



RECOVERY POTENTIAL ASSESSMENT FOR NORTHERN FUR SEALS (*Callorhinus ursinus*)



Northern fur seals (*Callorhinus ursinus*)
Photo by: A. W. Trites

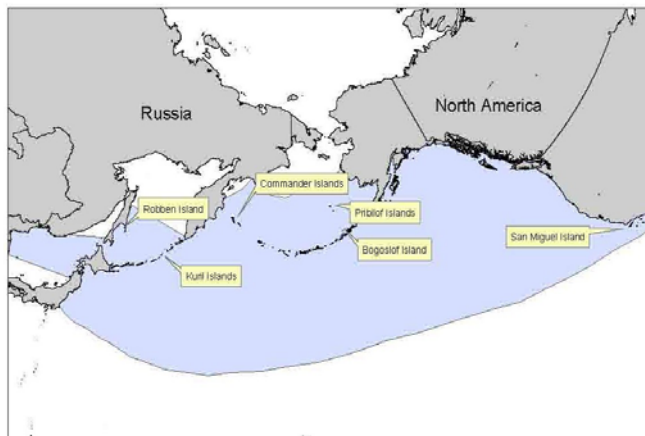


Figure 1. Range of northern fur seals showing location of breeding areas and extent of pelagic migration (shaded).

Context

In 2006, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended that the northern fur seal be listed under SARA as a threatened species. The recommendation was based on a 54% decline in pup production on the Pribilof Islands, the largest breeding area. A final decision on whether this species will be legally listed under SARA is pending.

DFO Science has developed a Recovery Potential Assessment (RPA) process to provide information and scientific advice for meeting SARA requirements for listed species, and for deciding whether to add species to the list. The RPA process includes an assessment of current population status, scope of human induced mortality, and characteristics and availability of critical habitat.

SUMMARY

- Northern fur seals inhabit the North Pacific and comprise a single population;
- Abundance of northern fur seals has declined from 1.7 million to 1.2 million over the last 30 years (3 generation). The decrease occurred at the largest breeding area on the Pribilof Islands; abundance at other breeding areas has not changed or has increased;
- The cause of the fur seal decline on the Pribilof Islands is unknown, but does not appear to be due to direct human-induced mortality;
- The breeding and wintering range of northern fur seals does not appear to have changed in recent years;
- During the pelagic migration, about 375,000 northern fur seals (30% of the population) winter along the west coast of North America (California to SE Alaska), with about one-third of those inhabiting Canadian waters during their peak abundance in May;

- Critical habitat has not been defined. The main wintering area in Canada is La Perouse Bank off SW Vancouver Island, which is utilized predominantly by adult females that forage primarily on herring;
- Recovery targets and sustainable levels of human-induced mortality have not been established;
- The recent, unexplained decline of fur seals on the Pribilof Islands is a conservation concern, but the species is still the most widely distributed and abundant pinniped in the North Pacific Ocean, and seasonally one of the most abundant pinnipeds off the west coast of Canada.

INTRODUCTION

In 2006 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) reviewed the status of northern fur seals in Canada and recommended they be listed as a threatened species under the Species at Risk Act (SARA). The recommendation was made on the basis of a 54% decline in pup production during 1974-2004 at the Pribilof Islands, Alaska, the largest fur seal breeding area and source of most animals wintering in Canadian waters. A decision on whether this species will be legally listed is pending.

In this Recovery Potential Assessment, trends in fur seal pup counts throughout the species' range were examined to determine the overall magnitude and geographic scope of declines in pup production. Information on movements of animals among breeding areas, dispersal of animals to new breeding areas, and extent of mixing during pelagic migrations was reviewed to establish an appropriate scale for assessing population status. Life tables and population models were used to estimate changes in total abundance and number of mature individuals over the last 30 years (3 generations). Information was also compiled on migration patterns and diet along west coast of North America, particularly off British Columbia, to determine important habitat and to facilitate a socio-economic assessment.

Species Biology

The northern fur seal is a small pinniped, but exhibits extreme sexual dimorphism. Pups are black and average about 5-6 kg at birth, but more than triple in body mass during a 4 month nursing period, by which time they weigh about a third as much as their mothers. Adult females typically weigh 35-45 kg, with most growth completed by 5 years of age. Males continue to growth until about 10 years of age, typically attaining a body mass of 150-200 kg, with the largest territorial males weighing just over 300 kg. Females typically mature at 4-6 years of age with pregnancy rates varying from 75-90% for females in their reproductive prime (8-13 years of age), with older animals exhibiting reproductive senescence. Female longevity may exceed 25 years, but due to high juvenile mortality, mean life expectancy is about 5 years. Mean generation time about 10 years. Maximum longevity of males may extend to 15 years, but mean life expectancy is just over 3 years.

The life cycle consists of a 4-5 month breeding season during which mature animals come ashore at rookeries to give birth, nurse their young and mate, followed by 7-8 month pelagic phase. Northern fur seals currently breed on 6 rookeries (Figure 1). The breeding season begins in May with the arrival of males, which stake out territories which they typically defend for 38-42 days (up to 87 days) while fasting. The breeding system is highly polygynous, with ratios of harem bulls to females ranging from about 9:1 in a natural population, to as high as 60:1 when subadult males are harvested, apparently with little effect on pregnancy rates. Females arrive on rookeries in late June or July and give birth to a single pup within a day or two. Mothers remain on land with the newborn pup for about a week, mate 3-8 days after parturition,

and subsequently make a series of foraging trips lasting 4-10 days, punctuated by 1-2 day visits on land to nurse pups. The foraging trips continue until pups are weaned in November at about 4 months of age.

After breeding, animals undertake a 7-8 month pelagic migration. Pups depart from rookeries soon after being weaned in November. Immature animals become widely distributed in the North Pacific Ocean and tend to remain at sea during the first 2-3 years of life. Adult males tend to winter at northerly latitudes in the Bering Sea, Sea of Okhotsk or Gulf of Alaska. Adult females tend to winter in coastal areas over the continental shelf or along the shelf break, but the subarctic-subtropical transition zone also appears to be an important wintering area and may serve as a southern barrier for fur seal prey species. Fur seals generally return to their birth site to reproduce, so each breeding area (or in some cases adjacent breeding areas) are considered stocks. Females from American breeding areas tend to winter along the North American coast, and females from Russian breeding areas tend to winter along the Asian coast, but there is considerable inter-mixing of stocks in wintering areas.

RECOVERY POTENTIAL ASSESSMENT

Population Status & Trajectory

Historically, fur seals in the North Pacific have experienced two major depletions. There may have been on the order of 2-3 million fur seals when the major breeding areas on the Commander Islands were discovered in 1742 and on the Pribilof Islands in 1786-87. Unregulated hunting at breeding areas rapidly depleted the population. Russian sealers subsequently imposed restrictions on killing females, and the population recovered during a regime of selective male harvests.

The second depletion was caused by pelagic sealing during 1868-1910, which took mainly females wintering in coastal areas. Victoria, B.C., served as the base for the sealing fleet after the U.S. prohibited American citizens from pelagic sealing in 1881. The fur seal population was again depleted, leading to the signing of the North Pacific Fur Seal Treaty in 1911, and the resumption of selective male harvests at breeding areas.

Population assessments for northern fur seals since the early 1900s have been based on estimates or counts of pups, the only component of the population that is on land at any given time. Pup numbers indicate fur seal populations recovered after pelagic fur sealing ended in 1911 (Figure 2). Pup production at the largest breeding area on the Pribilof Islands increased until the 1940s, but then stabilized. A large kill of females during the 1956-61, intended to increase productivity, actually precipitated a decrease in pup production. For reasons that are not understood, pup production has continued to decline on the Pribilof Islands, and is currently approaching the low levels last seen after pelagic sealing ended. Pup production on the Commander Islands also increased following pelagic sealing, but have exhibited little net change over the last 30 years. Pup production on Robben Island was increasing until the late 1960s, but again for reasons that are not understood declined until the 1980s, but appears to have increased in recent years. Fur seals were thought to have been extirpated on the Kuril Islands until a small breeding area was discovered in the 1950s, where pup production has steadily increased. Fur seals began breeding on San Miguel Island in the 1960s, where the numbers of pups born has generally increased, except for sharp decreases coinciding with El Niño years. In 1980, fur seals began breeding on Bogoslof Island, and pup production has increased sharply in recent years. Overall, pup production has declined by about 38% over the

last 30 years due to the declines on the Pribilof Islands; total combined pup production at the other breeding areas increased by 20% over the same period.

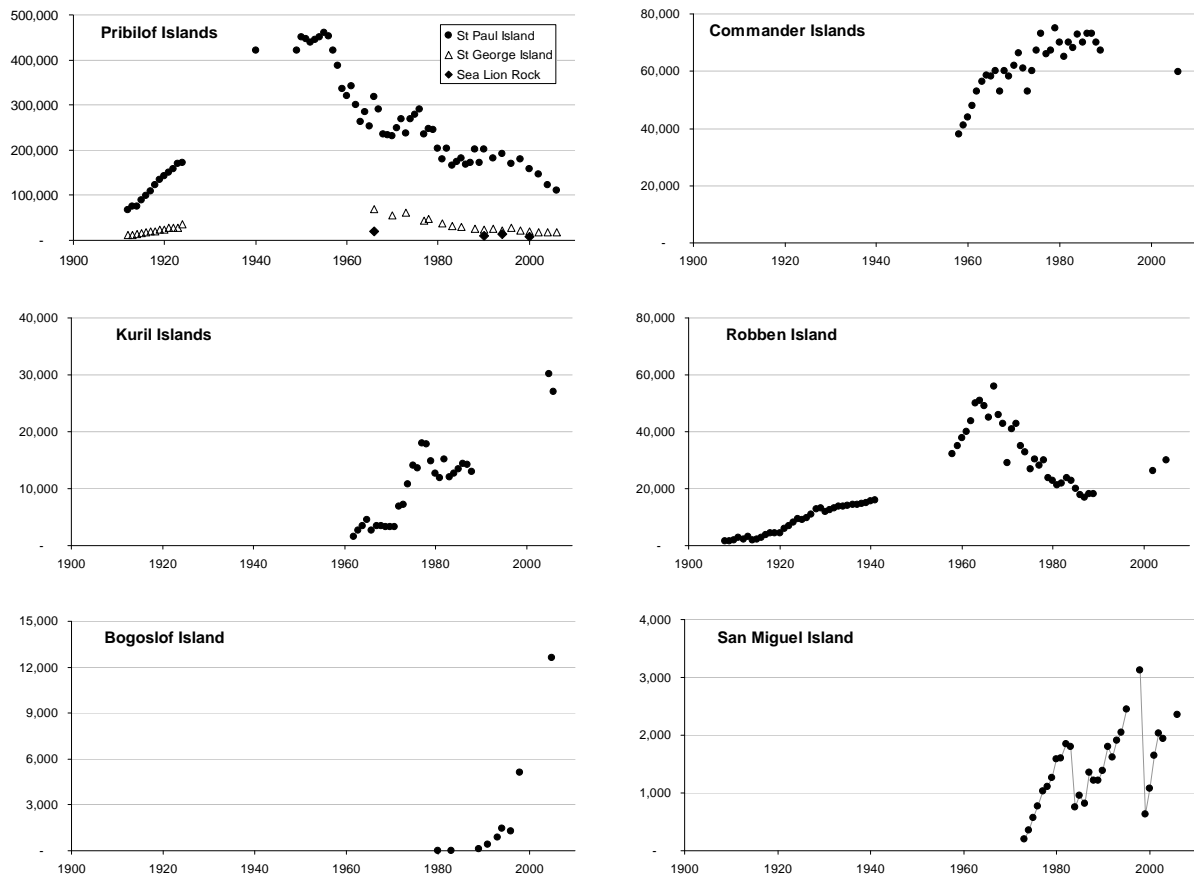


Figure 2. Recent trends in pup production at northern fur seal breeding areas.

Northern fur seals generally exhibit a high degree of fidelity to natal birth areas, but resights and kills of tagged animals indicate there is also considerable exchange of both males and females among breeding areas. In some cases, females have dispersed from natal breeding areas to establish new or re-colonize former breeding areas. There is no evidence of genetic differences among breeding areas, and no basis for designation of subpopulations.

Based on life tables derived from animals collected in the 1950s to 1970s, it is estimated that the ratio of total number of animals to pups is about 3.8:1 in harvested stocks and 4.5:1 in unexploited stocks. Population models predict slightly lower values – 3.6:1 and 4.2:1 respectively - for the declining Pribilof Island stock. A ratio of 4.0:1 was estimated for San Miguel Island based on the ages of immigrants to that rookery. Applying these multipliers, total abundance of northern fur seals was estimated to have declined by about 27% and the number of mature individuals is estimated to have declined by about 23% over the last 30 years (Table 1).

Table 1. Estimated changes in total abundance and number of mature individuals in the northern fur seal population over the last 30 decades, 1972-1976 to 2002-2006.

Breeding Area	1972-1976			2002-2006		
	Pup Count	Multiplier	Stock Size	Pup Count	Multiplier	Stock Size
Pribilof Islands	346,900	3.6	1,250,000	150,700	4.2	636,000
Commander Islands	62,800	3.8	239,000	59,800	4.5	268,000
Kuril Islands	10,500	4.5	47,000	28,600	4.5	128,000
Robben Island	33,500	3.8	127,000	28,200	4.5	126,000
Bogoslof Island	-	-	0	12,600	4.5	56,000
San Miguel Island	580	4.0	2,300	2,150	4.0	8,600
Total Abundance			1.7 million			1.2 million
Mature Individuals			699,000			537,000

Our understanding of the distribution of fur seals during their pelagic migration is based largely on historical sealing logbooks recorded from 1868-1911, and on pelagic research sightings and collections made during 1958-1974. Sample sizes are small, but more recent satellite tracks of migrating seals captured on the Pribilof Islands indicate they continue to utilize the same range, with most females wintering along the west coast of North America. Moreover, in recent years there have been anecdotal sightings of fur seals throughout the North Pacific Ocean from platforms of opportunity.

It is estimated that approximately 375,000 northern fur seals winter along the west coast of North America during December-June, with about one-third of those inhabiting coastal waters off British Columbia during peak abundance in May. Fur seal spend an average of 5 months in coastal foraging areas, with about 3 of those months spent in Canadian waters.

The fur seal population is abundant and widely distributed, but has been declining at its largest breeding area on the Pribilof Islands. It is not possible to determine whether the Pribilof fur seal population is currently at, above, or below carrying capacity levels; whether carrying capacity has changed significantly in the last two or three decades; or whether the observed population decline is due to declining carrying capacity, increasing mortality, or some combination of these factors. A recovery target could thus not be established at this time.

Threats and Limiting Factors

The cause of the declines in fur seals on the Pribilof Islands has not been identified. There are no documented sources of human-induced mortality in Canadian waters. A few animals are taken incidentally in U.S. fisheries, but large bycatches have not been documented in any fisheries since international high-seas drift-net fishing ended in 1991. There is a small subsistence harvest of subadult males on the Pribilof Islands, but takes are miniscule compared to the large commercial harvests that had been sustained for many decades. A small proportion of animals, mainly young males, are observed at breeding areas entangled in net fragments, packing bands, and other debris. It is possible that many additional animals become entangled and die at sea, but it is difficult to determine the total extent of mortality from the entanglement rates observed on land.

Northern fur seals may ultimately be limited by the availability of suitable prey, principally small-schooling forage fish and pelagic squid. Changes in prey availability can be caused by natural or anthropogenic factors, such as changes in ocean climate, over-fishing, or natural cycles or regime shifts. Sea lion and harbour seal populations, which also feed on small-schooling fishes (along with other types of prey), have increased in abundance and become more important predators along the west coast of North America. Most of the key prey utilized by pinnipeds also support commercial fisheries. Further research needs to be conducted to assess the ability

of these prey stocks to support apex predators, including fur seals and sea lions, as well as human fisheries.

Allowable Harm Assessment

In the past, fur seals have sustained large commercial harvests of subadult males, a portion of which are surplus in a polygynous breeding system and can be removed without affecting reproductive rates. However, relatively few males occur in Canadian waters.

Both of the two major population declines in the past have been precipitated by the removal of females. The more recent declines in pup production on the Pribilof Islands indicate that survival and/or reproductive rates of females are currently below replacement levels. An increase in mortality of females, which comprise the majority of animals wintering off British Columbia, would be expected to contribute to the declines in pup production on the Pribilof Islands. Therefore, human-induced mortality of females would increase the risk of further declines, which could jeopardize the survival or recovery of the species.

Critical Habitat

Critical habitat has not been defined for northern fur seals in Canada. The species requires two basic types of habitat. The first is breeding sites, which are characterized by availability of suitable beaches for rookeries with adequate prey resources within the commuting distance of reproductive females, which have high energetic requirements while lactating. The species currently does not breed in Canada, but breeding areas have shifted over the history of fur seal, and archeological remains from middens suggest breeding sites may have been more widely distributed along the west coast of North America in the past.

The second type of habitat are foraging areas. Coastal wintering areas over the continental shelf and along the shelf break represent important foraging habitat, especially for adult females. It is estimated that 74% of adult females in the northeastern Pacific Ocean population (including the Pribilof Islands) winters along the west coast of North America. Based on historic sealing records from 1891-1911 and scientific surveys conducted during 1958-74, the main wintering areas in British Columbia is LaPerouse Bank, with the highest densities of seals occurring between the 50 m and 200 m isopleths, where they fed mainly on herring (Figure 3). Salmon are also important prey off British Columbia, and squid are the predominant prey in offshore areas. Pregnant females, which have higher energetic requirements and spend more effort foraging, may be particularly dependent on adequate prey resources.

Sources of Uncertainty

The two main sources of uncertainty in population and trend estimates are imprecision and potential bias in the pup counts, and imprecision and potential bias in the multipliers used to estimate total population size and number of mature individuals. For the RPA, pup estimates projected from expected or theoretical population growth rates, or extrapolated from other components of population, were not used. While there may be considerable imprecision and bias in direct pup counts and mark-recapture estimates, the potential error is likely small compared to the magnitude of the long-term declines in pup production on the Pribilof Islands. For the other 5 breeding areas, counting error is not likely to alter the basic conclusion that pup production has not changed appreciably or has increased dramatically in recent years.

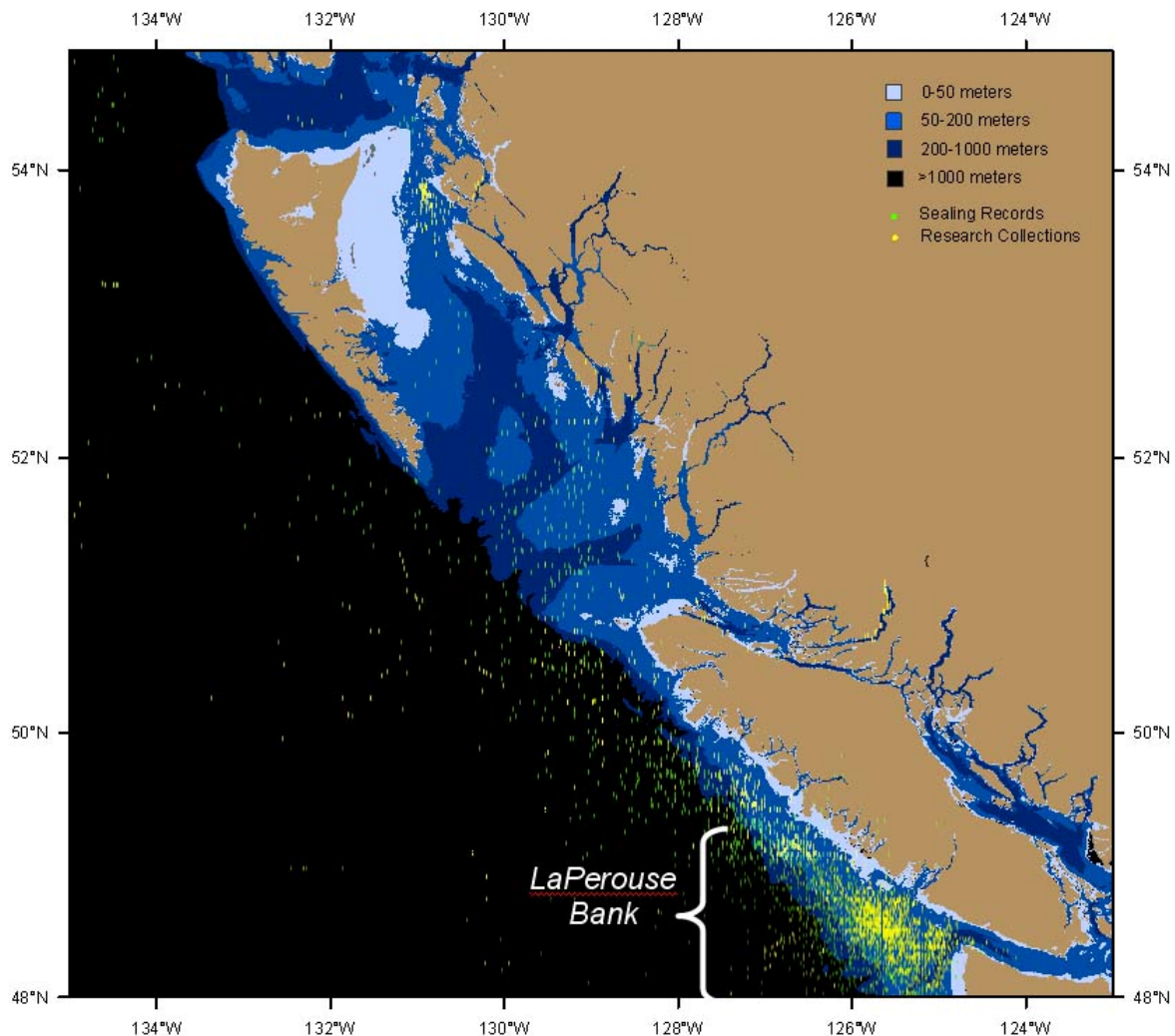


Figure 3. Distribution of northern fur seals in coastal waters off British Columbia based on locations of seals harvested during 1891-1911 and research specimens collected during 1958-1974.

Multipliers used to estimate total population size and number of mature individuals were based on estimates of survival and reproductive rates. Northern fur seal populations have been intensively studied, and previous population models for females have been validated by comparing expected pup production with actual pup counts. However, new data to update life history parameters have not been available since pelagic research collections ended in 1974 and commercial harvests were terminated in the early 1980s. Simulations indicate that fairly small changes in vital rates would explain the recent declines in pup production, and such small changes are not likely to have a major effect on the multipliers for females (range $\pm 6\%$ of the mean). There is considerably less certainty associated with the multipliers for males, and estimates of total male abundance are difficult to validate as the only counts for males are territorial bulls, which provide only an index of relative abundance. It is nevertheless clear the prevalence of adult males has increased to some extent. Uncertainty in the magnitude of the change in male multipliers after the cessation of harvesting is likely the largest source of error in estimating trends in total abundance and number of mature individuals.

Distribution and migration patterns of fur seals have been inferred from historic sealing records from the late 1800s and pelagic research sightings during 1958-1974. Neither source consist of systematic surveys, and effort was concentrated in areas known to support high seal densities,

although pelagic search effort was sometimes extended to other regions to delineate migration patterns. Sightings during pelagic research trips have been corrected for effort, but sighting conditions likely varied widely, such that the data provide only a crude index of relative abundance. The two sources of information suggest the same basic distribution, suggesting wintering areas had not changed dramatically over nearly a century, even through the population had been severely depleted. The proportion of females wintering in coastal areas versus offshore areas was estimated from satellite tracks, but sample sizes were very small.

There are no documented cases of bycatch of fur seals in Canada in recent years, but observer coverage of fisheries is incomplete. Some poaching may occur, but the species occurs offshore where such mortality would be difficult to monitor.

Our understanding of winter foraging habitat requirements is based on the stomach contents of specimens collected during 1958-74, but more recent data are not available. Fur seals appear to be opportunistic predators, and their diet likely changes as prey stocks fluctuate or cycle in abundance. Off California, for example, the most important prey species during the pelagic collections were northern anchovy, but sardines have since displaced northern anchovy as the dominant forage, and sardines are likely to be a more important part of the current diet of fur seals. While fur seals exhibit a general preference for small-schooling fish with high energy content, the type of forage fish can change over time.

CONCLUSIONS AND ADVICE

No genetic differences are evident in northern fur seals between breeding areas, and there are sufficient movements of both males and females among rookeries to preclude the designation of subpopulations. The northern fur seal should be regarded as a single population for status assessment.

Pup production at the largest rookery on the Pribilof Islands has declined significantly, whereas pup production at the other 5 smaller rookeries has not changed appreciably or has increased over the last 30 years. Total pup production is estimated to have declined by 38% over the last 30 years. During the same period, there has also been a demographic shift from a female-dominated population when subadult males were being harvested, to a population with a more natural sex ratio. Total abundance of northern fur seals is estimated to have declined by about 27% and the number of mature individuals by about 23% over the last 30 years.

Approximately 375,000 northern fur seals winter along the west coast of North America during December-June, with about one-third of those inhabiting coastal waters off British Columbia during peak abundance in May. The densest concentrations occur on La Perouse Bank over depths of 50-200 meters where they feed mainly on herring. The area was particularly important for adult female fur seals, but additional assessment would be required to determine if the area constitutes critical habitat.

There are no documented human-induced mortalities in Canada, and small kills in other parts of range do not appear to be the cause of the declines on the Pribilof Islands. The level of human induced mortality that could be sustained varies widely depending on the sex and reproductive status of animals killed, so limits were not estimated.

Northern fur seals may ultimately be limited by the availability of suitable prey, principally small-schooling forage fish and pelagic squid. Further research should assess the ability of prey stocks to support apex predators, including fur seals and sea lions, as well as human fisheries.

This might lead to a better understanding of underlying cause of the declines and help establish recovery targets, which could not be established in this assessment.

The recent and unexplained declines in pup production on the Pribilof Islands are a conservation concern, but the northern fur seal is still the most widely distributed and abundant pinniped in the North Pacific Ocean, and seasonally one of the most abundant pinnipeds off the west coast of Canada.

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