



## STATUS OF STELLER SEA LIONS (*EUMETOPIAS JUBATUS*) IN CANADA



Steller Sea Lions

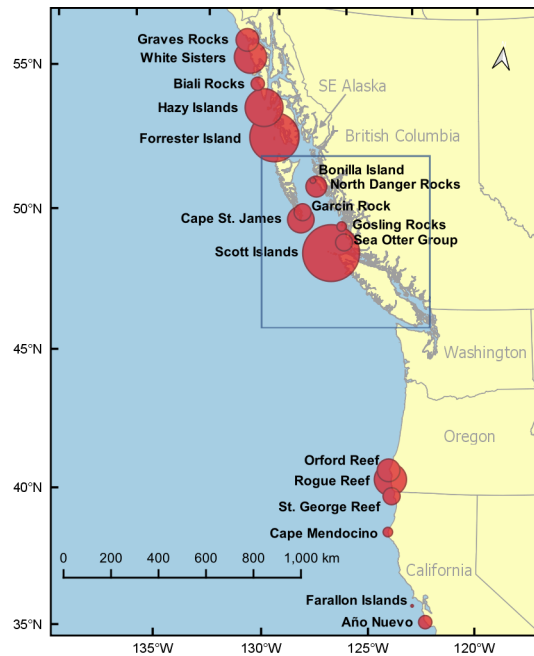


Figure 1. Map showing the location of breeding sites for the eastern population of Steller sea lion (red circles). The size of the circles is proportional to pup counts at each rookery during the range-wide survey in 2013.

### Context:

Steller sea lions (*Eumetopias jubatus*) inhabit the cool-temperate coastal waters of the North Pacific Ocean from California, north to the Bering Strait, and south along the Asian coast to Japan. They are the largest member of the family Otariidae and the only one that resides year-round and breeds in Canadian waters. Two distinct populations are recognized: an eastern stock (California to Southeast Alaska) and a western stock (Gulf of Alaska, Bering Sea, Aleutian and Commander Islands, and Sea of Okhotsk).

From 1912–68, Steller sea lions in British Columbia (B.C.) were subject to predator control programs and commercial harvests. A total of 55,000 sea lions were thought to have been killed during 1912–68, and by the 1970s breeding populations had been reduced to roughly 30% of historic levels estimated to have been present in the early 1900s.

In 2003 and again in 2013, COSEWIC recommended that the Steller sea lion be designated as Special Concern in Canada. The recommendation was initially based on the unexplained declines that had occurred in western Alaska, and more recently the sensitivity of the species to disturbances while on land and the limited number of breeding sites in Canadian waters. As required under the Species at Risk Act (SARA), Fisheries and Oceans Canada (DFO) developed a Management Plan for Steller sea lions, which includes recommendations for continued range-wide monitoring of distribution and abundance. An

*updated assessment of Steller sea lion abundance, range and population trends also supports requirements for post-delisting range wide monitoring in accordance with US endangered species legislation. The information obtained through such surveys is necessary to monitor risk to the population, by identifying new or re-established rookeries on the coast of British Columbia, and to inform management actions that serve to protect the species from identified threats.*

*This Science Advisory Report is from the October 20–24, 2014 Annual Meeting of the National Marine Mammal Peer Review Committee (NMMPRC). Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.*

## SUMMARY

- Fisheries and Oceans Canada (DFO) has conducted 13 province-wide aerial surveys since the early 1970s to monitor the Steller sea lion population in B.C. Surveys are timed to coincide with the end of the breeding season so as to provide an estimate of pup production, as well as counts of juveniles and adults (non-pups).
- During the most recent survey in 2013, a total of 28,452 sea lions were counted in B.C. This included 6,317 pups and 22,135 non-pups (10,969 on rookeries and 11,166 on non-breeding haulout sites). This compares to a total of 23,514 sea lions counted in 2010, including 5,485 pups and 18,029 non-pups. The counts from aerial surveys represent minimum abundance because some pups may have died and older animals foraging at sea would be missed.
- An estimate of the total population size during the 2013 breeding season of 39,200 (95% CI of 33,600 to 44,800) was obtained by applying a correction factor based on telemetry data to account for animals that were at sea and missed during surveys. There is evidence for a continued increasing trend from the 2010 estimate of 32,500 (95% CI 28,200-36,800) although the Confidence Intervals (CI) overlap.
- Both pups and non-pups have increased since early 1970s, and population growth appears to be increasing at an accelerating rate. Between 2010 and 2013, the population growth rate for Steller sea lions in B.C. pups was 5.64% and non-pups 4.55%. However, there is uncertainty around the degree of immigration from neighboring US rookeries and the contribution to the abundance and growth of the B.C. population.
- The number of rookeries and year-round haulout sites has increased in B.C. waters since the species was first protected in 1970. In addition to the recovery of the previously eradicated rookeries on the Sea Otter Group by 2006, new rookeries have been established since that time at Garcin Rocks, Gosling Rocks and off Bonilla Island.
- Abundance of Steller sea lions has also increased in recent years at neighboring rookeries in SE Alaska, Washington and Oregon, as has the number of rookeries and year-round haulouts.
- The most recent winter surveys in 2009–2010 indicated that an estimated 48,500 (95% CI 38,100 to 58,900) Steller sea lions winter in the coastal waters of B.C. The increase in abundance during the non-breeding season appears to be due to a net influx of animals from rookeries outside of B.C.

## BACKGROUND

### Species Biology

The Steller sea lion (*Eumetopias jubatus*) is the largest otariid and only member of the family that resides year-round and breeds in Canadian waters as part of its pan-Pacific range

(Figure 1). Steller sea lions have a polygynous mating system and congregate on traditional rookeries to breed. Animals tend to return to the rookeries on which they were born. Males mature at 3–7 years of age, but only the dominant bulls, most aged 9–13 years, breed. They are the first to arrive on rookeries in May to stake out territories, which they will defend while fasting for the next 20–68 days. Females mature at 3–6 years of age. Pregnant cows arrive on rookeries throughout June, and give birth to a single pup within a few days. Pups cannot swim at birth and are confined to the rookery for the first month of life. Mothers remain with newborn pups for the first week and then make regular feeding trips lasting a day on average. They subsequently spend a day on shore tending their pup.

In B.C., Steller sea lions breed at traditional rookeries on the Scott Islands off the north tip of Vancouver Island (Triangle, Sartine and Maggot Islands), at Cape St. James off the southern tip of the Queen Charlotte Islands, on the Sea Otter Group off the central coast (Virgin and Pearl Rocks) and on North Danger Rocks off the northern mainland coast (Figure 2). In addition to recolonizing the previously eradicated rookeries in the Sea Otter Group by 2006, Steller sea lions have established new breeding sites (>50 pups counted) on Garcin Rocks in Haida Gwaii (2008), Gosling Rocks in the Goose Group off the central mainland coast and Bonilla Island on the north mainland coast of B.C. (2013). Triangle Island, B.C. and Forrester Island, Alaska are the largest breeding sites in the range, contributing over half of total pup production for the eastern population.

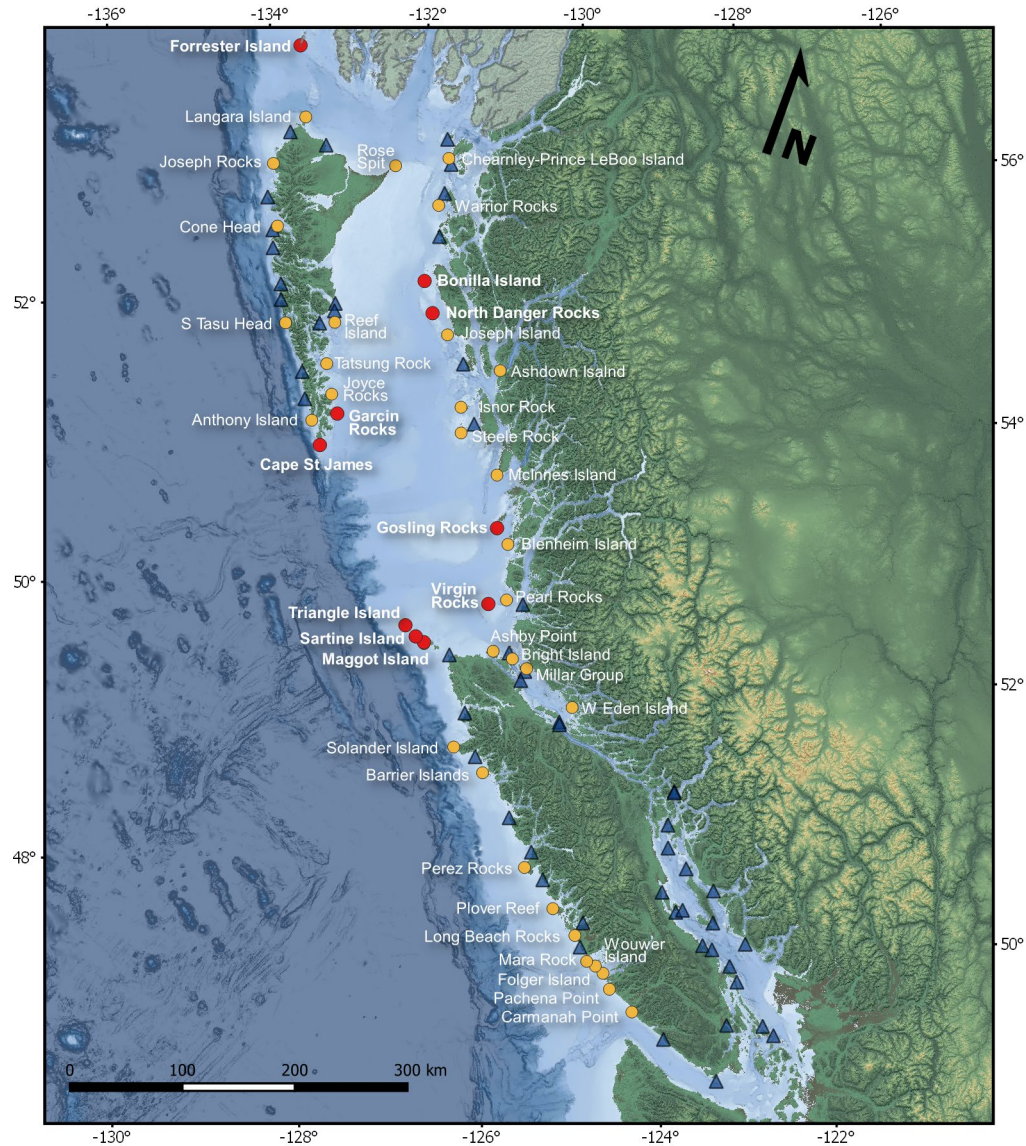


Figure 2. Map showing location of Steller sea lion breeding rookeries (●), year-round haulout sites (●), and significant winter haulout sites (▲) in British Columbia and at Forrester Island, Alaska.

During summer, non-breeding animals are found at year-round haulout sites. There are about 34 such sites distributed throughout coastal B.C., primarily along the outer exposed coast. In August, animals start to disperse from rookeries to feed and begin to occupy numerous winter haulout sites, many of which are located in inside protected waters. Young animals maintain bonds with their mothers and may continue to nurse into their 2nd or even 3rd year.

The species is non-migratory, but there are well-defined local seasonal movements in some areas. The movement of Steller sea lions northwards along the Oregon and Washington coast from the southern part of their ranges coincides with an increase in the number of sea lions wintering off southern Vancouver Island. Non-breeding animals have been known to disperse distances of up to 1,700 km from where they were born.

Mortality of pups during the first month of life appears to be high and influenced by factors such as storms with drowning as the primary cause of death. Deaths can also result from pups being

bitten, tossed or trampled by older animals, or becoming separated from their mothers. Rookeries are therefore particularly sensitive to disturbances during the breeding season.

Juvenile mortality is difficult to measure due to potential sampling biases, but appears to be high for both sexes – it has been estimated that only 48% of females and 26% of males survive to 3 years of age. Mortality rates are significantly lower for adults: 7–15% per year for females, and 12–25% for males, resulting in a progressively skewed sex ratio favouring females. The oldest males in the wild were aged about 18 years and the oldest females 30 years, although very few individuals attain such old ages.

Steller sea lions are opportunistic predators that tend to feed on prey that are locally and seasonally most abundant or accessible. Preferred prey appear to be small or medium-sized schooling fishes; in B.C. important prey species include Pacific herring, Walleye Pollock, Pacific cod, Pacific hake, Pacific sand lance, salmon, dogfish, Eulachon and Pacific sardine. They also feed on squid, octopus, and bottom fish including various species of rockfish, flounder and skate. Steller sea lions have been identified as an important prey species for threatened Bigg's (Transient) killer whales.

## ASSESSMENT

To support of an assessment of recovery of the B.C. population of Steller sea lions, Olesiuk (2008, 2018) compiled and examined kill and sightings records to estimate the impact of predator control efforts and reconstruct historic sea lion populations. It is estimated that 55,000 Steller sea lions were killed at rookeries and haulouts in B.C. between 1910 and 1970 (Figure 3).

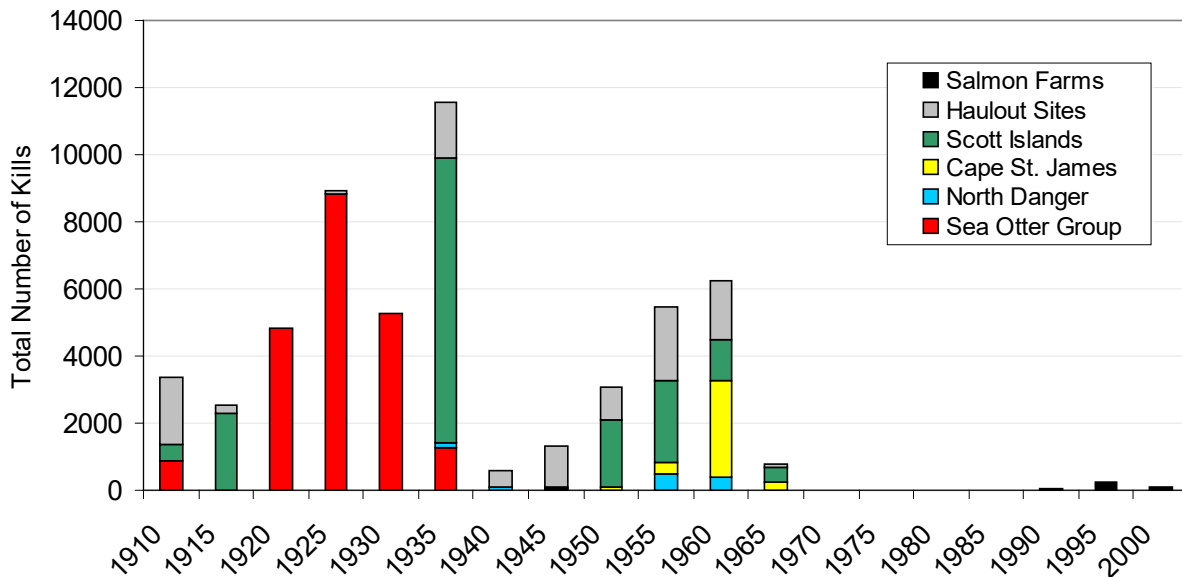


Figure 3. Numbers of Steller sea lions (pups, juveniles and adults) killed during control programs and harvests in B.C. during 1912–68 and at salmon farms during 1991–2003.

The first Steller sea lion counts, conducted in 1913 prior to any large-scale kills, estimated a breeding population on rookeries of about 14,000 animals. With the elimination of rookeries on the Sea Otter Group, numbers fell to roughly 12,000 by 1938 and by 1956, kills at other rookeries had reduced the breeding population to 8,900–9,400. The population declined sharply with the resumption of control programs for fisheries enhancement and harvests in 1956–66,

and by the time the species was protected in 1970, total numbers on B.C. rookeries had been reduced to about 3,400 animals (Figure 4).

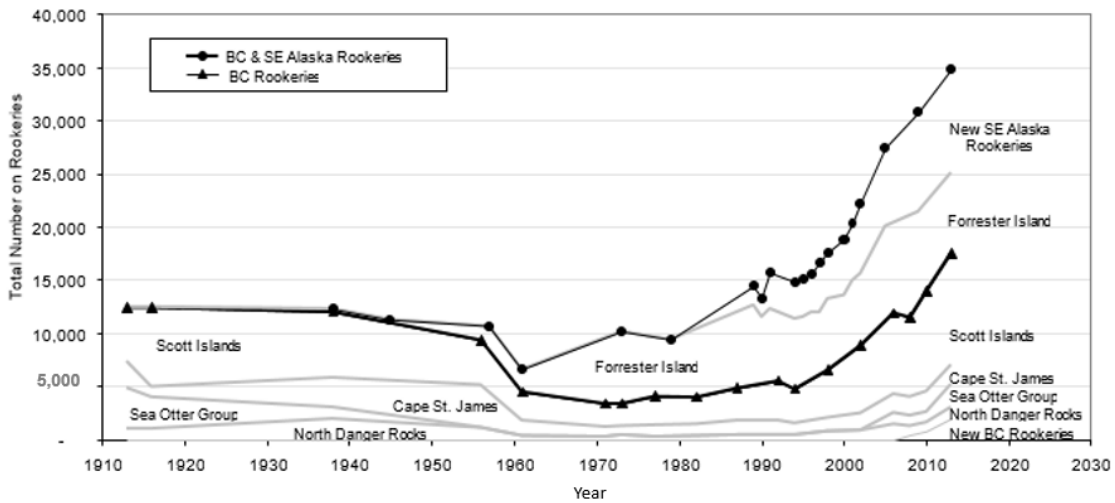


Figure 4. Historic trends in total numbers of the eastern population of Steller sea lions (pups, juveniles and adults) on rookeries in B.C. only (lower black line) and range-wide (upper black line) showing combined numbers in B.C. and SE Alaska. The thin grey lines show the distribution among breeding sites over time.

While control programs were underway in B.C., a new rookery became established at Forrester Island, situated less than 50 km north of the Alaska border. By the 1980s it had grown into the world's largest breeding site for the species (though recently surpassed by higher counts at Triangle Island, B.C.). Several additional rookeries were established in SE Alaska during the 1980s and 1990s. Combined abundance in B.C. and SE Alaska (which are difficult to separate due to the large rookery just north of the border and the possible dispersion/ intermixing of animals) has been increasing since the 1960s.

### Breeding season abundance

Since the early 1970s, DFO has conducted a series of 13 standardized aerial surveys to monitor the status of Steller sea lion populations. Surveys are timed to coincide with the end of the breeding season, after most pups have been born and before they have begun to disperse from rookeries, to provide an estimate of pup production. Counts of juveniles and adults (non-pups) from photos of rookeries and non-breeding haulout sites are used to provide information on distribution. The timing of recent breeding season surveys has been coordinated with US agencies to support range-wide assessment of breeding season populations.

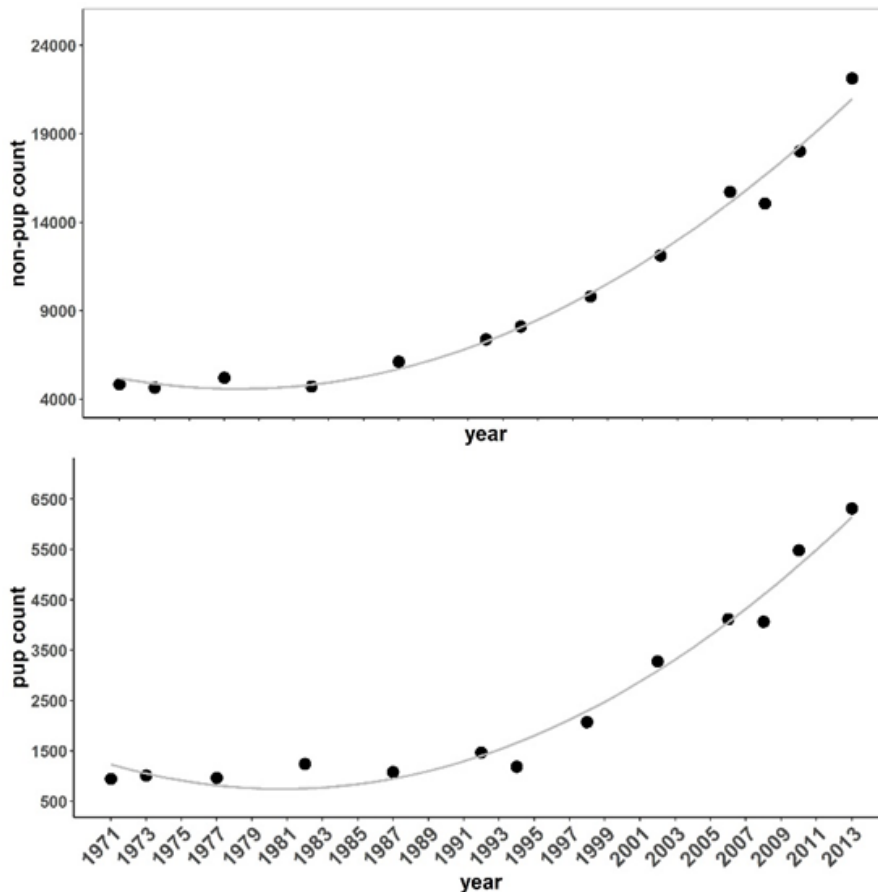


Figure 5. Number of non-pups (top) and pups (bottom) observed during aerial surveys in B.C. during 1971-2013 at all haulouts. Survey counts for adults were adjusted to account for animals at sea during surveys. The solid lines show population trends over the study period, fitted to a polynomial model, providing an estimate of growth rate.

The most recent survey (2013) indicates that abundance continues to increase for both non-pup and pups in B.C. (Figure 5). A total of 28,452 sea lions were counted in B.C., including 6,317 pups and 22,135 non-pups (10,969 on rookeries and 11,166 on non-breeding haulout sites). This compares to a total of 23,514 sea lions counted in 2010, including 5,485 pups and 18,029 non-pups. The counts from aerial surveys represent minimum abundance because some pups may have died and older animals foraging at sea would be missed.

An estimate of total abundance of 39,200 (95% CI of 33,600 to 44,800) in 2013 was obtained by applying survey correction factors that accounted for animals that were at sea and missed during surveys. A total of 7,300 pups were estimated to have been born on B.C. rookeries in 2013.

Population growth rates appear to be increasing for both pups and non-pups. Numbers of non-pups increased at an average rate of 3.8% per annum and pup production at a rate of 4.8% per annum over the study period, resulting in more than a 4-fold increase in abundance since the species was protected in 1970, with most of the increase occurring since the mid-1980s. Growth rates calculated for the interval 2010–2013 were 4.55% for non-pups and 5.64% for pups compared to 4.46% and 5.87% for non-pups and pups respectively between 2008–2010. The most recent growth rates, based on a polynomial regression, show similar trends to those

obtained using a piecewise log-linear regression used in previous assessments and were determined to be the best fit given the accelerating rate of growth seen in recent years.

A continued increase in the number of rookeries and major year-round haulouts has also been observed (rookery defined as >50 pups counted). During the last decade, Steller sea lions resumed breeding on the Sea Otter Group (Virgin Rocks) off Rivers Inlet, and established new rookeries on Garcin Rocks in Haida Gwaii (2006), Gosling Rocks off the central mainland coast and Bonilla Island off the northern mainland coast (2013) (see Figure 2).

Similar trends in distribution and abundance have been observed throughout their range. A northward shift in the overall breeding distribution has occurred, with a contraction of the range in southern California and new rookeries established in Southeast Alaska, and most recently, Washington (>100 pups counted in 2015). Abundance of both pups and non-pups increased in California, Oregon, Washington and Southeast Alaska between 1990 and 2015, with the most substantial growth observed in Southeast Alaska.

### **Non-breeding season abundance**

Non-breeding season surveys have also been conducted periodically to examine seasonal changes in abundance and distribution at haulouts in B.C.

Province-wide winter surveys conducted during 2009–2010, and an autumn survey conducted in 2012, indicated distinct seasonal shifts in distribution, with fewer animals hauling out on rookeries in winter than in summer or fall, and increasing numbers at year-round and overwintering haulouts (Figure 6). Overall seasonal changes in abundance of Steller sea lions in B.C. waters have also been observed; winter surveys in 2009–2010 indicated that an estimated 48,500 (95% CI 38,100 to 58,900) Steller sea lions wintered in the coastal waters of B.C. during the non-breeding season, 49% more than the number estimated in the summer of 2010 (32,500; 95% CI 28,200 to 36,800). The increase in abundance during the non-breeding season appears to be due to a net influx of animals from SE Alaska, Washington, Oregon and California.



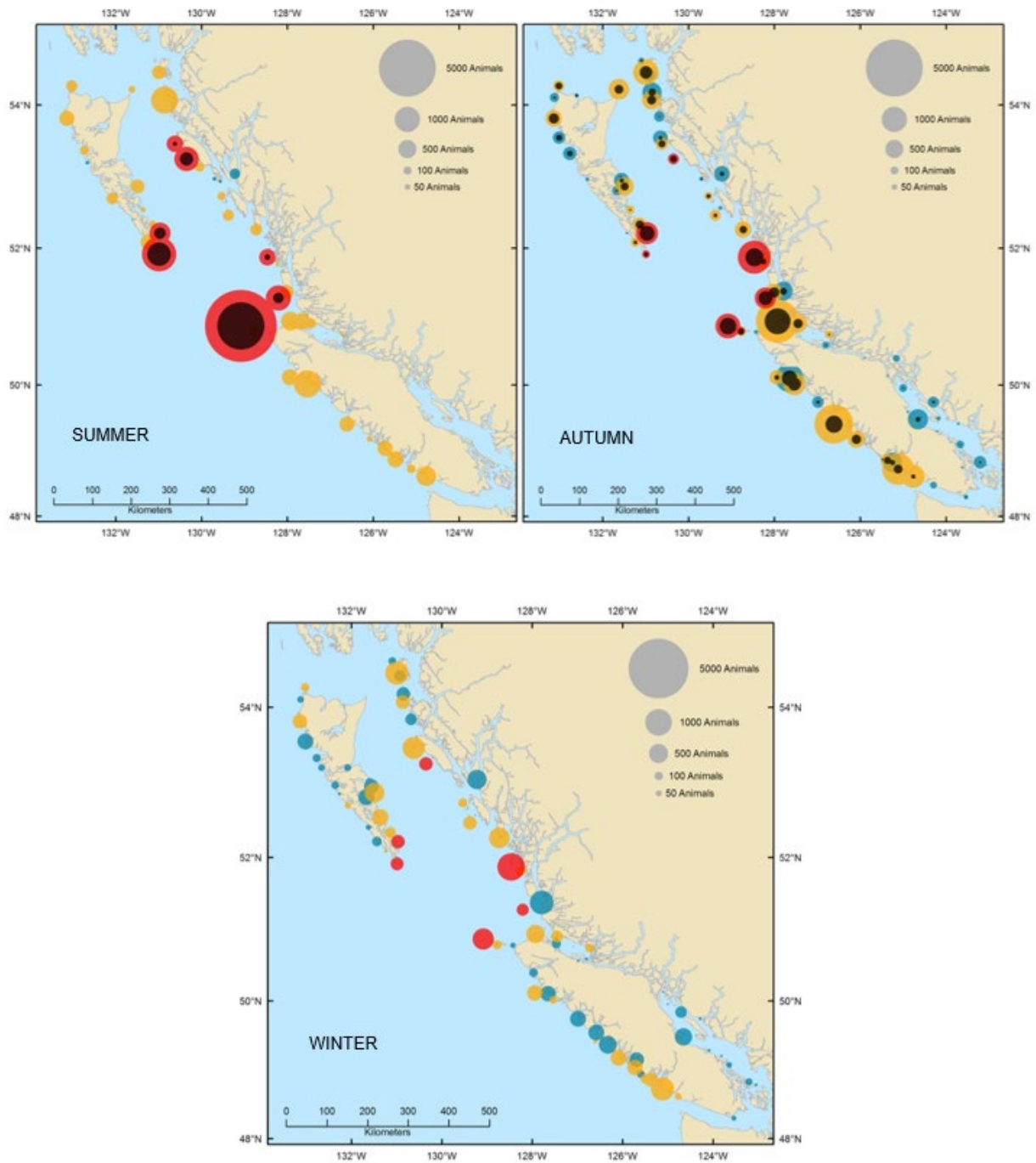


Figure 6. Maps showing seasonal changes in distribution of Steller sea lion counts for summer surveys in 2008–2013 (top left), an autumn survey in 2012 (top right), and winter surveys in 2009–2010 (bottom). Symbol sizes are proportional to the total number of animals (pups and non-pups) counted at each site. Black circles indicate the proportion of pups in summer and autumn surveys (pups had moulted and could no longer be distinguished from older animals in winter surveys). Red symbols denote rookeries, orange symbols year-round haulouts, and blue symbols winter haulouts.

## Sources of Uncertainty

There is uncertainty associated with reconstruction of historic populations of Steller sea lions in B.C. due to limited data and changing survey methods (e.g. counts conducted from boats or high points on land) prior to establishment of standardized aerial surveys in the early 1970s. While useful in considering overall trends and impacts of predator control programs on Steller sea lion populations, the reconstruction presented only extends to the early 1900s which may not represent long-term historical abundance of Steller sea lions. Population levels prior to that are essentially unknown, and caution should be exercised in comparing estimates of present-day populations with those in the early 1900s to gauge conservation targets.

There is uncertainty around the correction factors applied to survey counts to provide estimates of abundance. Correction factors have a direct, multiplicative effect on the estimate of sea lion abundance. Since most pups are born on traditional rookeries during June, and are confined to land for the first month of life, standardized surveys of rookeries at the end of June or early July are expected to provide a nearly complete count of annual pup production. As in previous Steller sea lion assessments, an arbitrary correction factor of 1.10 was applied to pup counts to account for pups that may have been born and died or swept off rookeries prior to surveys, or pups born after the survey. While this correction seems reasonable, there is little information on the actual number of pups missed, and the number could vary from year to year and between sites.

Counts are also corrected for the unknown proportion of animals foraging at sea during surveys (and therefore not included in counts from survey photos). The survey correction factors currently used were derived from satellite telemetry data collected from 25 Steller sea lions captured near Hornby Island in the Strait of Georgia between 2005–07. Satellite telemetry data collected during summer indicated that peak numbers of animals are hauled out during daylight hours, and estimated that 67% of animals were hauled out during surveys conducted in the summer breeding season. A survey correction factor of 1.48 was therefore applied to non-pup counts. In contrast, animals spent less time on land during the non-breeding season, and haulout bouts were less synchronized. As a result, it is estimated that only 37% of animals were hauled out and counted during winter surveys.

The main uncertainty associated with the survey correction factors is related to whether the behavior of the tagged animals was representative of the entire population, sufficiently capturing age and sex related differences in behavior. Since aerial surveys tend to be conducted when conditions are suitable for flying, and satellite telemetry records were continuous and reflected haulout behaviour under all conditions, survey correction factors could also be biased if environmental co-variates (such as wind, temperature, precipitation and tide) influence haulout patterns. Moreover, it is uncertain whether haulout behaviour has remained consistent, and survey correction factors relevant, despite changing demographics, predator abundance, dynamic ocean conditions and prey availability.

There is also uncertainty around the contribution of animals immigrating from neighboring rookeries in SE Alaska, Washington, Oregon and California to breeding season and overwintering populations in B.C. waters. Large numbers of breeding females and pups observed at sites just south of the Alaska border and along the southwest coast of Vancouver Island during the fall 2012 survey suggest an influx of breeding females and pups from rookeries outside of B.C. Satellite telemetry data from tagged animals and sightings of animals branded at U.S. rookeries in B.C. waters throughout the year confirm that Steller sea lions move widely throughout their range and that animals born at U.S. rookeries overwinter and possibly breed in Canada.

## CONCLUSIONS AND ADVICE

The eastern population of Steller sea lions in British Columbia has increased approximately four-fold between the early 1900's and since the species was protected in 1970. Recolonization and expansion of rookeries, as well as expansion of year-round and winter haulouts has occurred. Populations have also been increasing and rookeries expanding in neighboring waters of SE Alaska and Washington. Steller sea lions appear to have recovered from predator control programs, and the abundance in B.C. is estimated to be higher than levels thought to have been present in the early 1900s before any large-scale kills.

## OTHER CONSIDERATIONS

Although populations have grown in recent years, Steller sea lions still face a number of potential threats. During the breeding season, animals aggregate in large numbers on rookeries (~70% of pup production in Canada occurs on the Scott Islands), at which time animals are vulnerable to disturbances or potential environmental calamities.

Given the recent recovery and continued growth of populations, it is expected that natural regulatory mechanisms will likely begin to play a greater role in B.C. waters. Predator-prey interactions in the food web are not well understood and continued efforts should be made to explore seasonal patterns of abundance, distribution and diet of Steller sea lions throughout their range. Increasing numbers of California sea lions have been observed overwintering in B.C. in recent years; abundance, distribution and diet of California sea lions should be considered in assessing potential resource competition with Steller sea lions. Changes in the ocean environment (including warmer temperatures resulting in reduced prey availability) have been considered as a possible factor favoring California sea lions over Steller sea lions in some parts of the range and influencing trends in distribution and abundance for both species.

In support of ecosystem-based management, pinniped species serve as general indicators of the status of food webs in the North Pacific and data from these ongoing surveys should be integrated into regional ecosystem models.

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### SOURCES OF INFORMATION

This Science Advisory Report is from the October 20–24, 2014 Annual Meeting of the National Marine Mammal Peer Review Committee (NMMPRC). Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

- Bigg, M.A. 1984. Sighting and kill data for the Steller sea lion (*Eumetopias jubatus*) and California sea lion (*Zalophus californianus*) in British Columbia, 1892-1982, with some records from Washington and southeastern Alaska. Can. Data Rep. Fish. Aquat. Sci. 460.
- Bigg, M.A. 1985. Status of Steller sea lion (*Eumetopias jubatus*) and California sea lion (*Zalophus californianus*) in British Columbia. Can. Spec. Publ. Fish. Aquat. Sci. 77: 1-20.
- DFO. 2016. Proceedings of the Annual Meeting of the National Marine Mammal Peer Review Committee (NMMPRC); October 20-24, 2014. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2016/035.
- National Marine Fisheries Service. 2013. Post-Delisting Monitoring Plan for the Eastern Distinct Population Segment of Steller Sea Lion (*Eumetopias jubatus*). National Marine Fisheries Service, Protected Resources Division, Alaska Region, Juneau, Alaska. I + 21 pp. + Appendices.
- Olesiuk, P.F. 2018. Recent trends in Abundance of Steller Sea Lions (*Eumetopias jubatus*) in British Columbia. DFO Can. Sci. Advis. Sec. Res. Doc. 2018/006. v + 67 p.
- Pêches et Océans Canada. 2011. Plan de gestion de l'otarie de Steller (*Eumetopias jubatus*) au Canada [Version finale]. Série des plans de gestion de la Loi sur les espèces en péril. Pêches et Océans Canada, Ottawa. vii + 80 p.
- Pitcher, K.W., P.F. Olesiuk, R.F. Brown, M.S. Lowry, S.J. Jeffries, J.L. Sease, W.L. Perryman, C.E. Stinchcomb, and L.F. Lowry. 2007. Abundance and distribution of the eastern North Pacific Steller sea lion (*Eumetopias jubatus*) population. Fishery Bulletin 107: 102-115.
- Sweeney, K., L. Fritz, R. Towell, and T. Gelatt. 2015. Results of Steller Sea Lion Surveys in Alaska, June-July 2017. Memorandum to The Record, November 29, 2017. Available from Marine Mammal Laboratory, AFSC, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115.
- Trites, A.W. 2013. Évaluation et Rapport de situation du COSEPAC sur l'otarie de Steller (*Eumetopias jubatus*) au Canada. Rapport préparé pour la Comité sur la situation des espèces en péril au Canada.

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ISSN 1919-5087

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Correct Citation for this Publication:

DFO. 2020. Status of Steller Sea Lions (*Eumetopias jubatus*) in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2020/046.

*Aussi disponible en français :*

MPO. 2020. État de l'otarie de Steller (*Eumetopias jubatus*) au Canada. Secr. can. de consult. sci. du MPO, Avis sci. 2020/046.