



STOCK ASSESSMENT OF PACIFIC HARBOUR SEALS (*PHOCA VITULINA RICHARDSI*) IN CANADA IN 2019



Aerial view of Pacific Harbour Seals at a haul-out site (Photo: DFO)

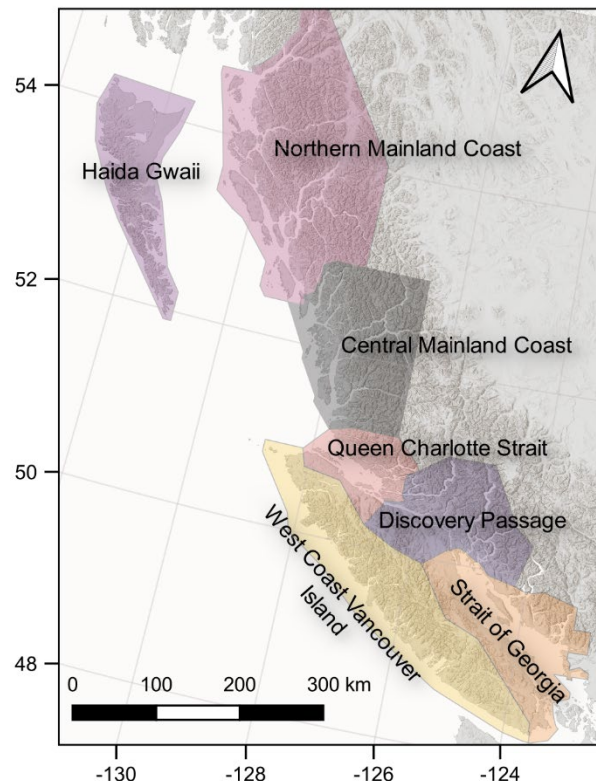


Figure 1. Map of British Columbia coast divided into seven regions for harbour seal stock abundance estimation and trends.

Context:

The Pacific harbour seal (*Phoca vitulina richardsi*) is the most abundant pinniped species in the Northeast Pacific and is found throughout coastal and estuarine waters of British Columbia (BC). When last assessed in 2010, ~105,000 harbour seals were estimated to be inhabiting Canadian Pacific waters. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) considers Pacific harbour seals “not at risk” in Canada.

A new coast-wide survey of harbour seals was conducted in 2015-2019. Resource Management requested Science to provide 1) an update on the status and trend of the stock as a whole, 2) the Potential Biological Removal (PBR) for this stock and, 3) if appropriate/possible, separately for the following regions: Strait of Georgia, West Coast Vancouver Island, Queen Charlotte Strait, Discovery Passage, Central Mainland Coast, Northern Mainland Coast and Haida Gwaii. This information will also support the Department in meeting requirements for an updated assessment of the Pacific harbour seal

stock as required under the U.S. Marine Mammal Protection Act (MMPA) bycatch provisions (should Pacific harbour seals ever be identified as bycatch).

*This Science Advisory Report is from the February 14-18 National Marine Mammal Peer Review on the Population status assessment and Potential Biological Removal (PBR) for the Pacific Harbour Seal (*Phoca vitulina richardsi*) in Canadian Pacific waters. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.*

SUMMARY

- The Pacific harbour seal stock in Canada is composed of two populations which are assessed as a single stock.
- As done previously, coast-wide abundance of harbour seals in BC was assessed through aerial surveys conducted over multiple years, and corrected for area covered, survey timing relative to peak pupping, and proportion of seals hauled out during surveys.
- To estimate the proportion of seals hauled out during survey conditions, satellite tags were deployed on 30 seals in the Strait of Georgia during 2019-2021. A haulout correction factor of 1.27 (CV=0.02) was applied to counts from the 2015-2019 surveys. This differs from the correction factor of 1.63 (CV=0.042) which was applied to counts prior to 2015.
- During 2015-2019, over 90% of the BC coast was surveyed, resulting in an estimated 85,400 (95% confidence interval 82,000-88,900) harbour seals. Over 40% of the seals were found in the Strait of Georgia.
- The total abundance of harbour seals in BC was re-estimated for the 2003-2008 period at 112,400 (95% CI 108,000-117,000) to better account for lower survey coverage. The updated estimate remains within the range of the original estimate of 105,000 (95% CI 90,900-118,900) and is significantly higher than the most recent estimate.
- The abundance of BC harbour seals increased from a low of approximately 10,000 in the 1960's to over 100,000 seals in the early 2000's, and is now stable or slightly declining. Abundance, density and trends varied regionally.
- Based on the estimated coast-wide abundance in 2019, Potential Biological Removal (PBR) for the BC stock is 5,045 seals.
- PBR was also estimated for the seven survey regions in their respective survey year. Although survey regions do not represent distinct populations, managing at a more local scale can help avoid local depletion. Accounting for regional abundance and trends, the estimates for regional PBRs are: Strait of Georgia =2,069, west coast of Vancouver Island=711, Queen Charlotte Strait=147, Discovery Passage=18, central mainland coast =58, northern mainland coast=581, Haida Gwaii=418.
- The proportion of animals not seen during the survey (haulout correction factor) has a large impact on the abundance estimate. The current correction factor, which is derived from the Strait of Georgia, may not be applicable to all regions.

BACKGROUND

The Pacific harbour seal is the most ubiquitous pinniped species in the Northeast Pacific. The species is found throughout coastal and estuarine waters of British Columbia (BC), using haulout sites to rest, molt and give birth. Harbour seals have a small foraging range and display high site fidelity, with mostly localized movements (tens of km). In BC, it is estimated that

harbour seal populations were depleted to approximately 10,000 animals coast-wide due to large-scale predator control programs and harvests in the late 1800s to mid-1900s. Abundance of harbour seals increased dramatically following their protection in the early 1970s. Based on historical reconstructions and survey data since 2003, it is estimated that a full recovery of harbour seal populations has taken place in BC waters.

ASSESSMENT

DFO has conducted standardized aerial surveys during the pupping season since the 1960s to determine harbour seal abundance and distribution in BC. Aerial surveys of harbour seal haulouts are conducted during low tides toward the end of the pupping season, when peak numbers of animals are expected to be hauled out on land. Three corrections are applied to the count data to generate an estimate of abundance: 1) potential unborn pups at the time of the survey, 2) the proportion of animals in the water at the time of the survey and 3) the proportion of area surveyed.

Given the vast area to cover during a coast-wide survey, an assessment represents a compilation of surveys of regions conducted over several years, and consequently, is not a synoptic view of the stock. Abundance estimates are compiled from counts within each subregion, applying the appropriate corrections, then summing to the regional level (Figure 1) or for the entire BC coast.

For the current assessment, aerial surveys were conducted during 2015-2019, achieving the highest compilation of survey coverage (90% of the BC coast) to date. Surveys were flown during an approximate 4-h window around the daily low tide, generally shortly after peak pupping to minimize the correction for unborn pups. One to three observers searched the area for known and new haulout sites, and photographed animals on the haulouts which were later counted from digital images (Figure 2).

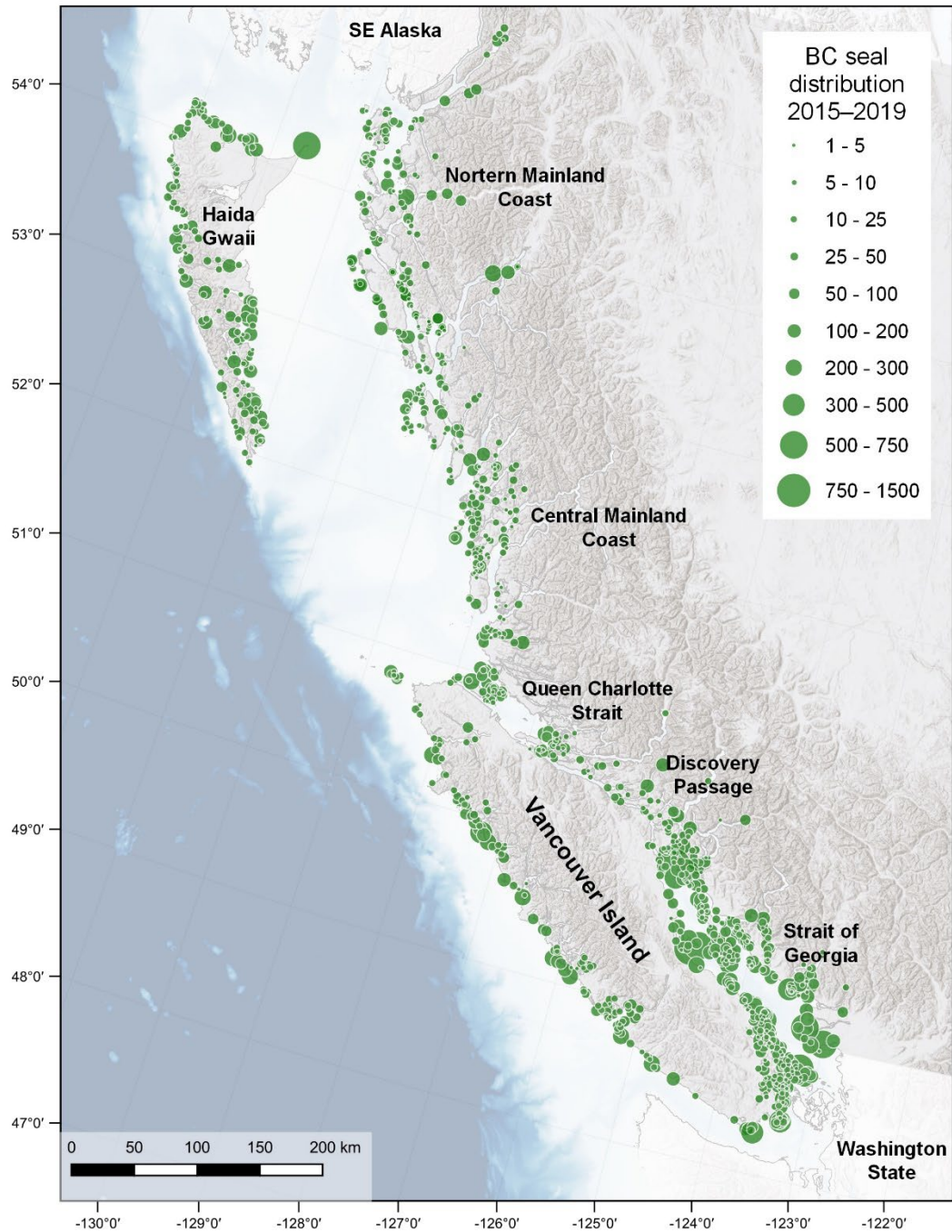


Figure 2. Distribution of harbour seal haulout sites in BC 2015–2019. Circles are scaled relative to the number of animals counted at a site.

The proportion of animals hauled out during survey conditions was estimated at 78.5% based on satellite transmitter deployments on 30 seals from the Strait of Georgia during 2019–2021, resulting in a count correction of 1.27 (CV=0.02) for the 2015–2019 surveys. This value is lower than the 1.63 (CV=0.042) correction factor obtained from telemetry studies in the early 1990's and applied to counts prior to 2015.

Survey effort for these and past surveys was reconstructed from flight track lines to estimate and correct for the proportion of surveyed coastline. In the absence of track lines (years prior to 2003) survey tracks were reconstructed using a network analysis in GIS.

An initial BC coast-wide stock in 1965 was estimated to be around 10,000 seals, based on historical stock reconstructions. Taking the sum of the regional estimates in the year surveyed (2015-2019), we estimated stock size to be 84,500 (95% CI 81,200-88,000) seals in BC. Projecting regional trends to 2019 for regions that were surveyed in the earlier years of the compilation of surveys, we obtained a slightly higher but statistically similar estimate at 85,400 (95% CI 82,000-88,900) seals (Figure 3). Correcting past surveys for uncovered areas resulted in an updated estimate for 2003-2008 of 112,400 (95% CI 108,000-117,000) seals, which is similar to the initial estimate of 105,000 seals (95% CI of 90,900-118,900). Given the uncertainty in the regional estimates, the stock in 2015-2019 is either stable or has declined slightly relative to the 2003-2008 assessment.

Based on the 2019 abundance estimate, the Strait of Georgia comprised the largest proportion of the stock (42%), followed in decreasing order by Haida Gwaii (18%), west coast of Vancouver Island (14%) and North Mainland Coast (12%). The remainder of the stock was spread among Queen Charlotte Strait, Discovery Passage, and Central Mainland Coast.

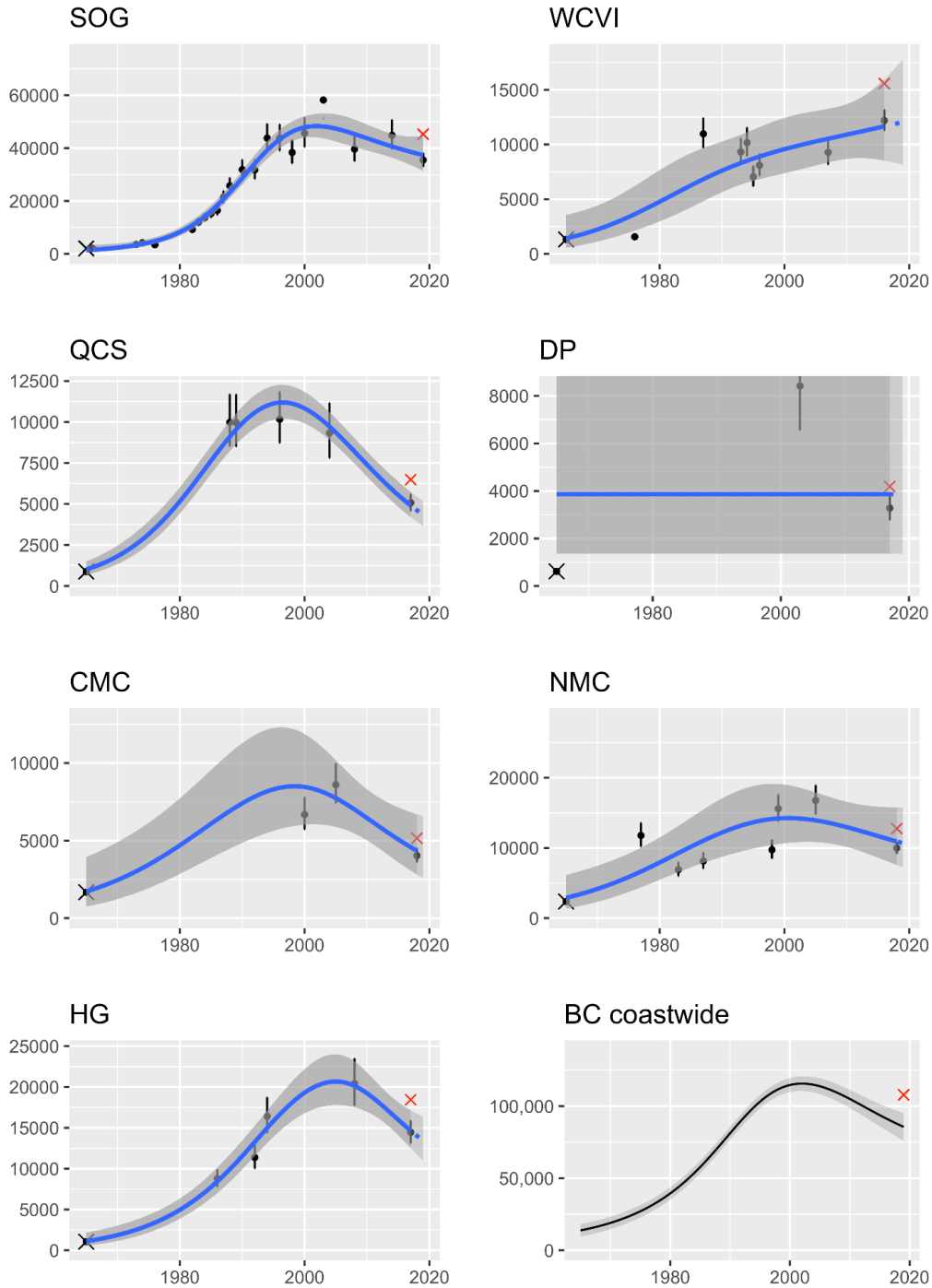


Figure 3. Abundance estimates (black dots) with 95% CI (black vertical bar) and trends for all seven regions and the BC composite. The black “x” is the reconstructed abundance estimate for 1965. The red “x” indicates the abundance estimate that would have been obtained using the old correction factor for the proportion of seals hauled out. Lines with shading represent the mean trends in abundance and standard errors based on model output. Blue dots are the projected abundances to 2019. Regions are: Strait of Georgia (SOG), west coast of Vancouver Island (WCVI), Queen Charlotte Strait (QCS), Discovery Passage (DP), central mainland coast (CMC), northern mainland coast (NMC), Haida Gwaii (HG) (see Figure 1).

Potential Biological Removals

Potential Biological Removal (PBR) for Pacific harbour seal in Canadian Pacific waters was estimated at 5,045 seals, using a N_{MIN} of 84,075, a recovery factor of 1.0, and the default R_{MAX} of 12%. The recovery factor was set to 1.0 based on the overall abundance of the stock and trend (stable or slightly declining).

Science was asked to consider local/regional PBR allocations. While the overall stock appears stable, there are declining trends in some regions. Simply partitioning the coast-wide PBR among regions is problematic as this increases the risk of local depletion. Therefore, regional PBRs were calculated using region-specific N_{MIN} and region-specific recovery factors based on local trends and uncertainty in abundance (Table 1). Regional PBRs were estimated as follows: SOG=2,069, WCVI=711, QCS=147, DP=18, CMC=58, NMC=581, HG=418.

Table 1. The estimated minimum population size (N_{min}) in the year surveyed, coefficient of variation (CV), trend in abundance (see Figure 3), recovery factor (RF) and PBR estimated for the seven survey regions. Regions are: Strait of Georgia (SOG), west coast of Vancouver Island (WCVI), Queen Charlotte Strait (QCS), Discovery Passage (DP), central mainland coast (CMC), northern mainland coast (NMC), Haida Gwaii (HG) (see Figure 1)

Region	N_{min}	CV	trend	RF	PBR
SOG	34477	0.034	abundant, stable	1	2069
WCVI	11848	0.034	abundant, stable/increasing	1	711
QCS	4885	0.045	declining	0.5	147
DP	3080	0.075	uncertain	0.1	18
CMC	3871	0.050	uncertainty around abundance, stable/declining	0.25	58
NMC	9683	0.037	abundant, stable/increasing	1	581
HG	13933	0.043	abundant, declining	0.5	418

Sources of Uncertainty

Surveys are timed to coincide with peak pupping. The data and correction factor for the timing of pupping is from the 1960s and may have changed since then, with impacts on abundance estimates and trends.

Similarly, the correction factor for the proportion of seals hauled-out in survey-like conditions came from a small number of seals and only from the Strait of Georgia and may not apply to other regions of BC.

The small number of surveys and low coverage in some regions required extrapolation to account for unsurveyed areas. This introduces uncertainty in the trends of abundance.

With a limited number of low-tide windows near the peak of pupping, five years were required to complete a full survey of the BC coast. Therefore, abundance was estimated assuming seal movements among survey regions was random between survey years, and that modelled trends can be projected a few years forward.

The regions delineated in this assessment were largely based on logistical reasons as well as environmental and geographic differences and may not reflect harbour seal biology. Stock structure of harbour seals in BC is unclear. While current genetics data indicate the existence of at least two populations, genetic sub-structuring might occur given the high site fidelity documented from telemetry studies. However, more information on movement patterns of seals across BC are needed to better inform regional delineations and associated PBRs.

CONCLUSIONS AND ADVICE

The abundance of BC harbour seals increased from a low of approximately 10,000 seals in the 1960's, to over 100,000 in the early 2000's, and is now stable or slightly declining. However, abundance, density and trends varied regionally. Most (42%) of the stock resides in the Strait of Georgia.

The coast-wide PBR was 5,045 seals. Regional PBRs were estimated as follows: SOG=2,069, WCVI=711, QCS=147, DP=18, CMC=58, NMC=581, HG=418. Although survey regions do not represent distinct populations, there was some justification for regional-based estimates of PBR given the large variation in abundance and trends among regions. However, the collection of additional data (genetic and movement data) is needed to better define population structure.

OTHER CONSIDERATIONS

Regular surveys are critical to monitor abundance and trends of harbour seals in BC, to understand their role as a key prey item for recovering Transient killer whales, to assess potential competition with Resident killer whales for fish prey species, and to support Marine Protected Area (MPA) planning and oil-spill response.

The Strait of Georgia is contiguous with Puget Sound, and an assessment of the abundance of harbour seals in the Salish Sea (comprised of the Strait of Georgia, Puget Sound and Juan de Fuca Strait) would benefit from coordinated surveys in neighboring U.S. waters.

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SOURCES OF INFORMATION

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