250,000-300,000 individuals (Kenyon and Rice 1961; Loughlin *et al.* 1984). Abundance subsequently declined to about 116,000 by 1989, 97,500 by 1994-95, and 95,000 by 1999-2002 (Braham *et al.* 1980; Merrick *et al.* 1987; Loughlin *et al.* 1992; Trites and Larkin 1996; Sease *et al.* 1999; Burkanov 2000; Pitcher *et al.* 2003; Sease and Stinchcomb 2003; Olesiuk 2011). In 2009, the western population was stable at ~50,000 individuals in the US portion of its range, while the eastern population numbered ~63,000 and was increasing (southeast Alaska to California; Allen and Angliss 2012; NMFS 2012).

Based on numbers of pups born, the total British Columbia population was about 28,600 in 2010 (range 27,100 – 29,500; Olesiuk 2011), of which ~11,500 were mature animals (~40%). However, numbers of non-pups counted at rookeries and haulouts in British Columbia suggest there may be as many 32,000 Steller Sea Lions in summer (range 27,200 – 36,700) and as many as 48,000 in winter (95% CI 37,900 – 58,300) due to the movement of Steller Sea Lions from the large rookery that occurs on Forrester Island just north of the British Columbia-Alaska border and an influx of Steller Sea Lions from Washington and Oregon (Olesiuk 2011). Approximately 60% of the Steller Sea Lions in British Columbia occur on rookeries during the summer (including pups) and the remaining 40% occur on haulouts (Olesiuk 2011).

Fluctuations and Trends

Between 1910 and 1970, Steller Sea Lions declined in British Columbia as predator-control programs killed an estimated 49,100 sea lions, and commercial hunting took another 5,700 animals (Figures 5 and 6). The most intensive culling occurred at Virgin and Pearl rocks in the Sea Otter Group. Federal fishery officers attempted to protect the Rivers Inlet salmon fishery by shooting as many breeding animals as possible at these two rookeries (mid-June 1923-1939) before landing and clubbing pups, most of which were too young to escape into the water. A total of ~20,000 animals (including 7,000 pups) were killed. Pup production declined from ~1,200 pups when the control program was initiated to fewer than 10 by the time it had ended in 1938. Of these two targeted rookeries, pupping no longer occurs at Pearl Rocks, but has returned since 2006 at Virgin Rocks (Figure 7).

Once the sea lions breeding on the Sea Otter Group rookeries had been extirpated, control programs were directed toward the Scott Islands, where about 7,500 animals (including 2,800 pups) were killed during 1936-1939 (Figure 5). There was some effort to establish a commercial hunt for hides, but this proved uneconomic. Large-scale culls were suspended during World War II, although the Canadian air force and navy may have killed significant numbers of animals during bombing practices (Pike and Maxwell 1958; Bigg 1985). No information is available on the magnitude of these kills (Bigg 1985). Some people hunted pups on the Scott Islands during the early 1950s to remove and alter the snouts in order to claim Harbour Seal bounties (fraudulently) (Olesiuk unpub. data).

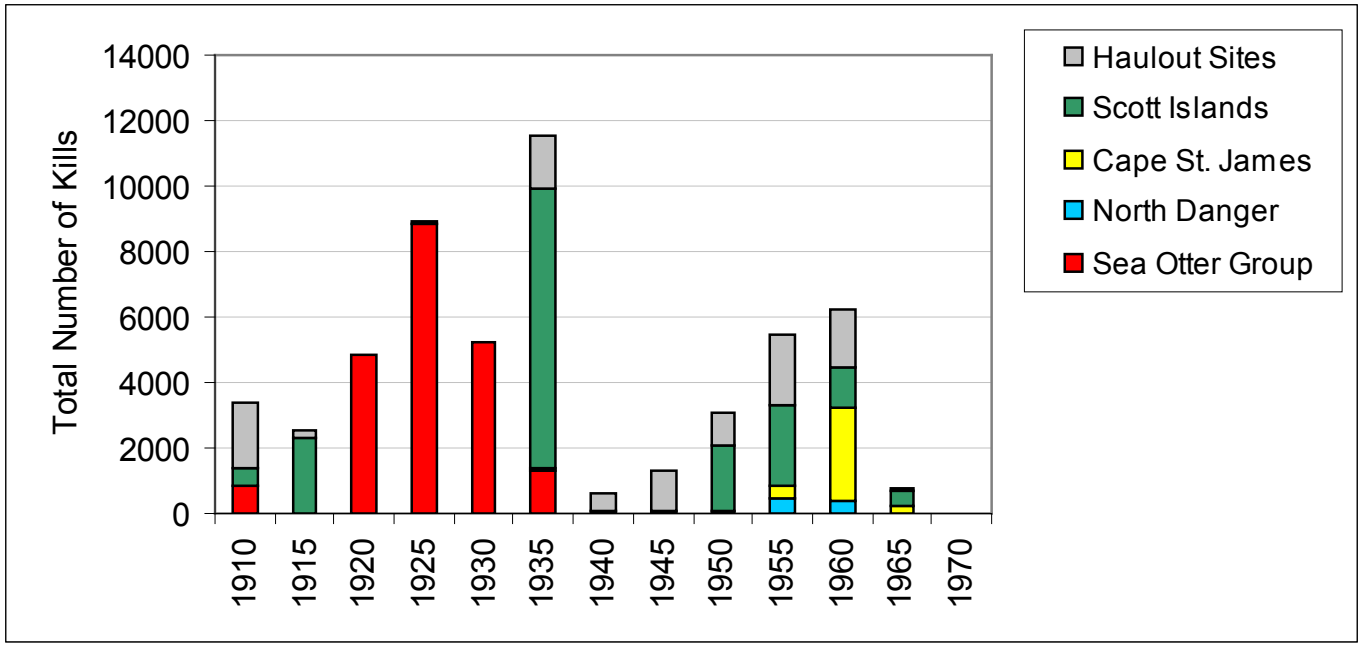

Figure 5. Total numbers of Steller Sea Lions reported to have been killed in British Columbia as part of control programs and commercial harvests during 1913-1970. Data have been grouped and totalled into 5-year periods, and are colour-coded by major breeding area. Data are from Bigg (1984).

Predator control resumed during 1956-1966 and resulted in the deaths of ~11,600 animals at the Scott Islands, Cape St. James and North Danger Rocks (Figure 5). Of this total, ~5,000 animals were commercially harvested for mink food (Bigg 1984).

In addition to predator control and commercial hunting, 764 animals were reportedly killed from 1913-1969 for research (Bigg 1984). No additional attempts have been made to eradicate Steller Sea Lions since they were protected in 1970 under the *Fisheries Act*.

Bigg (1984, 1985) reconstructed historical trends in numbers of breeding animals on rookeries from compiled historical sightings and counts of Steller Sea Lions (1892-1984; Figure 6). He considered the likely reliability of observations, the timing of counts in the context of the life history of Steller Sea Lions, and the potential effect of repeated disturbances. Bigg (1985) concluded that control programs and commercial hunting had depleted breeding populations, and estimated that the British Columbia rookeries were inhabited by ~14,000 animals (all ages, including pups) when the first counts were made in 1913-16 (Figure 6). The extirpation of the population using the Sea Otter Group rookeries, concurrent with a slight increase in numbers breeding on the Scott Islands, resulted in a reduced overall population of about 12,000 by 1938. By 1956, numbers on rookeries had been further reduced to about 8,900-9,400 sea lions (including 2,850 pups) (Pike and Maxwell 1958; Bigg 1985). The population declined sharply from 1956-1966 following the resumption of predator control and commercial hunting. Numbers on rookeries in BC were reduced to ~4,550 by 1961—and 3,390 (including 940 pups) by

the time the first aerial survey was conducted in 1971. Thus, Steller Sea Lions in British Columbia were depleted to about one-quarter of their historical size by predator control and commercial harvesting (Bigg 1985; Olesiuk 2011).

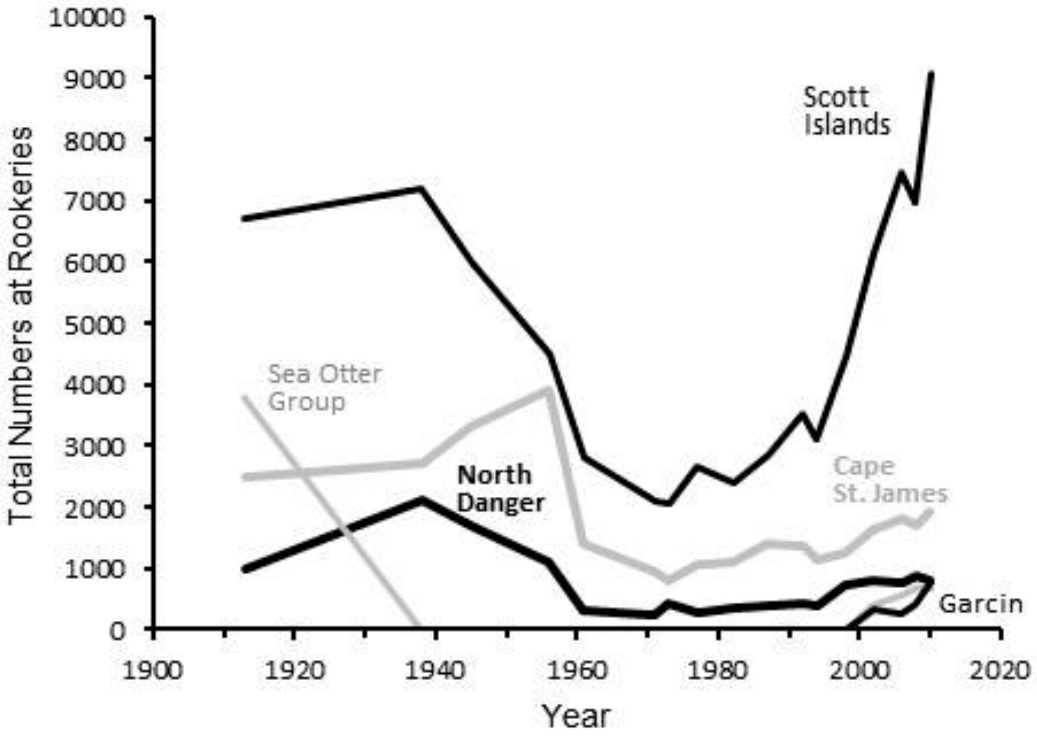

Figure 6. Historical numbers of Steller Sea Lions (pups and non-pups) on rookeries in British Columbia. Rookeries included the Scott Islands (Triangle I, Sartine I, and Maggot I), the Sea Otter Group (Pearl Rocks and Virgin Rocks), Cape St. James, North Danger Rocks, and Garcin Rocks. Data are from Olesiuk (2011) and Bigg (1985).

Population surveys indicate that non-pup abundance on rookeries and haulouts was stable from 1971-1983, but has increased at a mean rate of 4.7% since the mid-1980s (Figure 7, Olesiuk 2011). In contrast, pups increased slowly at an annual rate of 1.7% per year from 1971-1994, and at 7.3% per year since the mid-1990s (Figure 7, Appendices 1 and 2; Olesiuk 2011). This has resulted in a 4-5 fold increase the size of the Steller Sea Lion population in British Columbia since the 1970s, and a more than doubling in the number of year-round haulout sites they use (from 12 to 27; Olesiuk 2011). In 2010 the population appeared to be slightly larger than it was before harvesting and predator-control programs were instituted in the early 1900s—with no sign of population growth slowing (Figure 7).

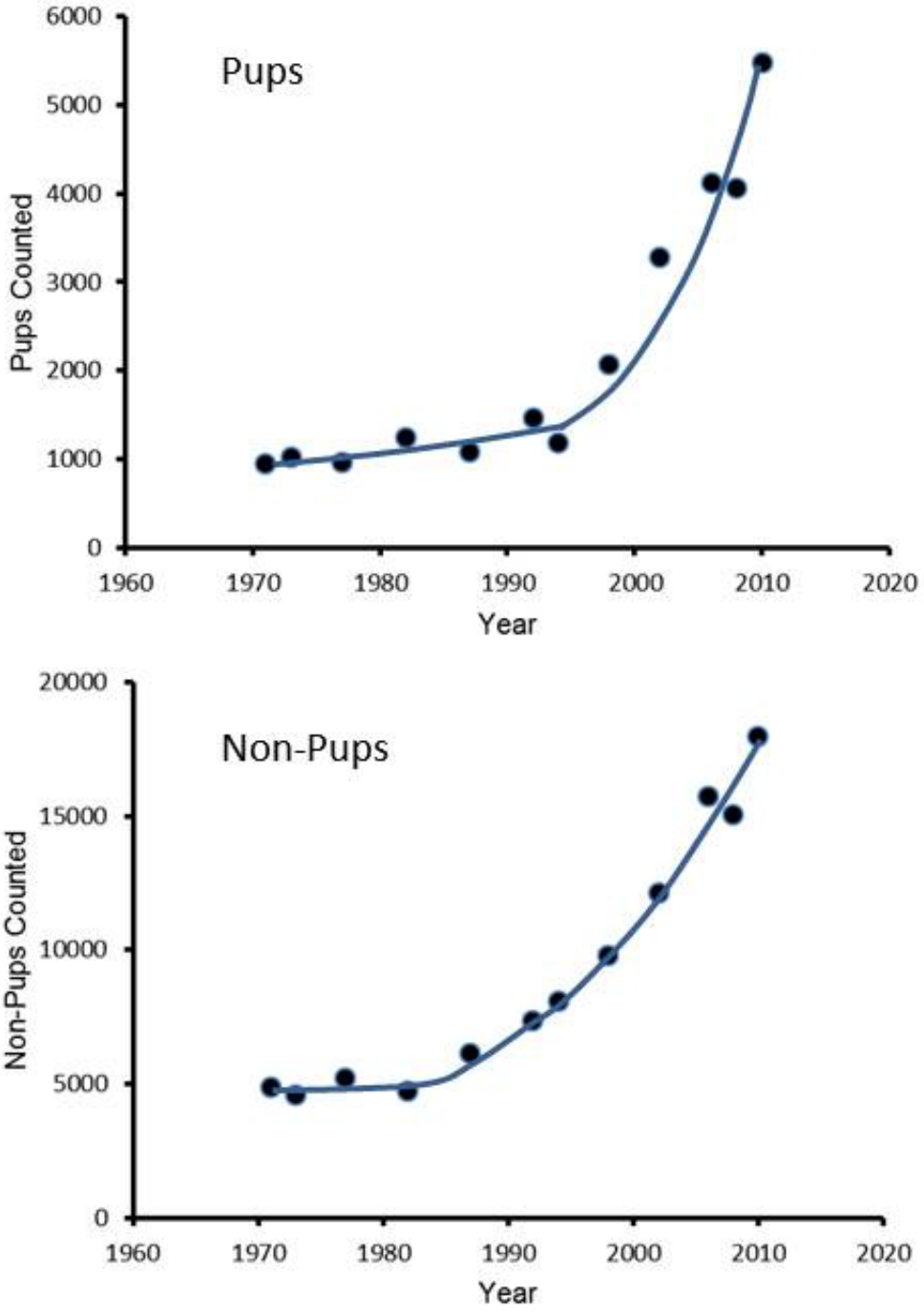

Figure 7. Numbers of pups (rookeries) and non-pups (rookeries and haulout sites) counted during aerial surveys in British Columbia from 1971-2010. Fitted lines are piecewise log-linear regression models from Olesiuk (2011).

Changes in the relative numbers of pups born each year is a standard means of inferring changes in the relative numbers of breeding animals in the population. Thus—based on pup counts—the percent increase in total number of mature individuals over the last 3 generations (i.e., 30-33 years, 1977-2010) was >450%. This inferred rate of increase assumes constant birth rates and a relatively constant ratio of breeding females to bulls over time.

Rescue Effect

Observations over the past century suggest that new Steller Sea Lion rookeries can be established if sufficient numbers of pregnant females successfully give birth at haulouts. This has been observed at several sites in Southeast Alaska, one in the Gulf of Alaska (Calkins *et al.* 1999), and two more recently in British Columbia (Olesiuk 2011). Given the rigidness and traditional nature of breeding sites, along with the tendency of sea lions to flee en masse from Humans and immediate disturbances such as passing boats and low-flying aircraft (Lewis 1987; Porter 1997; Kucey 2005; Kucey and Trites 2006; Wilson *et al.* 2012), it seems unlikely that new rookeries could be established with human intervention. Steller Sea Lions have been successfully born and raised in captivity (e.g., Hardervijk Dolphinarium Holland, Mystic Aquarium), but it is unclear whether such individuals could survive on their own if released in the wild. Recolonization of British Columbia, if ever needed, would likely only occur through immigration from rookeries in Oregon or Southeast Alaska.

Dispersal from Steller Sea Lion populations that breed in Southeast Alaska and Oregon would likely repopulate Canadian waters should it disappear or experience a decline. Steller Sea Lions are increasing in Southeast Alaska (NMFS 2012) and many that are born in this region feed and rest in Canadian waters. Similarly, the relatively small rookeries in Oregon have increased since the 1970s (Brown and Reimer 1992; NMFS 2012), and many of the pups born there have also been seen resting at Canadian haulout sites. Thus a rescue effect would be likely.

THREATS AND LIMITING FACTORS

There are two broad categories of factors that can limit Steller Sea Lions (Table 1). The first consists of anthropogenic threats such as shooting, incidental take in fishing gear, competition with fisheries, entanglement in debris, catastrophic accidents (oil spills), environmental contaminants, and displacement or degradation of their habitat. Of these threats, intentional and incidental killings are within sustainable levels (given the growth of the Steller Sea Lion population), and the other threats are likely to be localized and not population-wide (Table 1). The second category of limiting factors is natural changes in the ecosystem and includes naturally fluctuating prey populations, predation by Killer Whales, disease, and natural environmental factors (all of which will play an increasingly important role in dictating future population levels; Table 1).

Table 1. Threat assessment of Steller Sea Lions in Canada (based upon COSEWIC Threats Calculator).

Threat	Impact	Scope	Severity	Timing	Comments
Shooting / Hunting	Low	Pervasive	Slight	High	Small numbers illegally killed and taken by Aboriginal hunting
Incidental take in fishing gear	Low	Pervasive	Slight	High	Occasionally drowned in gillnets and trawl nets
Entanglement in debris	Low	Pervasive	Slight	High	Affects a minimum of 0.2% of sea lions.
Oil spills – catastrophic events	Low	Restricted	Moderate	Medium	Is yet an unrealized threat in British Columbia, but could have devastating consequences to rookeries
Environmental contaminants	Low	Pervasive	Slight	High	Accumulate in sea lion tissues, but no direct effects on sea lion births or survival yet reported
Displacement or degradation of habitat	Low	Small	Slight	High	Steller Sea Lions are easily scared from haulouts by boats, aircraft and people; and may abandon some sites
Prey reductions – fishery caused	Low	Restricted	Slight	Low	Competition with fisheries is difficult to establish, but is not thought to be currently occurring in British Columbia
Prey reductions – natural ecosystem change	Low	Restricted	Slight	Low	The most recent changes in the marine ecosystem appear to have favoured sea lion populations in British Columbia, unlike in the Aleutian Islands and Gulf of Alaska.
Predation by Killer Whales	Low	Pervasive	Slight	High	Killer Whales appear to be the largest source of constant sea lion mortality, but sea lion populations appear to be large enough to sustain it
Disease	Low	Pervasive	Slight	High	The gregarious nature of sea lions on land makes them susceptible to the transfer of disease and introduction of novel pathogens from terrestrial sources

For most of the 20th century, the main factor limiting Steller Sea Lions was killing by Humans. In recent years relatively small numbers have been taken by Aboriginals for subsistence (through a FSC–Food Social and Ceremonial Licence issued under the *Fisheries Act*) or killed at salmon farms and spawn-on-kelp operations (also done under licences issued by DFO; Jamieson and Olesiuk 2001; Olesiuk 2011), or killed illegally or incidentally in fisheries. However, the population trends of Steller Sea Lions since the mid-1980s imply that this mortality is within sustainable limits.

Although hunting occasionally occurs for food and whiskers (Aboriginal Traditional Knowledge Subcommittee of COSEWIC 2011), use of sea lions by First Nations' people appears to have declined during the 1800s and sea lion meat has not been a mainstay of First Nation diets since the early 1900s (Duff 1977; Bigg 1985). In Alaska, household surveys indicate that ~200 Steller Sea Lions have been taken annually in recent years (2000-2007), mostly in the northern part of the range (NMFS 2012). Less than 5% of the numbers hunted (~8 sea lions per year) originates from Southeast Alaska (Wolfe 1997; Wolfe and Hutchinson-Scarbrough 1999; Loughlin and York 2000; NMFS 2012), an area which is probably indicative of Aboriginal hunting levels in British Columbia.

Predator control at fish farms and herring impoundments in British Columbia have been the largest known source of fishery-related mortality for Steller Sea Lions in the North Pacific (Jamieson and Olesiuk 2001; Olesiuk 2004; Allen and Angliss 2012). A total of 316 Steller Sea Lions and another 21 sea lions not identified to species were killed from 1990-2000. Numbers of Steller Sea Lions shot annually were low (averaging less than 10) until the mid-1990s, but increased and peaked at an estimated 91 in 1999 (Jamieson and Olesiuk 2001). A mean of 45.8 Steller Sea Lions were shot per year in British Columbia from 1999-2003 (Olesiuk 2004). Three Steller Sea Lions were reported drowned as a result of entrapment in finfish aquaculture installations between 1989 and 2012 although prior to 2011 there were no reporting requirements for such incidents (unpubl. data from DFO Marine Mammal Response Program, Pacific Region).

Since the listing of Steller Sea Lions as Special Concern in 2004, the 100 or so salmon farms currently operating in British Columbia waters are not permitted to kill Steller Sea Lions, but can apply for licences to shoot nuisance California Sea Lions and Harbour Seals (Fisheries and Oceans Canada 2011). Whether or not Steller Sea Lions are being misidentified and shot is unknown (Fisheries and Oceans Canada 2011). However, the sensitivity of markets in the United States to marine mammals being harmed to produce farmed salmon has likely reduced the numbers of pinnipeds killed at fish farms in recent years. In recent years, all nuisance seals that are killed are reported publicly on line by DFO. However, this public reporting initiative may have led to more inaccurate reporting (report wrong species intentionally or not reporting at all) for fear of public or legal repercussions.

Steller Sea Lions are also killed incidentally in various fisheries, particularly drift gillnet and seine net fisheries for salmon, but there is not enough observer coverage in British Columbia to adequately monitor bycatch levels (Fisheries and Oceans Canada 2011). Animals can get trapped in trawl nets or entangled in drift and gillnets, and ultimately drown.

Data from observers (groundfish fisheries) and log books (salmon fisheries) in British Columbia reported 92 Steller Sea Lions as bycatch from 1996-2012, of which 70 were dead and 22 were released alive. These 92 incidents were associated with bottom trawl (80%), seine (14%), gillnet (3%), and midwater trawl (3%) fisheries (DFO Marine Mammal Response Program). Impacts of groundfish fisheries may be inflated over other fisheries because of having 100% observer coverage, whereas salmon fisheries have incomplete coverage, and compliance with mandatory reporting in logbooks is unknown. On average, 4 Steller Sea Lions were reported to die each year due to bycatch in British Columbia fisheries (not including accidental drownings in aquaculture installations). Other fisheries that may interact with sea lions do not have observers or electronic monitoring.

In the Gulf of Alaska and Aleutian Islands, a minimum of 28.5 Steller Sea Lions die on average each year, but only 1 sea lion is believed to die annually in fishing gear in California, Oregon, Washington and Southeast Alaska based on observer and stranding data (Loughlin and York 2000; Allen and Angliss 2012). Steller Sea Lions occasionally take fish from commercial troll and recreational gear, and it is not uncommon to see animals hooked in the esophagus or stomach with salmon flashers dangling from their mouths. Illegal and undocumented killing occurs in British Columbia as many fishers consider sea lions to be a nuisance and to negatively impact fish stocks. There are records for 5 confirmed reports of shooting at Steller Sea Lions, and 5 reported that were probable shootings dating back to 2007 (DFO Marine Mammal Response Program). However, the actual extent of killing is poorly understood, and the effect on Steller Sea Lion populations is unknown (Fisheries and Oceans Canada 2011).

Entanglement in synthetic debris is a growing worldwide problem and has been implicated in the declines of other species of pinnipeds (Fowler and Merrell 1986; Fowler 1988). Debris such as net fragments and packing bands can get caught around necks, eventually leading to abrasion or cutting deeply into tissue as animals grow. In Steller Sea Lions, entanglement begins to occur at 2 to 4 years of age (entanglement of pups and yearlings has not been observed), with packing bands and net debris being the most common material (Calkins 1985; Mate 1985; Loughlin *et al.* 1986; Stewart and Yochem 1987; Fowler 1988; Raum-Suryan *et al.* 2009).

The most extensive survey of entangled sea lions in northern British Columbia and Southeast Alaska found 0.26% of sea lions at 69 rookeries and haulouts were entangled in debris or had ingested fishing gear (Raum-Suryan *et al.* 2009). Packing bands were the most common neck entangling material (54%), followed by rubber bands (30%), net (7%), rope (7%) and monofilament line (2%). However, much of the debris found at sea or washed ashore may be too large for an animal to transport, so the observed rate of entanglement at haulouts could represent a small fraction of numbers actually being entangled and drowned at sea. Some sea lions had ingested fishing gear including salmon fishery flashers (lures – 80%), longline gear (12%), hook and line (4%) spinners/spoons (2%), and bait hooks (2%). Additional data from the DFO Marine Mammal Response Program (1998-2012) indicate that 53% of reported entangled Steller Sea Lions had debris around their necks, and 47% had hooks

and flashers dangling from their mouths. Of the neck entanglements, 14% were described as miscellaneous line/rope, 6% net, 1% anchor, 1% chain, 1% band, and 24% unidentified types of gear/debris (obscured or unidentifiable). Overall, entanglement in marine debris and ingestion of fishing gear can lead to a slow and excruciating death due to infection and inability to feed. Entanglement appears to affect many sea lions and is being monitored, but the impact on Steller Sea Lion populations is unknown.

Displacement from or degradation of essential habitat may also limit sea lion populations. Repeated disturbances by aircraft, boats, pedestrians, construction, and fishing activities can lead animals to temporarily leave haulouts and rookeries (Sandegren 1970; Calkins and Curatolo 1980; Johnson *et al.* 1989; Brown 1997; Kucey 2005) and eventually abandon them permanently (Pike and Maxwell 1958; Kenyon 1962). Acoustic disturbance related to oil and gas exploration, alternative energy development and other resource extraction also has the potential to disturb animals (Fisheries and Oceans Canada 2011). Steller Sea Lions can habituate to some level of disturbance, and some haulout sites are located in high traffic areas close to major urban centres such as Vancouver and Victoria (Bigg 1985; Olesiuk unpub . data).

Environmental contaminants such as heavy metals, polychlorinated biphenyls (PCBs) and other organochlorines such as DDT, dioxins and furans bioaccumulate through marine food chains and have been reported in Steller Sea Lions in British Columbia (Alava *et al.* 2012). As with other marine mammals, contaminant concentrations in Steller Sea Lions (predominantly organochlorines) increase with age and are highest among old males, whereas females reduce contaminant loads during lactation (Lee *et al.* 1996). The possible negative effects of contaminants on birth and survival rates are unknown, but are presumably dose-dependent.

Steller Sea Lions can be affected by catastrophic accidents such as chemical and oil spills (St. Aubin 1990), although population level effects have rarely been established. The main threat is likely through contact with heavy oil when the source of the spill is near rookeries and haulout sites, and to a lesser degree from absorption through skin, ingestion of oil directly or through feeding, exposure to vapours, and fouling of pelage by fresh oil (Smith and Geraci 1975; Engelhardt *et al.* 1977; Englehardt 1987; St. Aubin 1990). Sea lions are insulated by blubber, so oiled fur interferes less with thermoregulation than it would if the animals depended on fur for insulation (Kooyman *et al.* 1976). Heavy fouling in thick oil can impede swimming and result in drowning (Geraci and St. Aubin 1980), but light contamination and light-viscosity oil usually wears off within several days (Geraci and Smith 1976).

Calkins and Pitcher (1982) reported seeing Steller Sea Lions in the Gulf of Alaska with tar in their throats or around their lips, jaws and necks. Oil observed on the pelage of pinnipeds during the *Exxon Valdez* oil spill (EVOS) in Prince William Sound did not persist on the coats of Steller Sea Lions as long as it did on Harbour Seals (Calkins *et al.* 1994a). Nevertheless, Steller Sea Lions were observed in the vicinity of the oil spill and metabolites in the blood showed they had been exposed to hydrocarbons.

Premature births were more common and pup production was somewhat lower in the year following the spill, but limited data prior to EVOS and the ongoing population decline in the area made it difficult to assess the statistical significance of the impact (Calkins *et al.* 1994b; Loughlin *et al.* 1996).

Several Steller Sea Lions with small patches of oiled fur were observed during the *Nestucca* spill that spread along the west coast of Vancouver Island in 1988 (Harding and Englar 1989). Reports of large numbers of completely fouled animals after this spill most likely concerned California Sea Lions, which have black pelage (Olesiuk unpub . data). Because Steller Sea Lions are widely dispersed along the entire British Columbia coast, the potential threat of oil and chemical spills is one of local depletion, particularly at rookeries during the breeding season, as opposed to a threat that would affect the entire population. However, considering that over 70% of pup production in British Columbia occurs on the Scott Islands, an oil spill in that area during the pupping season could have a significant impact. This threat is likely to increase due to the planned expansion of shipping from the port of Kitimat, due to the proposed Northern Gateway Project, as well as liquid natural gas pipelines and facility construction.

Environmental factors may limit Steller Sea Lion populations through changes in their prey base or by increasing their susceptibility to disease. Storms can cause pups to be washed from rookeries (Edie 1977), and *El Nino* events have led to abnormally high mortality in California (Allen *et al.* 1999). With the focus on climate change, researchers are beginning to appreciate that the environment fluctuates, and evidence is accumulating on decade-scale oscillations that affect the biota of the North Pacific (Benson and Trites 2002; Trites *et al.* 2007c; Maschner *et al.* 2013).

Environmental shifts and fishing can both affect the abundance and availability of prey (e.g., Alverson 1992; Benson and Trites 2002; Trites *et al.* 2007c), which in turn can affect both foraging behaviour and the population dynamics of pinnipeds (e.g., Trillmich and Ono 1991; Boyd *et al.* 1994), and ultimately carrying capacity (Trites *et al.* 1997). Steller Sea Lions consume many of the same prey resources sought by other predators, including Humans (McAlister and Perez 1976; Kajimura and Loughlin 1988; Fritz *et al.* 1995; Wada 1998; Trites *et al.* 1999b), but the effects of this competition are unknown (Bowen 1997; Trites 1997; Trites *et al.* 1999a).

One hypothesis suggests the decline of the western population of Steller Sea Lions was driven by a reduction in the quantity of available prey, which reduced body growth, birth rates and ultimately survival—while an alternative hypothesis suggests the decline was due to an increase in the abundance of low quality prey that reduced birth rates (Calkins and Goodwin 1988; Calkins *et al.* 1998; Pitcher *et al.* 1998; Trites and Donnelly 2003; NMFS 2008). However, debate continues over the relative influence of natural fluctuations in environmental conditions, regime shifts, and anthropogenic effects that may be the result of climate change, whaling and commercial fisheries (Pascual and Adkinson 1994; Fritz and Ferrero 1998; Trites *et al.* 1999b; Rosen and Trites 2000a; Shima *et al.* 2000; Benson and Trites 2002; Springer *et al.* 2003; Trites *et al.* 2007b; Trites *et al.* 2007c; Bernard *et al.* 2011; Horning and Mellish 2012; Maschner *et al.* 2013).

Natural predators may also limit populations, particularly when populations are at low numbers. In general, Steller Sea Lions and other high trophic level predators are thought to be regulated by bottom-up processes that limit the availability of prey (Trillmich and Ono 1991; Boyd *et al.* 1994; Trites *et al.* 1997; Trites *et al.* 2007c). However, it has been hypothesized that some populations may be limited by top-down processes, such as predation by Killer Whales (Estes *et al.* 1998; Springer *et al.* 2003; Horning and Mellish 2012). Although detailed data on Killer Whale predation rates are lacking, models show that predation by Killer Whales could be holding depressed populations of Steller Sea Lions below carrying capacity (Guénette *et al.* 2006; Guénette *et al.* 2007).

Finally, disease may also limit pinniped populations, especially at high densities (Harwood and Hall 1990; Lavigne and Schmitz 1990). Steller Sea Lions are host to a number of pathogens including *Leptospira interrogans*, caliciviruses, *Chlamydia psittaci, Brucella sp.*, morbilliviruses, influenza A, *Toxoplasma gondii*, phocid herpesviruses, canine parvovirus and canine adenoviruses 1 and 2 (Burek *et al.* 2003; Burek *et al.* 2005). Steller Sea Lions in British Columbia have not been screened for disease, although the few recovered carcasses that showed cause for disease concern have been tested (S. Raverty, pers. comm.).

Number of Locations

Steller Sea Lions are most vulnerable to threats while concentrated at haulouts and the 5 rookeries (Table 1). Rookeries are groups of breeding sites within a radius of 20 km that would all likely be affected by the same catastrophic event, such as an oil spill. The distribution of haulouts throughout BC waters (Figure 4) lessens the threats posed by catastrophic events such as oil spills. Even the risk posed to the high concentration of sea lions at the three historical breeding sites (Figure 4) is somewhat mitigated by the creation of two new breeding sites (since 2006) and having ~40% of the population remaining at haulouts during the breeding season (Olesiuk 2011).

PROTECTION, STATUS AND RANKS

Legal Protection and Status

The Steller Sea Lion was designated Not at Risk in April 1987, and reassessed as Special Concern in November 2003 based on an update status report. The 2003 assessment indicated that the species met criteria for Threatened because only three breeding locations occurred in British Columbia at that time—but it was designated as Special Concern because the population was increasing and a rescue effect was possible. Now listed as Special Concern under *SARA*, a management plan for Steller Sea Lions is in place (Fisheries and Oceans Canada 2011). COSEWIC re-assessed this species in November 2013 as Special Concern.

Management of marine mammals in Canadian waters is a federal responsibility. Since 1970, sea lions have been protected by various regulations enacted under the *Fisheries Act* and enforced by Fisheries and Oceans Canada (DFO). In the Pacific Region, which encompasses the entire Canadian range of Steller Sea Lions, protection was originally provided under Section 21 of the British Columbia Fishery (General) Regulations, which stipulated that: "*No person shall fish for, catch and retain, kill, disturb or molest an elephant seal, a harbour seal, a sea lion or a sea otter or have in possession any such seal, sea lion or sea otter or any portion thereof except under licence issued by the Minister*". Prior to being amended in 1984, however, the regulations also contained a provision giving blanket exclusion to commercially licensed fishers, who were allowed to disturb or kill seals and sea lions to protect their gear and catch. The provision was not widely known, and although no statistics on such kills are available, discussions with fishers suggest they were probably rare.

In 1993, the regional regulations were superseded by the national Marine Mammal Regulations under the *Fisheries Act*, which in Section 7 stipulated "*No person shall disturb a marine mammal except when fishing for marine mammals under the authority of these Regulations*". Section 5 further states that: "*Subject to section 6 (exclusion for natives), no person shall fish for marine mammals except under the authority of a licence issued under these Regulations or under the Aboriginal Communal Fishing Licences Regulations*". Section 6(1) allows that "*An Indian or Inuk other than a beneficiary may, without a licence, fish for food, social or ceremonial purposes for (a) seals…*". Since 1993, the entire Pacific Region has been closed to commercial hunting of all marine mammals, including Steller Sea Lions.

In addition to protection from killing, Section 11 of the regulations stipulates that: "*No person, other than the holder of a licence to fish for marine mammals for experimental, scientific, educational or public display purposes issued under the Fishery (General) Regulations, shall (a) move a live marine mammal from the immediate vicinity in which it is found; or (b) tag or mark, or attempt to tag or mark, a live marine mammal in any manner.*" During the 1990s, three permits were issued to the North Pacific Universities Marine Mammal Research Consortium through the University of British Columbia to live-capture a total of 15 pups for captive studies. Six additional pups were captured in 2003.

Since being protected in 1970, small numbers of Steller Sea Lions have been killed in British Columbia under special permits. In 1990, DFO began issuing permits to salmon farm sites on the west coast (mainly salmon farms, but also a few herring spawn-on-kelp operations and fish traps) that allowed them to shoot seals and sea lions that were interfering with their activities. DFO has since amended the Marine Mammal Regulations to create a new class of licence for killing nuisance 'seals', which as defined in the regulations includes Steller Sea Lions. A nuisance 'seal' is defined as one that: "*a) represents a danger to fishing equipment despite deterrence efforts, or b) based on a scientific recommendation, represents a danger to the conservation of anadromous or catadromous fish stocks because it inflicts great damage to them along estuaries and in rivers and lakes during the migration of those species*". However, the killing of Steller Sea Lions under a Nuisance Seal Permit has been prohibited by DFO since they were listed under *SARA* as a Species of Special Concern.

In the United States, the Steller Sea Lion is protected under the *US Marine Mammal Protection Act* and is listed as endangered in the western portion of its range under the *US Endangered Species Act* (NMFS 2008). In 2013, the US government delisted the eastern population (shared with Canada) because it has increased and new breeding sites have been established. Steller Sea Lions are not listed under CITES (the Convention on International Trade in Endangered Species).

Non-Legal Status and Ranks

Eumetopias jubatus monteriensis has increased steadily since 1979, and in 2011 it was 170% larger than in 1981. Therefore, *E. j. monteriensis* qualifies for Least Concern according to the IUCN Red List (Gelatt and Lowry 2012).

NatureServe Canada ranked the global status of Steller Sea Lions in 2011 as G3 – Vulnerable, noting that "*The handful of Canadian breeding colonies, once considered small and peripheral to the heart of the species' range in the Aleutian Islands, now represent one of the few stable populations of Steller Sea Lions"* (Cannings *et al.* 2005; www.natureserve-canada.ca). The Steller Sea Lion is thus considered to be a Canadian species of global conservation concern.

The Steller Sea Lion was red-listed in British Columbia by the provincial government in 1992, primarily on the basis of there being only three major breeding areas in British Columbia, the total population numbered only about 10,000, and the lack of recovery since cessation of the population culls (Cannings *et al.* 1999). Its Provincial Conservation Status has since been down-listed to a blue-listed species (B.C. Conservation Data Centre 2012). Blue-listed species are any indigenous species or subspecies considered to be of Special Concern in British Columbia. Taxa of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not Extirpated, Endangered or Threatened. Steller Sea Lions have a Provincial Status of S2S3B,S3N (2007) and a Conservation Framework (CF) Priority of 2 (B.C. Conservation Data Centre 2012). It is considered to be Imperilled to Vulnerable on the breeding grounds, and Vulnerable in the non-breeding season.

Habitat Protection and Ownership

The breeding rookeries at the Scott Islands, as well as several haulout sites within this archipelago, have also been designated as Ecological Reserves under the British Columbia *Ecological Reserves Act*. The rookery at Cape St. James was also once an Ecological Reserve, but became part of Gwaii Haanas National Park Reserve when it was created in 1987 under the federal *National Parks Act*. The Gwaii Haanas Park Reserve is co-managed by the federal government and the Haida Nation. In 2010, the Gwaii Haanas National Marine Conservation Area Reserve was established, which protects 3,500 km^2 of marine waters surrounding the National Park Reserve. Thus 3 of the 5 existing breeding areas are protected (only Danger Rocks and Virgin Rocks are not). Extraction of resources is not permitted, and visitation is restricted through the issuance of permits.

The *Oceans Act* introduced in 1996 also provides protection for marine-mammal habitat by allowing for the creation of Marine Protected Areas to protect non-commercial species as well as threatened and endangered species. One of the first two pilot MPAs to be established on the Pacific coast of Canada was Race Rocks, in part because it was recognized as an important winter haulout for Steller and California sea lions.

Management of marine mammals in the waters adjacent to British Columbia is a US federal responsibility, and Steller Sea Lions are protected from disturbance and killing under the US *Marine Mammal Protection Act* of 1972 (*MMPA*). Due to the dramatic declines that have occurred in the Gulf of Alaska and Aleutian Islands, the western population of Steller Sea Lions is considered to be *depleted* under the *MMPA*, and was listed as *endangered* in 1997 under the *U.S. Endangered Species Act* (62 US Federal Register 24345, 5 May 1977). Although similar declines have not been observed south of Prince William Sound, the eastern population was listed as *threatened* in the US, primarily due to concerns that the declines would spread from the same causes with the same severity (which did not occur), and doubts about the then tentative evidence of genetic distinction between the two populations (also since shown to be unfounded). The US is considering removing the eastern population from the

Endangered Species List due to continued population growth (NMFS 2012). The listings of the western population prompted a number of management actions to protect Steller Sea Lion critical habitat, including the creation of 3-nautical-mile no-entry zones around breeding rookeries, prohibition of groundfish trawling within 10-20 nm of certain rookeries, and spatial and temporal reallocation and in some cases closure of Walleye Pollock and Atka Mackerel (*Pleurogrammus monopterygius*) fisheries. A recovery plan for Steller Sea Lions was developed (NMFS 1992; NMFS 2008).

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None.

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Appendix 1. Number of non-pup Steller Sea Lions counted during province-wide breeding season surveys during 1971-2010. (Data from DFO.)

Site Name	Type	28 June-30 June 1971	29 June-03 July 1973	27June-30 June 1977	28 June-01 July 1982	29 June-03 July 1987	28 June-03 July 1992	28 June-01 July 1994	29June-04 July 1998
CARMANAH PT	W/Y	0	NS	181	170	146	103	150	255
PACHENA PT	W/Y	0	0	0	0	0	0	0	0
WOUWER ISL	W/Y	0	0	0	0	0	0	0	0
MARA ROCK	W/Y	0	(NS)	0	3	0	0	41	87
LONG BEACH	Y	394	265	10	262	231	344	298	535
PEREZ ROCKS	Y								
RAPHAEL PT	W	0	0	0	0	0	0	58	0
FERRER PT	W								
BARRIER ISLS	Y	NS	NS	105	153	149	274	290	843
O'LEARY ITS	W/Y	331	NS	200	85	60	81	14	74
SOLANDER ISL	W/Y	0	3	1	0	0	51	419	179
CAPE SCOTT	W	0	(NS)	1	0	1	42	68	0
MAGGOT ISL	R	418	416	627	442	550	511	371	245
BERESFORD ISL	Y	71	6	24	100	124	164	119	5
SARTINE ISL	R	628	616	879	806	600	575	343	262
TRIANGLE ISL	R	550	375	570	376	1057	1603	1626	2540
ASHBY POINT	W/Y	NS	82	4	1	210	3	226	225
BUCKLE GROUP	W/Y?								(NS)
MILLER GROUP	W/Y								
VIRGIN ROCKS	Y/R	317	205	62	190	229	157	131	168
PEARL ROCKS	Y	100	81	276	23	128	126	98	199
GOSLING ROCKS	Y	106	NS	37	179	135	72	192	133
MCINNES ISL	Y	196	NS	45	0	0	109	241	163
STEELE ROCK	Y	NS	NS	85	150	7	35	137	227
ASHDOWN ISL	W	(NS)	(NS)	0	NS	NS	25	NS	0
ISNOR	Y								0
JOSEPH ISL	?								
N DANGER RKS	R	148	347	230	288	339	301	309	583
BONILLA ISL	Y	29	158	333	219	19	265	272	303
WARRIOR ROCKS	Y	?	?	?	?	?	416	2	282
CHERNEY ISL	W/Y								0
ROSE SPIT	W/Y								0
REEF ISL	Y	207	105	88	36	482	489	538	216
SKEDANS	W	0	(NS)	0	45	0	0	0	0
JOYCE ROCKS	?								
CAPE ST. JAMES	R	631	549	782	698	1021	867	797	763
S TASU HD	Y	76	NS	278	117	263	80	196	285
MORESBY ITS	W	(NS)	(NS)	(NS)	(NS)	0	3	115	65

Site Name	Type	28 June-30 June 1971	29 June-03 July 1973	27June-30 June 1977	28 June-01 July 1982	29 June-03 July 1987	28 June-03 July 1992	28 June-01 July 1994	29June-04 July 1998
CONE HD	W/Y	(NS)	(NS)	(NS)	(NS)	0	70	21	1
JOSEPH ROCKS	Y	408	NS	399	366	309	327	397	601
LANGARA ISL	W/Y	6	NS	0	3	3	NS	0	217
ANTHONY ISL	Y	?	?	?	?	44	279	617	359
GARCIN ROCKS	Y/R								0?
Miscellaneous	-	1		2	1	2	4	5	3
Number Counted	-	4617	3208	5219	4713	6109	7376	8091	9818
Missed (sites)	-	272(3)	831(9)	0(0)	13(1)	13(1)	2(1)	13(1)	0(0)
Total Estimated	**-**	**4889**	**4039**	**5219**	**4726**	**6122**	**7378**	**8104**	**9818**

Site Name	Type	02 July-06 July 2002	01 July-03 July 2006	01 July-09 July 2008	26 June-03 July 2010
CARMANAH PT	W/Y	237	247	162	514
PACHENA PT	W/Y	0	44	53	166
WOUWER ISL	W/Y	31	4	48	89
MARA ROCK	W/Y	296	264	376	514
LONG BEACH	Y	714	3888	295	367
PEREZ ROCKS	Y	0	353	466	321
RAPHAEL PT	W	0	0	0	0
FERRER PT	W	0	16	2	0
BARRIER ISLS	Y	585	542	1051	1284
O'LEARY ITS	W/Y	2	141	0	0
SOLANDER ISL	W/Y	187	876	320	632
CAPE SCOTT	W	0	0	0	0
MAGGOT ISL	R	456	590	362	286
BERESFORD ISL	Y	147	13	397	153
SARTINE ISL	R	268	379	264	231
TRIANGLE ISL	R	2995	3576	3645	4621
ASHBY POINT	W/Y	519	786	541	479
BUCKLE GROUP	W/Y?	47	2	0	461
MILLER GROUP	W/Y	0	0	151	140
VIRGIN ROCKS	Y/R	419	516	595	533
PEARL ROCKS	Y	467	449	247	263
GOSLING ROCKS	Y	160	257	308	439
MCINNES ISL	Y	25	81	236	139
STEELE ROCK	Y	101	92	194	173
ASHDOWN ISL	W	(NS)	0	0	17
ISNOR	Y	72	29	0	109
JOSEPH ISL	?	0	1003	0	128
N DANGER RKS	R	592	375	652	527

Site Name	Type	02 July-06 July 2002	01 July-03 July 2006	01 July-09 July 2008	26 June-03 July 2010
BONILLA ISL	Y	215	692	282	508
WARRIOR ROCKS	Y	588	498	1114	1106
CHERNEY ISL	W/Y	19	30	244	508
ROSE SPIT	W/Y	0	253	132	57
REEF ISL	Y	370	0	194	316
SKEDANS	W	0	0	0	0
JOYCE ROCKS	?	0	0	23	64
CAPE ST. JAMES	R	982	1094	811	1077
S TASU HD	Y	151	47	98	251
MORESBY ITS	W	2	1	0	0
CONE HD	W/Y	131	27	85	97
JOSEPH ROCKS	Y	696	770	511	339
LANGARA ISL	W/Y	3	484	218	98
ANTHONY ISL	Y	313	513	473	186
GARCIN ROCKS	Y/R	329	261	305	565
Miscellaneous	-	3	28	49	208
Number Counted	-	12121	15721	15061	17996
Missed (sites)	-	0(0)	0(0)	0(0)	0(0)
Total Estimated	**-**	**12121**	**15721**	**15061**	**17996**

NOTE: Sites were classified as R-rookeries, Y-year-round haulouts, and W-winter haulouts, although in some cases sites used appeared to change over the course of the study period. NS denotes the site was not surveyed and animals likely missed, and (NS) denotes the site was not surveyed but it was not expected that any animals were missed based on the preceding and proceeding surveys. The “?” denotes that the site was not known to exist, and could have been overlooked in previous years. The estimated number of animals missed (and the number of missed sites) is given near the bottom of the table.

Appendix 2. Number of Steller Sea Lion pups counted during province-wide breeding season surveys from 1971-2010. (Data from DFO.)

Site Name	28 June-30 June 1971	29 June-03 July 1973	27June-30 June 1977	28 June-01 July 1982	29 June-03 July 1987	28 June-03 July 1992	28 June-01 July 1994	29 June-04 July 1998
MAGGOT ISL	174	188	147	171	178	107	74	72
SARTINE ISL	163	273	309	409	176	253	62	148
VIRGIN RKS	0	0	0	0	2	0	0	0
TRIANGLE ISL	181	189	140	185	305	476	630	1211
N DANGER RKS	86	93	64	74	54	148	84	144
CAPE ST. JAMES	337	272	303	404	367	484	333	484
GARCIN RKS								
Miscellaneous	0	0	0	2	4	0	3	4
Total BC	**941**	**1015**	**963**	**1245**	**1084**	**1468**	**1186**	**2073**
FORRESTER ISL	NS	2371	NS	2120	2073	3261	2073	2364

Site Name	02 July-06 July 2002	01 July-03 July 2006	03 July-07 July 2008	27June-02 July 2010
MAGGOT ISL	76	62	36	56
SARTINE ISL	146	178	101	104
VIRGIN RKS	1	55	95	154
TRIANGLE ISL	2199	2674	2550	3776
N DANGER RKS	219	403	216	272
CAPE ST. JAMES	635	723	900	846
GARCIN RKS			104	217
Miscellaneous	6	23	65	60
Total BC	**3281**	**4118**	**4067**	**5485**
FORRESTER ISL	3057	3429	NS	4036