



## TRENDS IN ABUNDANCE AND DISTRIBUTION OF STELLER SEA LIONS (*EUMETOPIAS JUBATUS*) IN CANADA



Steller sea lion (photo: DFO)

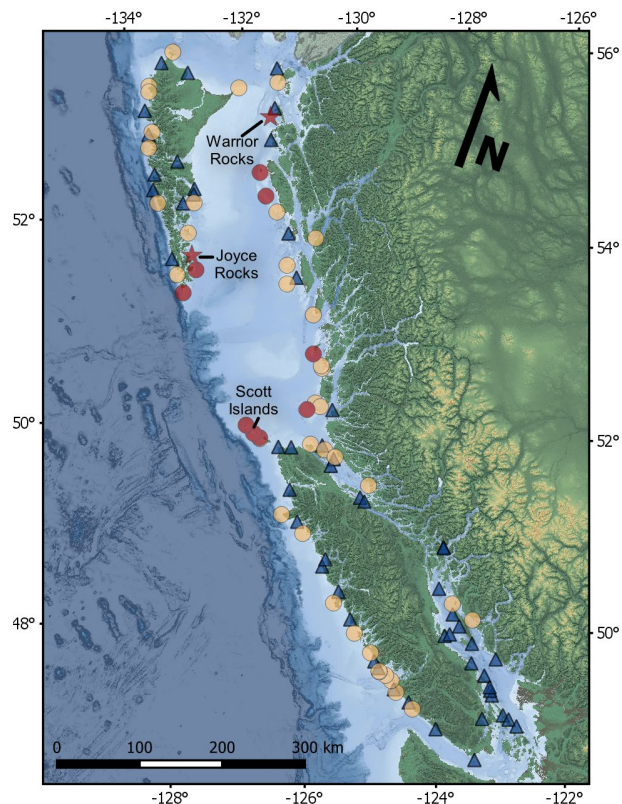


Figure 1. Map showing location of Steller sea lion breeding rookeries (red dot), new rookeries observed in 2017 (red star), year-round haulout sites (yellow dot), and major winter haulout sites (blue triangle) in British Columbia.

### Context:

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 ongoing range-wide monitoring of distribution and abundance. 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 (BC), and to inform management actions that serve to protect the species from identified threats.

Surveys were flown during the summer 2017 breeding season, as well as fall 2016 and winter 2017. Science was requested to provide an update on abundance, range and population trends for Steller sea lions in Canadian Pacific waters to support the following: monitoring of Steller sea lion population recovery, monitoring of key prey populations for recovering Transient killer whales, assessment of potential competition with Resident killer whales for fish prey species, Marine Protected Area (MPA)

*planning and oil-spill response. An estimate of Potential Biological Removal was also requested to meet new requirements under the Marine Mammal Protection Act and support assessment of emerging proposals for harvest.*

*This Science Advisory Report is from the February 17-22, 2020 National Marine Mammal Peer Review on Steller Sea Lion Population Abundance Estimate. Additional publications from these meetings 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 14 breeding season aerial surveys since the early 1970s to monitor the Steller sea lion population in British Columbia (BC). Surveys are timed to provide counts of both pups and non-pups (juveniles and adults).
- DFO has also conducted periodic fall and winter aerial surveys to examine seasonal changes in abundance and distribution of Steller sea lions overwintering in BC.
- In 2017 a total of 6,640 pups and 25,113 non-pups were counted. Models fit to the counts indicate a possible slowing in the annual rate of growth in pup production since 2013, but not in the rate of growth in the non-pup component of the population.
- An estimate of the total population size was obtained by applying a correction factor to non-pup counts to account for animals that were at sea and missed during surveys. The adjusted 2017 breeding season population estimate was 43,200 (95% CI of 38,700 to 48,200) suggesting no significant change from the previous assessment.
- The winter survey in 2017 provided an estimate of 52,700 (95% CI 41,000 to 67,800) Steller sea lions wintering in the coastal waters of BC. Larger numbers of sea lions estimated from winter surveys compared to breeding season surveys appear to be due to a net influx of animals from rookeries outside of BC.
- The number of rookeries and year-round haulout sites continues to increase in BC waters.
- The Potential Biological Removal (PBR) for Steller sea lions during the summer breeding season is 2,474 for Canadian waters.

## BACKGROUND

### Species Biology

The Steller sea lion (*Eumetopias jubatus*) resides year round and breeds in Canadian waters as part of its pan-Pacific range. Steller sea lions occur throughout the coastal water of British Columbia (BC) (Figure 1), with distinct seasonal patterns in distribution. Animals are highly aggregated at rookery and outer coast year-round haulout sites during the summer breeding season but disperse to other areas of the coast for foraging through fall and winter.

Steller sea lions have a polygynous mating system and tend to return to the rookeries on which they were born. In BC, Steller sea lions breed at seven traditional rookeries and three newly established rookeries. During summer, non-breeding animals are found at year-round haulout sites. There are about 34 such sites distributed throughout coastal BC, 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 protected waters.

Since the early 1970s, Fisheries and Oceans Canada (DFO) has conducted a series of 14 standardized aerial surveys to estimate the abundance of the breeding season Steller sea lion

populations in BC. Surveys are timed to coincide with the end of the breeding season (between June 27-July 9), by which time most pups have been born but are still confined to rookeries, and the highest number of non-pups are expected to be hauled out. Counts of pups and non-pups (juveniles and adults) made from survey photos taken of rookeries and non-breeding haulout sites are used to provide estimates of abundance and distribution. The timing of recent breeding season surveys has been coordinated with US agencies to support the range-wide assessment of breeding season populations. Non-breeding season surveys have also been conducted periodically to examine seasonal changes in abundance (winter) and distribution at haulouts in BC (fall and winter).

## **ASSESSMENT**

### **Breeding season abundance**

The most recent breeding season survey (June 28 – July 3, 2017) indicates that the number of non-pups and pups counted in BC continued to increase (Figure 2). A total of 31,753 Steller sea lions were counted in 2017 (6,640 pups and 25,113 non-pups). This compares to 28,452 Steller sea lions counted in 2013 (6,317 pups and 22,135 non-pups).

Models fit to the counts indicate a potential slowing in the annual rate of increase in pup production since 2013, but not in the rate of increase for the non-pup component of the population (Figure 2). Growth rates calculated for the 2013-2017 interval were estimated to be 2.8% per year for pups and 4.3% per year for non-pups, as compared to 5.6% for pups and 4.6% for non-pups estimated for 2010-2013.

Adjusting for animals not hauled out at the time of the survey (estimated to be 67% hauled out during breeding surveys), the estimated breeding season abundance of Steller sea lions was 43,200 (95% CI of 38,700 to 48,200) in 2017. This compares to an estimated breeding season abundance of 39,200 (95% CI of 33,600 to 44,800) in 2013, indicating there was no significant change in estimated abundance over the four year period.

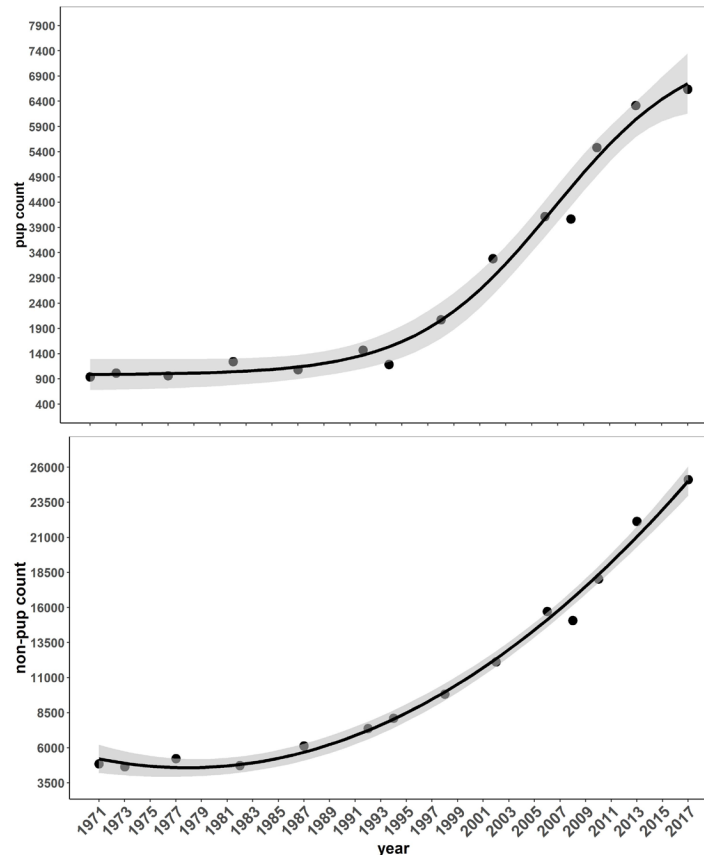


Figure 2. Recent trends in the number of pups (top panel) and non-pups (bottom panel) based on breeding season aerial surveys, 1971-2017. Black lines and shading denote the logistic model fit to pup counts (top panel) and the polynomial model fit for non-pup counts (bottom panel). Grey shading denotes 95% confidence intervals.

### Non-breeding season abundance

A total of 22,295 animals were counted during surveys conducted in winter 2017 (January 27 – 1 February). A correction factor to adjust for animals not hauled out at the time of the survey (estimated to be 59% hauled out during winter surveys) was applied to the counts. The adjusted abundance estimate was 52,700 (95% CI 41,000 to 67,800) Steller sea lions wintering in coastal waters of BC.

In both the 2017 and 2009-10 surveys, winter abundance was higher than the breeding season estimate. The higher winter abundance compared to breeding season abundance continues to suggest there is a net immigration of Steller sea lions into BC during the non-breeding season.

### Distribution

The seasonal distribution of Steller sea lions on haul-outs in BC by type (rookery, year-round or winter haulout) observed during fall surveys (2016) and during winter and breeding season surveys (2017) are shown in Figure 3.

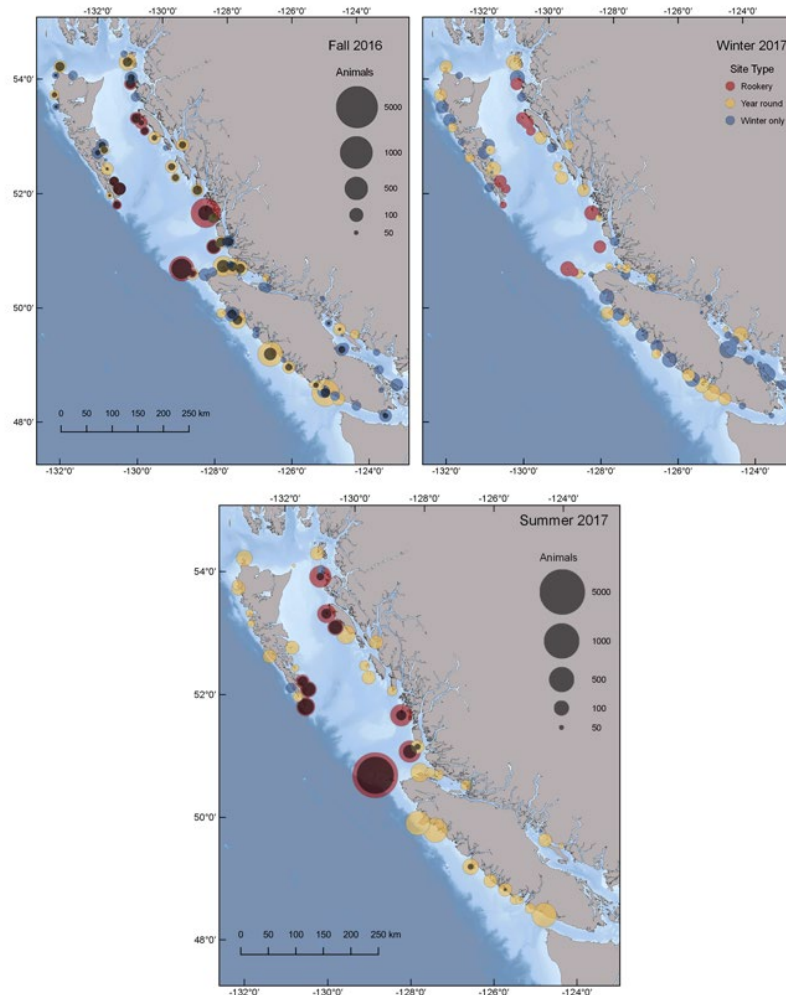


Figure 3. Maps showing seasonal changes in distribution of Steller sea lion counts for fall 2016 (top left), winter 2017 (top right) and summer breeding season 2017 (bottom) surveys. Symbol sizes are proportional to the total number of animals (pups and non-pups) counted at each site. Black circles indicate the proportion of pups in summer and fall surveys. No pups are indicated in the winter surveys because pups had moulted and could no longer be distinguished from older animals. Red symbols denote rookeries, orange symbols year-round haulouts, and blue symbols winter haulouts.

The number of rookeries and year-round haulouts continued to increase in recent surveys. Ongoing changes in patterns of use at rookeries were observed in 2017 with a continued northward shift of rookery sites and increased relative importance of rookeries on the central and north mainland coast. Two rookeries were newly designated in 2017 (i.e. the number of pups counted increased to >50) at Warrior Rocks off Bonilla Island (North Mainland Coast) and at Joyce Rocks off Moresby Island (Haida Gwaii). The relative contribution of the Scott Islands to total BC pup production was 61% as compared to 68% in 2013 and 72% in 2010. Four new winter haulout sites were observed in 2017 and two winter haul-out sites were redesignated as year-round sites, including a new major year-round haulout site in the Strait of Georgia.

### Potential Biological Removal (PBR)

Using an  $N_{\text{MIN}}$  of 43,215, a recovery factor of 1.0, and the default  $R_{\text{MAX}}$  of 12%, the PBR for Steller sea lions during the summer breeding season is estimated to be 2,474. A recovery factor

of 1.0 was determined to be most appropriate for this population due to its overall abundance, ongoing expansion of breeding and year-round haul-out sites, and the available time series data. PBR takes into account all removals (e.g. aquaculture sites, bycatch, harvest).

### **Sources of Uncertainty**

Non-pup counts are corrected for the unknown proportion of juvenile and adult animals foraging at sea during surveys (and therefore not included in counts from survey photos). There is uncertainty around the correction factors (both summer and winter) and associated variance applied to survey counts to provide estimates of abundance. It is uncertain whether haulout behaviour has remained consistent, and if the current survey correction factors are applicable, despite potential changes in population demographics, predator abundance, dynamic ocean conditions and prey availability.

There is uncertainty associated with the counts themselves, related to distinguishing pups at rookeries during the breeding season and fall surveys, and most notably in species identification at mixed haulouts of Steller and California sea lions during fall and winter surveys. This variability could be estimated by using multiple counters generating independent counts. Another source of variability is related to day to day changes in numbers of animals at individual haulout sites. The best way to quantify this uncertainty is by flying repeated surveys during the survey period.

Changes in patterns of haulout use were observed, including redistribution of animals among known haulout sites and expansion to new sites. It is possible that newly identified haulouts were previously occupied but missed during past surveys; there is also the possibility that additional undocumented haulouts were missed during the 2016-17 surveys.

There is also uncertainty around the contribution of animals immigrating from neighboring rookeries in South East (SE) Alaska, Washington, Oregon and California to breeding season and overwintering populations in BC waters. Satellite telemetry data and sightings of animals branded at United States (US) rookeries in BC waters throughout the year confirm that Steller sea lions move widely throughout their range and that animals born at US rookeries overwinter and possibly breed in Canada.

## **CONCLUSIONS AND ADVICE**

These surveys provided current abundance estimates for Steller sea lions in BC in the breeding season and during the winter. A breeding season abundance of 43,200 (95% CI of 38,700 to 48,200) represents no significant change from the previous assessment. The growth in pup production appears to be slowing, but the reasons for this are uncertain. The winter survey provided an abundance estimate of 52,700 (95% CI 41,000 to 67,800). The larger numbers of sea lions in winter is likely due to a net influx of animals from rookeries outside of BC. Fall surveys provide key information about the seasonal shift in distribution from rookeries to year round and winter haulouts. Recolonization and expansion of rookeries, as well as expansion of year-round and winter haulouts, continues to occur in BC and elsewhere throughout the range. There is evidence for redistribution throughout the range and continued range wide analysis is required to better understand drivers affecting abundance and distribution in BC. A PBR of 2,474 was provided for the summer population.

## OTHER CONSIDERATIONS

Increasing numbers of California sea lions have been observed overwintering in BC in recent years. Abundance, distribution and diet of California sea lions should be considered in assessing potential resource competition with Steller sea lions.

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## SOURCES OF INFORMATION

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Fisheries and Oceans Canada. 2010. Management Plan for the Steller Sea Lion (*Eumetopias jubatus*) in Canada [Final]. Species at Risk Act Management Plan Series. Fisheries and Oceans Canada, Ottawa. vi + 69 pp.

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.

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