

COSEWIC
Assessment and Update Status Report

on the

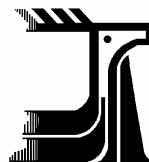
Northern Fur Seal
Callorhinus ursinus

in Canada



THREATENED
2006

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 – April 2006

Common name

Northern fur seal

Scientific name

Callorhinus ursinus

Status

Threatened

Reason for designation

The population that breeds on the Pribilof Islands in the Bering Sea feeds in, and migrates through, British Columbia waters. This population numbered about 629,000 animals in 2004. Although still relatively large, the population, as inferred from pup counts, has declined by 50-60% over three generations (1974-2004). The rate of decline has been particularly rapid since 1998. Trends in counts of adult males from 1974-2004 are confounded by response to the cessation of the selective commercial harvesting of sub-adult males in 1984. These counts have declined rapidly and inexplicably since 1992. The reasons for the population decline are unknown. Entanglement in marine debris, disturbance, pollution, and environmental changes, possibly including a regime shift in the Bering Sea and North Pacific ecosystems, are thought to be contributing factors. Little is known about possible limiting factors in British Columbia and other regions where fur seals forage during their annual migration.

Occurrence

British Columbia, Pacific Ocean

Status history

Designated Not at Risk in April 1996. Status re-examined and designated Threatened in April 2006. Last assessment based on an update status report.



COSEWIC
Executive Summary

Northern Fur Seal
Callorhinus ursinus

Species information

The northern fur seal (*Callorhinus ursinus*, Linnaeus 1758) is a sexually dimorphic species. Mature males exceed the size of females by an average factor of 3.4-5.4, and are black to reddish brown in colour. Females are gray-brown along their dorsal surface, and lighter along their ventral surface.

Distribution

Northern fur seals are restricted to the northern hemisphere and range throughout the North Pacific Ocean and Bering Sea. They breed at three locations in both Russia (Kuril Islands, Robben Island, and the Commander Islands) and the United States (Pribilof Islands, Bogoslof Island, and San Miguel Island). Approximately three-quarters of the world population breeds on the Pribilof Islands. Fur seals tend to migrate either along the coast of North America or eastern Asia depending upon the location of their rookeries. Most of the fur seals found off the coast of British Columbia are believed to come from the eastern Bering Sea (Pribilof Islands and Bogoslof Island), although some likely come from Asia and California.

Habitat

Northern fur seals are predominantly pelagic, feeding mostly offshore in areas along the continental slope and shelf break from the Bering Sea to California. The highest concentrations of northern fur seals in the open ocean are associated with major oceanographic frontal features such as canyons, sea mounts, valleys, and the continental shelf break. Northern fur seals of both sexes exhibit strong fidelity to traditional breeding sites. Within Canada, the offshore waters of British Columbia represent important habitat for migrating northern fur seals.

Biology

Northern fur seals are a polygynous species, with bulls establishing and maintaining territories on land while mating with several females. Adult males arrive at the rookery in mid-May. Females give birth to a single pup shortly after arriving on

shore in June and July. Females typically embark on 3 to 10-day foraging trips after giving birth, and return to suckle their pups for an average of 1-2 days. This cycle continues until the pups are weaned at about four months (late October / early November). Females and immature fur seals from the Pribilof Islands embark on a southward migration that extends to California, while mature males tend to stay in more northern waters. Mortality of pups and animals to age two is relatively high, but decreases as the animals approach sexual maturity. Northern fur seals forage at relatively shallow depths (100-200 m for females, < 400 m for males), mostly over the continental slope and along the shelf break. Seventy-five different species of prey have been identified in northern fur seal stomachs and scats.

Population sizes and trends

There have been three major declines in the worldwide population of northern fur seals since their discovery in the late 1700s by Russian explorers. The initial Pribilof population of between 2-3 million was reduced by over-hunting and was restored by instituting a policy of killing only immature males. This policy was disregarded following the purchase of Alaska in 1867 and resulted in the population declining to a low of 300,000 animals by the early 1900s. Reinstating the male-only harvest and providing international protection from at-sea hunting increased the population to an estimated size of 2.1 million in the 1950s. However, an experimental program to increase the productivity of the population by killing mature females caused the population to decline again through the late 1950s and 1960s. Population recovery was short-lived through the early 1970s once females were again protected. An unexplained decline of about 6.1% per year occurred between 1975 and 1981. The population was then stable at about 1 million for most of the next two decades, but began declining again in 1998. The population numbered approximately 629,000 individuals in 2004. Commercial harvests of immature males ceased on the Pribilofs in 1973 on St. George Island and in 1984 on St. Paul Island. Today they are only taken for subsistence use.

Limiting factors and threats

The cause of the current population decline on the Pribilof Islands is not known. Entanglement in marine debris, disturbance, pollution, and environmental changes are thought to be contributing factors. Environmental regime shifts and commercial fisheries are also thought to have contributed to changes in the Bering Sea ecosystem, and may have affected prey availability. Little is known about possible limiting factors in British Columbia and other regions outside of the Bering Sea where fur seals migrate.

Special significance of the species

Since their discovery, northern fur seals breeding on the Pribilof Islands have been subjected to commercial harvests that severely affected their size and composition. In Canada, northern fur seals were hunted pelagically off the west coast of Vancouver Island and throughout the Haida Gwaii region. Native peoples throughout the North Pacific have also harvested northern fur seals for subsistence use for several millennia.

Fur seal meat is currently eaten for food on the Pribilof Islands, and pelts are used for a handicraft program.

Existing protection

In Canadian waters, northern fur seals are protected under the Marine Mammal Regulations of the Fisheries Act of Canada, which makes it illegal to hunt or disturb pinnipeds except for subsistence use. In the United States, northern fur seals are protected by the Marine Mammal Protection Act, and are designated as a 'depleted' species.



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 5th 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 (2006)

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 it 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.

**Update
COSEWIC Status Report**

on the

Northern Fur Seal
Callorhinus ursinus

in Canada

2006

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SPECIES INFORMATION

There are currently five recognized populations of northern fur seals in the North Pacific: the Commander Islands population (Russia), the Kuril Islands population (Russia), the Robben Island population (Russia), the Pribilof Islands and Bogoslof Island populations (USA), and the San Miguel population (USA) (Figure 1, NMFS 1993). The populations can be divided into eastern and western populations based on their locations and the restricted migratory ranges along each side of the Pacific Ocean (see Figure 2 for migratory paths of fur seals from the Pribilof Islands).

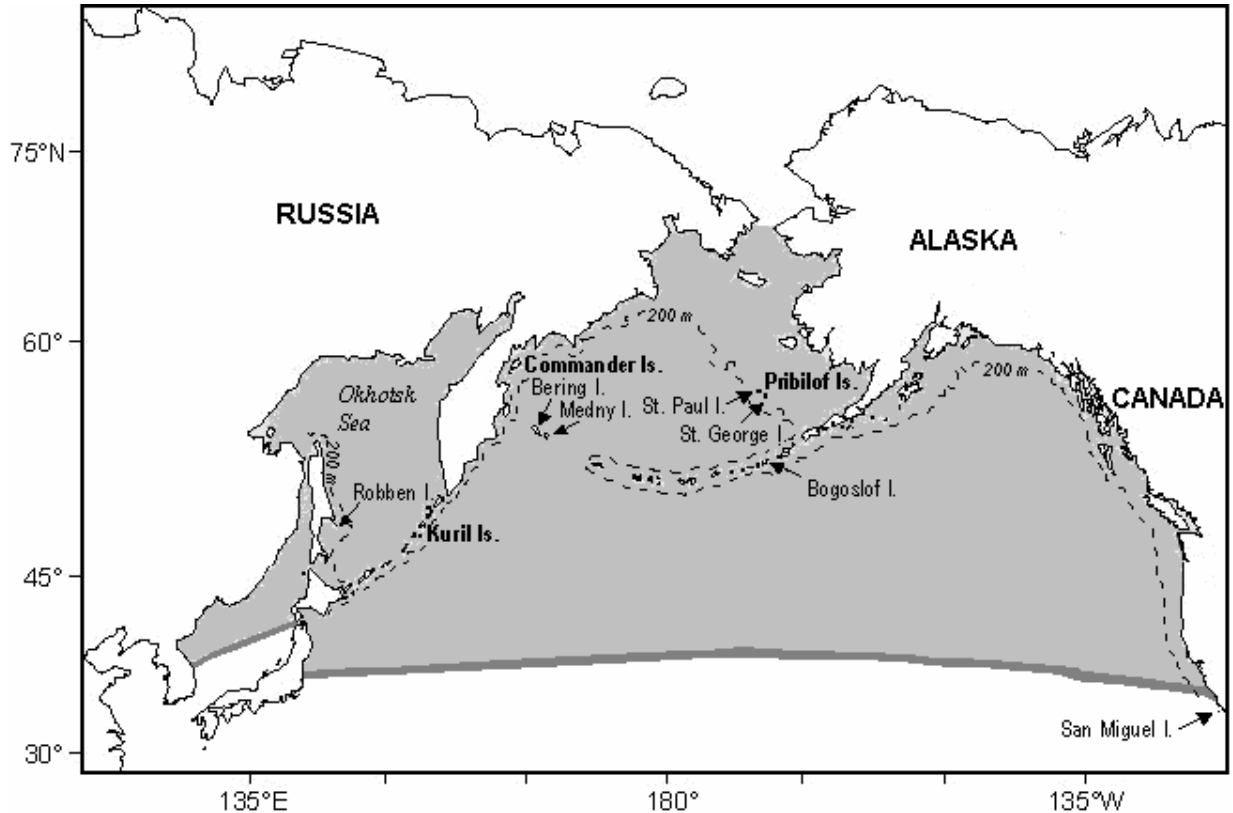


Figure 1. Worldwide range of northern fur seals and the location of breeding islands used by the species, including the locations of the continental shelf break (dashed line approximates the 200 m contour). The dark shaded area represents the southern extent of the pelagic distribution. Modified from Gentry (1998).

There is no breeding location within Canadian waters. The majority of animals that occur in Canadian waters migrate from the eastern Pacific population (Bigg 1990; Loughlin *et al.* 1999). Information presented in this report therefore pertains predominantly to the eastern Pacific population of northern fur seals.

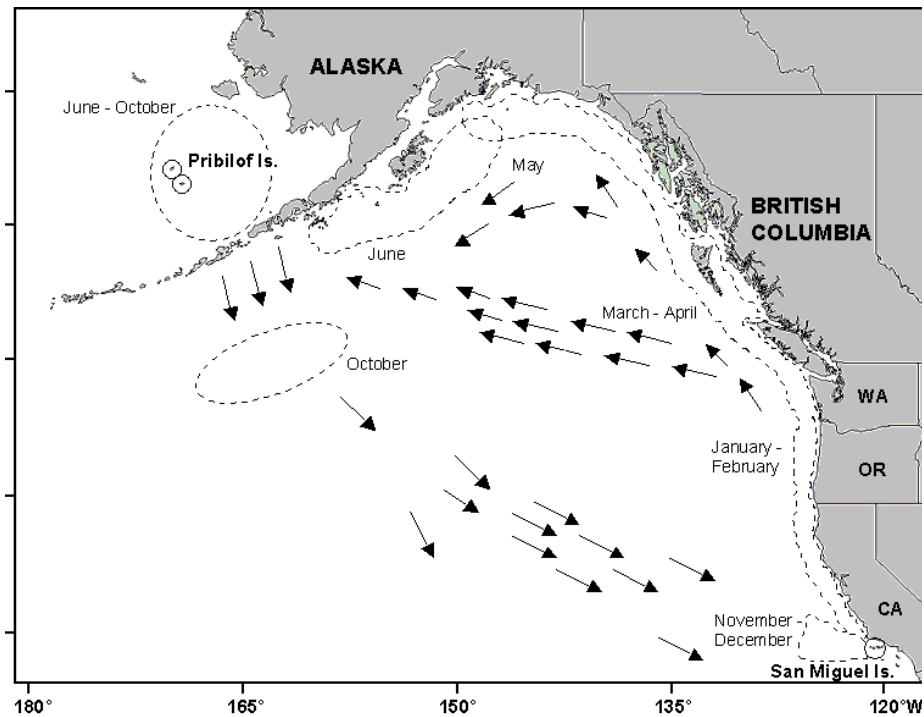


Figure 2. Approximate migratory pattern of northern fur seals from the eastern Pacific population. Modified from Gentry (1998). Dashed lines indicate the at-sea location of the majority of the seals in this population, by month.

Name and classification

Within the Suborder Pinnipedia (seals, sea lions, fur seals and walruses), the northern fur seal (*Callorhinus ursinus*, Linnaeus 1758) is the only extant species of the genus *Callorhinus*. Northern fur seals are known in other languages as *Otarie des Pribilofs* (French), *Lobo fino del norte* (Spanish), and *Nördliche Pelzrobbe* (German). Indigenous names for the species include *Hlaaqudax* (western dialect – Unangan/Aleut), *Laaqudax* (eastern dialect – Unangan/Aleut), and *Algax* (Commander Island dialect – Unangan/Aleut) (M. Dirks, pers. comm. 2004).

In the early 1900s it was thought that northern fur seal populations breeding at different locations throughout the North Pacific represented three distinct species or subspecies (Gentry 1998; Rice 1998). However, subsequent research indicated that these populations were morphologically indistinguishable, and the modern species, *C. ursinus*, is currently recognized as a single species (Rice 1998).

Morphological description

The northern fur seal is the smallest pinniped found off the west coast of Canada (Figure 3). The species exhibits extreme sexual dimorphism, with males reaching sizes up to 3.4 times larger than females prior to mating, and 5.4 times heavier when

defending a breeding territory (Scheffer and Wilke 1953; Trites and Bigg 1996). Adult males weigh between 100 – 200 kg and reach 1.5 – 2.0 m in length. In contrast, females weigh between 35 – 45 kg, and reach an average length of 1.3 m (Trites and Bigg 1996; Gentry 1998). Pups weigh between 4.5 – 5.4 kg at birth, with male neonates generally 0.6 kg heavier than females (Trites 1991; Reeves *et al.* 1992). Fur colour of outer guard hairs on adult males varies from black to reddish brown with a mane over the shoulders; guard hairs on females are gray-brown along the dorsal surface and lighter along the underbelly. Underfur is brown for both sexes, but cannot be seen on dry animals. Pups are born with black fur and have a lighter coloured belly that changes after their first moult (Scheffer 1962). Vibrissae colour varies with age, with younger animals exhibiting black vibrissae and older animals having white vibrissae.



Figure 3. Northern fur seal (*Callorhinus ursinus*). Photo by A.W. Trites.

Unlike species of the other fur seal genus *Arctocephalus*, the northern fur seal has a short rostrum and therefore does not exhibit a dog-like profile (Gentry and Kooyman 1986). As a result, the head of the northern fur seal looks quite small compared to the rest of its body. Ear pinnae are long, clearly visible, and furless at the tips in older animals. Relative to its body size, the flippers of northern fur seals are the longest of any otariid, with hind flippers measuring approximately one-fourth of total body length (Jefferson *et al.* 1993). Fur is absent from the tops of the fore flippers, and hind flippers have extremely long, cartilaginous terminal flaps on all toes (Jefferson *et al.* 1993).

Genetic description

Callorhinus is the oldest genus of living Otariidae. Results from genetic analyses are consistent with the fossil record and suggest that northern fur seals diverged from the line leading to the remaining fur seals and sea lions between three and six million years ago (Kim *et al.* 1975; Repenning *et al.* 1979; Wynen *et al.* 2001).

DISTRIBUTION

Global range

Northern fur seals are restricted to the northern hemisphere of the Pacific Ocean, ranging from central Japan (latitude 36°N) and the Aleutian Islands to the Gulf of Alaska, British Columbia and the U.S.-Mexican border (latitude 32°N) (Figure 1, Gentry 1998). Fossil remains found in California, Oregon, and Alaska suggest that the species likely evolved within at least part of their present geographic range (Lyman 1988; Gentry 1998; Pyle *et al.* 2001). However, northern fur seals pre-date some of the islands where they currently breed, and bones in kitchen middens have been found at several mainland sites in the United States (Burton *et al.* 2001), suggesting that some population redistribution has occurred (Gentry 2002).

In the Bering Sea, northern fur seals breed at colonies located on the Commander Islands (Bering and Medny islands) of Russia, and the Pribilof Islands (St. Paul and St. George islands) of Alaska (Figure 1, Gentry 2002; Angliss and Lodge 2003). The Pribilof Islands constitute approximately 74% of the entire world population of northern fur seals. The breeding colonies on Robben Island and the Commander Islands are home to approximately 15 and 9% of the population, respectively. Other breeding colonies are located on the Kuril Islands north of Japan and on Robben (Tyuleniy) Island within the Sea of Okhotsk. New rookeries were established at San Miguel Island off California in 1965, and at Bogoslof Island in the Aleutian chain in 1980. Fur seals tend to migrate either off the coast of North America or Asia (Bigg 1990).

Canadian range

Northern fur seals are restricted to the west coast of Canada, where females and sub-adult males are typically found off the continental shelf during winter and spring months (Bigg 1990; Trites and Bigg 1996). In general, the largest numbers occur in waters off British Columbia from January through June about 20-150 km offshore (Baird and Hanson 1997; Heise *et al.* 2003). Some northern fur seals have also been observed at sea lion haulouts and rookeries in Canada and Southeast Alaska (Fiscus 1983; Baird and Hanson 1997; Trites pers. obs.).

HABITAT

Canadian habitat

Within Canada, the offshore waters of British Columbia represent important habitat for northern fur seals, mostly for migrating and over-wintering animals (Bigg 1990; Trites and Bigg 1996; Heise *et al.* 2003). Between 300,000 to 500,000 northern fur seals are thought to pass through Canadian waters during their migration (Antonelis and Perez 1984; Heise *et al.* 2003), mostly off the west coast of Vancouver Island and throughout the Haida Gwaii region (Queen Charlotte Islands) (Antonelis and Perez 1984; Bigg 1990; Heise *et al.* 2003).

Over 2,000 northern fur seals were shot in Canadian waters from 1958 to 1974 as part of joint research program conducted by Canada and the United States (Lander 1980b). The database contains information about dates, locations, ages, sexes, diets, reproductive condition and body sizes of fur seals found in Canada. However, detailed regional analyses of these data have only been undertaken for Haida Gwaii (Heise *et al.* 2003), where peaks in numbers of animals occur in May and June as animals make their way north. The majority of migrants in Haida Gwaii consist of mature females and immature animals that feed predominantly on squids (~64% of the diet), salmonids (~23%), pollock and other fishes (~9%). The east side of Haida Gwaii (Hecate Strait) appears to be an important area for wintering animals, where numbers appear to be stable from January to April (Heise *et al.* 2003). At this time of year, they appear to feed primarily on herring (~55% of the diet) and gadids (~19%). Other components include squid (~9%), sablefish (~5%), and other fish species (~6%).

Haida Gwaii is not the primary habitat for fur seals in British Columbia. Numbers of fur seals were collected in proportion to their abundance, and the Haida Gwaii region accounted for only 10-15% of all the fur seals taken in BC waters (P. Olesiuk, pers. comm.). Most fur seals are believed to use the offshore regions of British Columbia (Bigg 1990), but some, particularly juveniles, are known to winter in such inlets as Knight Inlet, Fitz Hugh Sound, Douglas Channel, as well as northern Hecate Strait. A more complete overview of habitat off the west coast of Canada will require detailed analyses of the available data as Heise *et al.* (2003) have done for Haida Gwaii.

Habitat requirements

As a migratory and territorial species, northern fur seals require different habitats for foraging and for reproduction. The species is among the most pelagic of pinnipeds, with males spending between 305-320 days at sea each year, and females spending 327-330 days foraging on small fish and squid over deep water and along the continental shelf break (Bigg 1990; Loughlin *et al.* 1993; Gentry 1998). While at sea, the subpolar continental shelf and shelf break (within 150 km of shore) serve as feeding grounds from the Bering Sea to California (Antonelis and Perez 1984; Bigg 1990). The highest concentrations of northern fur seals in the open ocean are associated with major oceanographic frontal features such as canyons, sea mounts, valleys, and along the continental shelf break (Lander and Kajimura 1982; Kajimura 1984). Northern fur seals thus use neritic, epipelagic, and mesopelagic areas (to 200 m) in both temperate and subpolar waters.

Habitat requirements differ between and within the sexes. Adult females are well known to use continental shelf and slope waters off British Columbia, Washington, Oregon and California in winter months (Bigg 1990), while adult males from Alaskan populations appear to remain in Alaskan waters year-round (Loughlin *et al.* 1999). Sub-adults of both sexes use coastal waters off British Columbia and Washington along with offshore areas of the North Pacific (Kajimura 1984; Bigg 1990; Trites and Bigg 1996).

During the summer breeding season, adult females forage predominantly in waters above the continental slope in the eastern Bering Sea (Loughlin *et al.* 1987; Goebel *et al.* 1991; Robson 2001). Adult territorial males do not forage during this period, but remain at the breeding sites to defend their territories (Peterson 1968). Lactating females on the Pribilof Islands exhibit significant colony-specific foraging behaviour, with females from St. Paul Island feeding in different areas than females from St. George Island (Robson *et al.* 2004).

Much of what is known about fur seal diet, distribution, etc. came from collections during the pelagic fur seal research program (Lander 1980b). The collectors went specifically to sites along the continental shelf where fur seals were believed to be in greatest abundance. However, there was no effort to define or describe other areas in the North Pacific where fur seals occur in large numbers. Ongoing satellite telemetry studies will provide additional information of fur seal distribution over the coming years.

Habitat trends

Colonization of new islands by northern fur seals is conservative compared to some other fur seal species (Gentry 1998). Only two new breeding sites have formed since 1786 — at San Miguel Island, California in 1965 (Peterson *et al.* 1968), and Bogoslof Island, Alaska in 1980 (Loughlin and Miller 1989). More recently, northern fur seals with identification tags from San Miguel Island have been observed on the South Farallon Islands, California, where breeding may have occurred between 1991 and 1996 (Pyle *et al.* 2001).

Habitat protection/ownership

All northern fur seal breeding sites located in the United States are on federally owned land and are protected. Except for the Pribilof Islands, none of the locations where the species breeds are inhabited by humans. In 1999, approximately 952 Aleuts lived on the Pribilof Islands (768 on St. Paul Island, 184 on St. George Island) (Corbett and Swibold 2000). Lands inhabited near the rookeries and haulouts are owned by the local Aleut community, which has developed support facilities for halibut and crab fisheries (Baird and Hanson 1997; Corbett and Swibold 2000). The U.S. federal government still owns land and buildings in the villages of St. Paul and St. George, as well as all the land where fur seal rookeries and haulouts occur.

BIOLOGY

Life cycle and reproduction

Northern fur seals are a polygynous species, with bulls establishing and maintaining territories on land while mating with several females. Territories are defended with mostly vocal and postural threats, and fighting between bulls is rare (Bartholomew and Hoel 1953; Peterson 1968). Both male and female northern fur seals

reach sexual maturity between 3-7 years of age (and average 5 y) (York 1983), but males are usually not large enough to successfully hold a territory until they are 8-9 years old (Gentry 1998). Female northern fur seals mate almost immediately after they reach sexual maturity, and may continue to reproduce into their 20s (Lander 1981). Females can therefore produce up to 20 offspring in their lifetime. Males have a significantly shorter reproductive life span than females, an average of 1.5 seasons (Peterson 1968), although the maximum territorial occupancy recorded for a male northern fur seal was 10 years (Gentry 1998).

The majority of adult fur seals occur on land between June and October (Bartholomew and Hoel 1953; Peterson 1968). Individual females show strong site fidelity, often giving birth within 8 to 10 m of their birthing site of the previous year (Kenyon and Wilke 1953; Kenyon 1960; Gentry 1998). Similarly, males defend only one territorial location throughout their reproductive lifetime (Gentry 1998). As a result of this site fidelity, breeding aggregations of northern fur seals are extremely predictable, and there are no significant changes in site sizes or shapes between years (Gentry 1998). Although northern fur seals can colonize new islands and beaches, the rate is low compared to other species of fur seals (Gentry 2002).

The onset and duration of the breeding season is fairly stable and does not appear to vary with weather or climate (Trites 1992c; Trites and Antonelis 1994). Adult territorial males arrive at the rookery in mid-May, and fast while holding their territories (maximum area = 110 m²) (Gentry 1998). Males spend the majority of their time interacting and mating with females throughout the main breeding season until they abandon their territory in late July and early August (Peterson 1968). Pregnant females arrive from mid-June through August, with a peak in early July (Trites 1992c), and give birth to a single pup. Mating occurs 3-8 days after parturition (average = 5.3 days) (Bartholomew and Hoel 1953; Gentry 1998), and there is a 4-month delay in blastocyst implantation until lactation ends and the pups are weaned (Daniel Jr. 1981; Trites 1991; York and Scheffer 1997). At birth, the sex ratio of northern fur seals is 1:1 (Trites 1991). In contrast the breeding ratio is 9:1 adult females to males (Gentry 1998). The skewed sex ratio reflects a higher natural mortality of males (Lander 1981), competitive exclusion between territorial males, and perhaps the effects of commercially harvesting males. Pregnancy rates of specific female age classes can exceed 83%, and highest pregnancy rates occur in females 8-13 years of age (Lander 1981).

Females leave the rookery 8-10 days after parturition for 3-10 day foraging trips, but return to the rookery for 1-2 days to suckle their pups (Costa and Gentry 1986; Gentry and Holt 1986). Pups are nursed for four months through late October/early November and are weaned at approximately 40% of adult female mass (Gentry 1998). Approximately 10% of pups die on shore before weaning (Trites 1989). Starvation, trauma, hookworm, diseases, parasites, and various infections all contribute to pup mortality (Bigg and Lyons 1981; Calambokidis and Gentry 1985).

Upon weaning, pups leave the rookery for the open ocean and embark on the southward migration with the rest of the population (Ragen *et al.* 1995). The majority of

pups born in a specific year (60-80%) do not survive to age two (Lander 1975; Trites 1989), the age at which their cohort returns to land (Fiscus 1978). Most of this mortality is thought to occur throughout the first winter (Lander 1979). More than 80% of adult females survive until age 15, after which survival decreases to about 30% by age 19 (Smith and Polacheck 1981). Mortality rates in adult males is higher than adult females, especially after 7-10 years when males become strong enough to defend territories (Johnson 1968).

Predation

The major predators of all ages of northern fur seals are large sharks and killer whales (Gentry 2002; NMFS 2004a). Pups may also be preyed upon by Steller sea lions and foxes (Gentry and Johnson 1981; Reeves *et al.* 1992; Baird and Hanson 1997). Killer whales were documented attacking fur seals off the Pribilof Islands as early as 1868 (Scheffer *et al.* 1984).

Diet

Northern fur seals are high-level consumers and opportunistic foragers, taking a variety of fish, cephalopods, and crustaceans. Seventy-five different species of prey have been identified in northern fur seal scats and stomachs. Principal prey species include juvenile walleye pollock (*Theragra chalcogramma*), Pacific herring (*Clupea harengus pallasii*), northern anchovy (*Engraulis mordax*), capelin (*Mallotus villosus*), Pacific whiting (*Merluccius productus*), eulachon (*Thaleichthys pacificus*), rockfish (*Sebastes* spp.), myctophids, and numerous species of squid (Kajimura *et al.* 1980; Kajimura 1984; Perez and Bigg 1986; Sinclair *et al.* 1994; Sinclair *et al.* 1996; Antonelis *et al.* 1997; Mori *et al.* 2001; Robson 2001; Robson *et al.* 2004).

In Canadian waters off British Columbia, Pacific herring is the predominant prey species in inshore waters from February through June; Their diet in oceanic waters is almost exclusively onychoteuthid squids and salmonids (Kajimura 1984; Perez and Bigg 1986). Other species of prey documented in British Columbia from 1958-1968 include eulachon, sablefish, rockfish, Pacific cod, Pacific whiting, and Pacific saury and squid (*L. opalescens* and *Onychoteuthis borealijaponicus*). Composition of the northern fur seal diet in British Columbia may have changed over time with changes in fish stocks (Perez and Bigg 1986; Bigg 1990).

Physiology

Northern fur seals retain heat by means of a dense pelage with water repellant underfur in which small bubbles of air are trapped and improve insulation. While on land, northern fur seals avoid overheating by keeping hind flippers damp, fanning them, or by panting (Bartholomew and Wilke 1956; Irving *et al.* 1962).

The theoretical aerobic dive limit for a 45 kg adult female is approximately 3.7 minutes, and 20 minutes are required for recovery at the surface after a dive of that

length (Gentry 2002). However, it should be noted that pinnipeds inexplicably often exceed these limits. The large size of males may allow them to reach deeper prey that females cannot reach, and may also help explain why males do not migrate at the end of the breeding season like females and juveniles (Gentry 1998).

Vision in northern fur seals is extremely effective in both air and water. Hearing sensitivity in northern fur seals is equal or superior to all other pinnipeds tested in frequency ranges from 2 to 28 kHz (Moore and Schusterman 1987). Their upper frequency limits are approximately 36 kHz and 40 kHz in air and water, respectively.

Body growth of northern fur seals is seasonally dependent, with rapid growth and gain in body mass occurring during a brief one- to three-month period (May-July) as the population migrates northward through the coastal waters of northern British Columbia and Alaska on their way to the Pribilof Islands (Trites and Bigg 1996).

Migration

The migration of northern fur seals begins in November, when females and juveniles of both sexes leave the breeding islands and disperse throughout the North Pacific Ocean (Bigg 1990) (Figure 2). From November through March they concentrate along continental margins, and most remain north of approximately 35°N without coming ashore. Adult males do not leave at this time, but instead remain in the northern waters around the breeding areas before eventually moving east to the Gulf of Alaska and eastern Pacific Ocean or west to the Kuril Islands (Loughlin *et al.* 1993; Gentry 1998; Burton and Koch 1999; Loughlin *et al.* 1999). Adult females tend to migrate to the mid-Pacific into the transition zone, while juveniles may be found all over the North Pacific (as witnessed by their being caught in high-seas salmon and squid gill net fisheries). The migratory routes and distribution of pups are not well known due to the constraints of size associated with instrument attachment, although it appears that their migration is highly variable (Ragen *et al.* 1995). In November of their birth year, the pups migrate south through the Aleutian passes and into the North Pacific Ocean, and are seen along the coasts of British Columbia, Washington, and Japan by the following January (Scheffer 1950). Pups may remain at sea for up to 22 months before returning to their rookery of birth (Trites 1989; Bigg 1990; Gentry 1998).

In spring, females move to areas along the continental shelf breaks and begin to migrate north to their respective breeding islands in the Bering Sea (Bigg 1990; Trites and Bigg 1996; Gentry 1998). Adult males arrive at the breeding areas in mid-May (see 'Life cycle and reproduction' subsection in 'Biology'), pregnant females arrive in June, and give birth mostly in July (Trites 1992c; Trites and Bigg 1996). Juveniles and some nonbreeding females may remain in the Pacific Ocean (French *et al.* 1989; Bigg 1990) and feed in the transition zone between the Oyashio and Kuroshio currents (Gentry 1998), not returning north until early August (Trites and Bigg 1996).

Interspecific interactions

Northern fur seals are sometimes observed at California and Steller sea lion haulouts (Kuzin *et al.* 1977; Fiscus 1983; Baird and Hanson 1997; Trites pers. obs.). However, different species often prefer different areas of the territory, and sea lions sharing sites with northern fur seals in the Kuril Islands occupied lower and more even sites (Kuzin *et al.* 1977). There is a potential for competition to occur between northern fur seals and California and Steller sea lions. However little is known about the extent of dietary overlap between the species.

Adaptability

Northern fur seals only use a few traditional sites to give birth and mate, and undertake age-structured annual migrations with precise predictable timings that cover a broad area of the North Pacific (Bigg 1990; Baker *et al.* 1995; Trites and Bigg 1996). The rigidity of their life cycle and the restricted numbers of breeding sites suggests that they may not be particularly adaptable to changes in the wild.

Northern fur seals are amenable to captivity and have been successfully raised and cared for in a number of aquariums and research facilities. Average survival of northern fur seals held in captivity is 0.884 (n=95; 95% CI = 0.856–0.912). Annual survival rates of captive northern fur seals in their first year of life is 0.332 (n=28; 95% CI = 0.194–0.571) (Roberts and DeMaster 2001).

POPULATION SIZES AND TRENDS

Search effort

Northern fur seals use only a few traditional sites to give birth, and do not haul out during their annual migration (Baker *et al.* 1995; Gentry 1998). Surveys of pinniped breeding sites (harbour seals and Steller sea lions) are regularly conducted throughout the coastal regions of British Columbia, but no concentrations of hauled-out fur seals have ever been reported.

At-sea distributions of fur seals are known from ship-board studies conducted from 1958-1974 (Lander 1980b), but no recent attempts have been made to locate fur seals at sea and off-shore during their annual migration through Canadian waters.

Abundance

Fur seal population trends and abundance have been assessed through direct counts of harem and idle males and by estimates of pups born using mark-recapture techniques. Population estimates for the eastern Pacific population were calculated by estimating the number of pups at rookeries and multiplying that number by expansion factors determined from a life table analysis (Lander 1981). Most recent population

estimates are equal to the mean of pup counts from 1998, 2000, and 2002 multiplied by 4.5 (Angliss and Lodge 2003).

Approximately 74% of the world population and 99% of the U.S. population of northern fur seals breeds on the Pribilof Islands (Roppel 1984; Angliss and Lodge 2003). The 2000 population estimate of the eastern Pacific population of northern fur seals was approximately 941,756 animals (Angliss and Lodge 2002). The most recent population estimate of the eastern Pacific population of northern fur seals is from the Draft 2003 U.S. Stock Assessment that estimates approximately 888,120 animals, with a minimum of 751,714 animals (Angliss and Lodge 2003).

No estimates are available for the proportion of fur seals that use Canadian waters, although most of the Pribilof population likely passes through at some point in time.

Fluctuations and trends

There have been three major declines in the worldwide population of northern fur seals since the time of their initial discovery. It is estimated that northern fur seals numbered between 2-3 million when the Pribilofs were discovered in 1742 (Lander and Kajimura 1982; Roppel 1984). Aleuts were brought to the Pribilof Islands in 1786, and forced to harvest an average of 100,000 fur seals annually for the next 40 years, the majority of which were pups (Roppel 1984). This harvest went unchecked until 1822, when restrictions were placed on the number of pups and bulls that could be killed, and a policy towards taking only immature males was initiated. By the time Alaska was purchased by the United States in 1867, the population was believed to have returned to near historic highs and an average of 30,000 to 35,000 immature male fur seals were being killed annually (Scheffer *et al.* 1984). However, with the onset of U.S. ownership in 1867, harvesting of fur seals proceeded without regulation, with approximately 240,000 fur seals killed in 1868 alone. Northern fur seals were also harvested at sea, where at least 800,000 seals, mostly adult females, were killed between 1868 and 1911. A large number of these individuals were taken from waters off British Columbia (Scheffer *et al.* 1984). By the early 1900s, the Pribilof population had declined to approximately 300,000 and was in danger of going extinct (Kenyon *et al.* 1954; Lander and Kajimura 1982). Protective measures were thus introduced in 1911 that included a moratorium on all hunting of fur seals (1911-1917), and later restricted the harvesting to immature males on land and banned the hunting of fur seals at sea (Roppel 1984).

The restrictive management measures resulted in the Pribilof fur seal population increasing to 2.2 million animals by the 1950s (Figure 4, Briggs and Fowler 1984). Failure of the population to continue growing led to the implementation of management actions that were premised on theoretical concepts about density dependent responses in wildlife populations. Thus a herd reduction program was initiated on the Pribilof Islands in 1957 based on mathematical calculations that suggested a smaller herd would exhibit higher pregnancy and survival rates (Lander 1981). Between 1956 and 1968, over 300,000 female fur seals were killed on the Pribilof Islands (Lander 1980a;

Roppel 1984), and another 16,000 animals were killed at sea between 1958 and 1974 (York and Hartley 1981). The action failed to increase the productivity of the population until the male-only harvest policy was reinstated in 1969 (Figure 4, Roppel 1984; Trites and Larkin 1989).

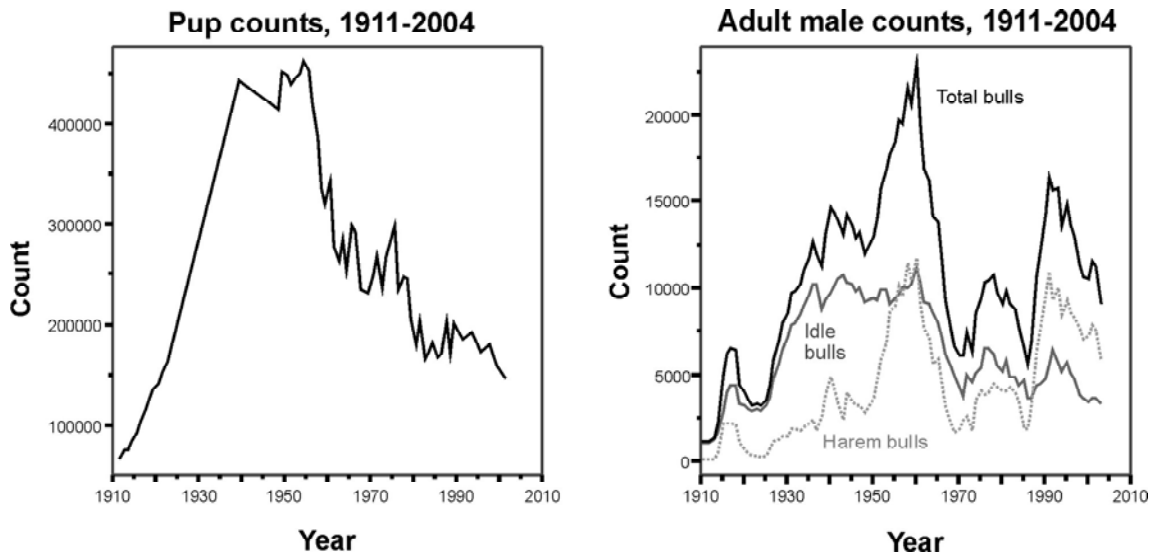


Figure 4. Pup and adult male counts on St. Paul Island from 1911-2004. Data are from the U.S. National Marine Fisheries Service.

Pup counts have long been used as an index of total population size for pinnipeds (Berkson and DeMaster 1985). The U.S. National Marine Fisheries Service uses the biennial pup counts on St. Paul and St. George Islands to track overall population trends (expansion factor: 4.5) for eastern North Pacific fur seals (Angliss and Outlaw 2005). By 1992, population size on the Pribilof Islands was estimated to be just under one million animals (Loughlin 1992; Baird and Hanson 1997). Throughout the mid-1990s, the population remained relatively stable, and numbered approximately 973,000 animals in 1998 (Robson 2000). However, between 1998 and 2002, pup production declined at 5.14% (SE = 0.26%, P = 0.03) and 5.35% (SE = 0.67%, P = 0.08) per year on St. Paul and St. George Islands, respectively (NMML 2002). Total pup production for this same period on the Pribilof Islands declined at 5.20% per year (SE = 0.19%, P = 0.02) (NMML 2002). In 2002, the pup count was less than 200,000 animals and was the lowest in over a decade (Angliss and Lodge 2003).

The 2004 estimate of numbers of pups born on St. Paul Island was 122,825 (SE=1,290), which was 15.7% less than the estimate in 2002, and 22.6% less than the estimate in 2000 (Angliss and Outlaw 2005). The 2004 pup estimate for St. George Island was 16,876 (SE=415), which was 4.1% less than the estimate in 2002, and 16.4% less than the estimate in 2000. Total numbers of pups born on the Pribilof Islands reflects a total population estimate of approximately 629,000 animals of all ages (= $4.5 \cdot [122,825 + 16,876]$). Estimated numbers of pups born declined at 6.2% per

year (SE = 0.78%, P = 0.01) on St. Paul Island, and at 4.5% per year (SE = 0.45%, P = 0.01) on St. George Island, from the estimated numbers in 1998. Estimated numbers of pups on the two islands, as a whole, has declined at 6.0% per year (SE = 0.59%, P = 0.01) since 1998 (NMFS 2004b). The 2004 pup production estimate on St. Paul Island was lower than the 1921 level, while the estimate on St. George was below the 1916 level (Figure 4, Angliss and Outlaw 2005).

Between 2002 and 2003, the total number of adult males on St. George and St. Paul Islands decreased by 13.4% and 2.8%, respectively (NMML 2003). Overall, the total numbers of adult males on the Pribilof Islands was 9,978 in 2004, a decline of 23.8% since 2003 (NMML 2004). This is the lowest count of adult males since 1930 when there had been a harvest of more than 20,000 juvenile males per year 3-5 years earlier.

The 2004 estimates of pups and adult males, combined with the declining trends, suggest that the eastern Pacific population is still declining (Figure 4).

Rescue effect

The breeding behaviour of northern fur seals makes it unlikely that animals will colonize new beaches or islands unless severe changes in environment force them to overcome their extreme site fidelity (Gentry 1998). Nevertheless, it should be noted that two new colonies were established in the past century at Bogoslof and San Miguel Islands (Peterson *et al.* 1968; Loughlin and Miller 1989).

LIMITING FACTORS AND THREATS

Changes in adult female and juvenile survival are factors that may be closely linked to the current lack of recovery of northern fur seals (York and Hartley 1981; Trites and Larkin 1989; Trites 1992b). However, the factors that affect survival of northern fur seals are poorly understood, particularly while the animals are outside of the Bering Sea (Calambokidis and Gentry 1985; Trites 1992b; Trites 1992a). Based on studies of Steller sea lions, the most significant limiting factors are likely to be predation by killer whales, and changes in the quality or quantity of available prey (DeMaster and Atkinson 2002; NRC 2003; Trites and Donnelly 2003). However, at the southern extreme of the fur seal range, climatic effects such as El Niño can dramatically alter the abundance of prey and reduce the survival of pups (Carretta *et al.* 2004).

Changes in water temperature and ocean currents, commercial fisheries, and the removal of baleen whales may have all contributed to changes in the prey base or rates of predation in the North Pacific Ocean and Bering Sea ecosystems (Trites *et al.* 1999; Benson and Trites 2002; Hunt Jr. *et al.* 2002; Springer *et al.* 2003; DeMaster *et al.* 2005). Some studies of species abundances in the North Pacific and Bering Sea have described long-term fluctuations or oceanographic regimes that may have influenced prey availability for northern fur seals, specifically a lack of early life-stage forage fish

(Sinclair *et al.* 1994; Beamish and Bouillon 1995; Sinclair *et al.* 1996; Anderson *et al.* 1997; McFarlane *et al.* 2000; Benson and Trites 2002). Other studies have also suggested that environmental factors have caused changes in the base of the food web (Burton and Koch 1999; Hirons *et al.* 2001; Trites *et al.* 2005).

Commercial fisheries could affect prey availability for northern fur seals if they reduce the prey base upon which the species feeds. In the Bering Sea, walleye pollock is an important prey species not only for northern fur seals (Sinclair *et al.* 1994; Sinclair *et al.* 1996; Antonelis *et al.* 1997), but also for other marine mammals, seabirds, and fish species (Livingston 1993; Merrick and Calkins 1996; Trites *et al.* 1999). There is also a large commercial fishery for walleye pollock in this area. However, the extent of overlap between age classes taken by northern fur seals and commercial fisheries is not well known (NMFS 2004a). Recent evidence suggests that there are considerable spatial and dietary overlaps of pinnipeds and fishery activities in the Bering Sea — however, the extents of these overlaps in the case of northern fur seals are unknown (Kaschner and Pauly 2004), and the presence of dietary overlap does not necessarily mean that competition is occurring (CIESM 2004).

An average of 22 northern fur seals per year were killed incidental to both the foreign and joint U.S.-foreign commercial groundfish trawl fisheries in the North Pacific from 1978 to 1988 (Perez and Loughlin 1991). In contrast, the foreign high seas driftnet fisheries incidentally killed large numbers of northern fur seals, with an estimated 5,200 (95% CI: 4,500-6,000) animals taken during 1991 (Larntz and Garrott 1993). These fisheries no longer operate, although some low level of illegal fishing may still be occurring (Angliss and Lodge 2003). Commercial net fisheries in international waters of the North Pacific Ocean have decreased significantly in recent years. The assumed level of incidental catch of northern fur seals in those fisheries is thought to be minimal (Angliss and Lodge 2003).

Effects of both long-term and short-term environmental change on northern fur seal reproduction are mostly unknown (NMFS 2004a). However, global climate change or oceanographic regime shifts are likely to affect northern fur seals more indirectly than directly (Gentry 1998) (e.g. a 1-2 degree change in water temperature could have serious effects on spawning and larval survival of northern fur seal prey (Gentry 1998), but would likely not cause large changes in fur seal metabolic rates (Miller 1978)). However, changes in environmental and oceanographic features such as severe storms and extremely low temperatures may directly affect mortality rates (Blix *et al.* 1979; Trites 1990; Trites and Antonelis 1994).

Entanglement in marine debris also contributes to northern fur seal mortality, and may have contributed to the decline of the Pribilof Islands population (e.g. Fowler 1982, 1987; Trites and Larkin 1989; Laist 1997). Many studies have reported on entanglement on adult females (e.g. DeLong *et al.* 1988; Robson *et al.* 1996; Kiyota and Baba 2001), adult males (Zavadil *et al.* 2003), and juvenile males (Scordino and Fisher 1983; Scordino 1985; Stepetin *et al.* 2000). Although exact levels of entanglement at sea are unknown, there is an unrecorded number of animals entangled in large debris

and killed at sea that do not make it back to the breeding grounds (Laist 1997). Entanglement and mortality rates associated with large debris may therefore be higher than current estimates, and the unrecorded number of animals entangled and killed at sea could be a potentially significant factor (Laist 1997). It has also been suggested that young fur seals less than 2-3 years old are more susceptible to entanglement in marine debris than older fur seals (Fowler 1987). However, tests of this hypothesis were not significant (Trites 1992b), suggesting that entanglement alone was not likely the cause for decline of the Pribilof Islands population (Trites 1992b).

Disturbance can also affect northern fur seal mortality, and can occur from low flying aircraft and construction activities, and through increased vessel traffic close to shore, research activities, and human presence (Johnson *et al.* 1989; Gentry *et al.* 1990). Any of these could increase pup mortality and animal injuries if animals are spooked and stampede into the water. Continued economic development of the Pribilof Islands may also threaten the breeding population through nearshore discharge of seafood processing waste, increased direct human disturbance, and increased levels of noise and olfactory pollution (Angliss and Lodge 2002). Habitat degradation as a result of development, pollution, and diesel fuel spills is also possible (Corbett and Swibold 2000).

Environmental pollutants may be a factor affecting northern fur seals based on studies that have measured organochlorine (PCBs and DDTs) and heavy metal concentrations in blubber and tissue samples (e.g. Noda *et al.* 1995; Krahn *et al.* 1997; Beckmen *et al.* 1999; Saeki *et al.* 2001; Beckmen *et al.* 2002; Loughlin *et al.* 2002; Kajiwara *et al.* 2004). Organochlorine concentrations in northern fur seal blubber samples from St. George Island exceeded recommended levels for human consumption (Loughlin *et al.* 2002). Beckmen *et al.* (1999) suggested that the overall level of these contaminants could affect pup immune systems. Levels of PCBs and DDTs were also high in samples of blubber from female northern fur seals off the coast of Japan (Tanabe *et al.* 1994). Furthermore, concentrations of mercury were higher in the fur of northern fur seals from the Pribilof Islands than both the eastern and western stocks of Steller sea lions (Beckmen *et al.* 2002). Some of the reported concentrations of organochlorine contaminants in blubber from northern fur seals on the Pribilof Islands were almost an order of magnitude higher than those from other seal species (Krahn *et al.* 1997).

Oil spills can affect the insulative properties of northern fur seal fur and cause mortality. Unlike seals and sea lions, northern fur seals do not have thick layers of blubber for insulation, but rely instead on the insulative properties of their dense underfur to keep warm. Oil that comes in contact with fur diminishes insulating capacity causing some animals to become hypothermic and die (St. Aubin 1990). Oil can also irritate mucous membranes, cause inflammation of skin, or cause other deleterious effects if ingested or inhaled (St. Aubin 1990).

Impacts of oil in British Columbia would likely be less destructive than near summer breeding grounds. Nevertheless, an oil spill from tankers carrying crude oil from the Valdez terminal along the west coast of British Columbia or the United States

could easily affect northern fur seals during their spring and fall migrations (NMFS 2004a). Similarly, the routine discharge of oil that is a chronic problem affecting seabirds likely affects northern fur seals as well. However, fur seals probably occur too far offshore for recovery of their oiled carcasses.

The extreme site fidelity exhibited by northern fur seals makes them particularly vulnerable to humans (Gentry 1998). Past management plans have largely been successful due to their reliance on the species' polygynous mating system, whereby more males survive to adulthood than is absolutely necessary for reproduction. The differential arrival of age and sex classes has allowed certain age groups to be exploited. Killing moderate numbers of young males for fur (mostly ages 2-6 y) did not change the adult sex ratio to the point where pregnancy rates were put at risk (Roppel and Davey 1965; Roppel 1984). In the past, periods of low population sizes coincided with harvesting females (Roppel and Davey 1965; Scheffer *et al.* 1984). However, there has been no commercial harvest in the Pribilof Islands for 20 years (Scheffer *et al.* 1984; Gentry 1998), and current levels of subsistence harvests are not thought to be having a detectable negative effect on the population (NMFS 2004a). There is a potential for pelagic sealing to occur outside of the exclusive economic zones of Canada and the United States (Baird and Hanson 1997). Attempts to establish a new treaty protecting northern fur seals from pelagic harvests have been unsuccessful (see 'Existing protection and status designations' below). There is also concern about the potential for fur seals to be incidentally killed in illegal driftnet fishing that might occur outside of the exclusive economic zones of Canada and the United States.

The cause of the recent population declines of northern fur seals from the Pribilof Islands is not known. In all likelihood, a number of factors have contributed to their current state, and the extent of different causes may have changed over time. Primary threats appear to be entanglement in marine debris, disturbance, pollution and reduced availability of prey (caused by fisheries or environmental change).

SPECIAL SIGNIFICANCE OF THE SPECIES

Northern fur seals are the only species of fur seal that occurs in the northern hemisphere, and are the only fur seal species represented in Canada. They are endemic to the temperate waters of the North Pacific Ocean. In Canada, northern fur seals were hunted pelagically by non-natives off the west coast of Vancouver Island and throughout the Haida Gwaii region, perhaps as early as 1866 (Scheffer *et al.* 1984).

Native peoples throughout the Aleutian Islands, coastal Alaska, British Columbia, Washington and Oregon have also harvested northern fur seals for subsistence use for several millennia (Gustafson 1968; Huelsbeck 1983; Savinetsky *et al.* 2004). Harvests were likely pelagic and conducted throughout the year when fur seals were available.

The subsistence harvest on the Pribilof Islands is currently limited to a 47-day harvest season from June 23 – August 8 to minimize negative effects on the population

(NMFS 2004a). Throughout this period, only sub-adult males can be taken; from 1997 – 2001 the mean subsistence harvest level was 1,132 animals (range = 750 – 1,558) (Angliss and Lodge 2003). Fur seal meat is eaten by Aleuts for food, and pelts are used for a handicraft program (Corbett and Swibold 2000).

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

International

The large numbers of northern fur seals taken throughout the 19th century led to the ratification of the Treaty for the Preservation and Protection of Fur Seals and Sea Otters by Great Britain (for Canada), Japan, Russia, and the United States in 1911. Pelagic sealing was stopped, and the harvest of fur seals on land was reduced. The treaty was in effect until 1941 when Japan abrogated (Roppel 1984). In 1957 a new treaty, the “Interim Convention on Conservation of North Pacific Fur Seals” was ratified by Canada, Japan, Russia, and the United States. Under the terms of this agreement, northern fur seals were protected from hunting at sea, but females were still taken by the United States and Canada for research purposes. Additionally, a commercial harvest of fur seals in the Pribilof Islands was still allowed, and Canada received 15% of skins from harvests and was required to initiate research on the species (Baird and Hanson 1997). In 1984 the international convention lapsed when the United States Senate failed to ratify a protocol for extension. Management of northern fur seals in U.S. waters thus became subject to the Fur Seal Act of 1966 and the Marine Mammal Protection Act of 1972. The commercial harvest on the Pribilof Islands was terminated after the National Marine Fisheries Service (NMFS) determined that it could not occur under domestic laws.

In June 1988, northern fur seals from the Pribilof Islands were designated as depleted under the Marine Mammal Protection Act (MMPA) due to population declines of about 35% since in the 1970s (~1.3 million animals) and 60% since the 1950s (~2.2 million animals) (Briggs and Fowler 1984). Additionally, a conservation plan was prepared in 1993 for northern fur seals that outlined protective measures and research activities to be carried out (NMFS 1993). An updated plan is pending (Angliss and Outlaw 2005). In 1994, amendments to the MMPA made intentional lethal take of any marine mammal illegal except for subsistence hunting by Alaska Natives or when imminently necessary to protect human life (Angliss and Lodge 2002). The northern fur seal is not listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), thus international trade is not monitored or regulated.

Canadian

In Canada the northern fur seal is protected under the 1993 Marine Mammal Regulations of the Fisheries Act of Canada. Under the terms of these regulations hunting of northern fur seals in Canadian waters is not permitted except by aboriginals,

who must obtain a licence. Licences are good for one year and are issued at the discretion of the Minister of Fisheries and Oceans. With the exception of hunting, these regulations prohibit disturbance, broadly defined as an activity that alters, disrupts or prevents a marine mammal from carrying out its normal life processes (DFO 2002). Northern fur seals were designated as 'Not At Risk' by COSEWIC in 1996.

TECHNICAL SUMMARY

Callorhinus ursinus

Northern fur seal

Otarie à fourrure du Nord

Range of Occurrence in Canada: Coastal and offshore waters of British Columbia

Extent and Area Information	
<ul style="list-style-type: none"> • <i>Extent of occurrence (EO)(km²)</i> (Offshore and coastal waters of British Columbia) 	> 20,000 km ²
<ul style="list-style-type: none"> • <i>Specify trend in EO</i> 	Unknown
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in EO?</i> 	No
<ul style="list-style-type: none"> • <i>Area of occupancy (AO) (km²)</i> 	> 2,000 km ² (offshore and coastal waters of British Columbia); < 50 km ² (breeding habitat on St. Paul, St. George, Bogoslof and San Miguel Islands, combined)
<ul style="list-style-type: none"> • <i>Specify trend in AO</i> 	Unknown
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in AO?</i> 	No
<ul style="list-style-type: none"> • <i>Number of known or inferred current locations</i> 	4 islands for breeding (at most)
<ul style="list-style-type: none"> • <i>Specify trend in #</i> 	2 new breeding rookeries established since 1965 (Bogoslof and San Miguel Islands)
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in number of locations?</i> 	No
<ul style="list-style-type: none"> • <i>Specify trend in area, extent or quality of habitat</i> 	Unknown but habitat change may be at least partly responsible for recent population decline
Population Information	
<ul style="list-style-type: none"> • <i>Generation time (average age of parents in the population)</i> 	10yr (females) (see Lander, 1981)
<ul style="list-style-type: none"> • <i>Number of mature individuals</i> 	50% of 2004 population estimate: 314,000 Calculation based on computation table for females 3+ yr and males 4+ yr (see table 10 in York <i>et al.</i> , 2000)
<ul style="list-style-type: none"> • <i>Total population trend:</i> 	Declining
<ul style="list-style-type: none"> • <i>% decline over the last 10 years</i> 	1994-2004: ~36% (inferred from St. Paul Island pup counts, see Figure 4)
<ul style="list-style-type: none"> • <i>% decline over the last 3 generations</i> 	1974-2004: ~54% (inferred from St. Paul Island pup counts, see Figure 4)
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in number of mature individuals?</i> 	No
<ul style="list-style-type: none"> • <i>Is the total population severely fragmented?</i> 	No
<ul style="list-style-type: none"> • <i>Specify trend in number of populations</i> 	
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in number of populations?</i> 	
<ul style="list-style-type: none"> • <i>List populations with number of mature individuals in each:</i> 	

Threats (actual or imminent threats to populations or habitats)	
<ul style="list-style-type: none"> - Prey availability (see Pages 11-12) - Breeding habitat degradation and disturbance (outside Canada) (see Page 13) - Environmental pollution (see Page 13) - Entanglement in fishing debris (see Page 12) 	
Rescue Effect (immigration from an outside source)	
<ul style="list-style-type: none"> • <i>Status of outside population(s)?</i> USA (San Miguel colony): Depleted under the US Marine Mammal Protection Act Russia (populations have declined, but no official status given) 	
• <i>Is immigration known or possible?</i>	Yes
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	Probably
• <i>Is rescue from outside populations likely?</i>	Low likelihood
Quantitative Analysis	None
Current Status	
<ul style="list-style-type: none"> • COSEWIC: Not at Risk in April 1996. Status re-examined and designated Threatened in April 2006. 	

Status and Reasons for Designation

Status: Threatened	Alpha-numeric code: Met criteria for Endangered, A2b; B2ab(v), but designated Threatened, A2b; B2ab(v), because there are still more than 600,000 individuals and the species does not appear to be in imminent danger of extinction.
<p>Reasons for Designation:</p> <p>The population that breeds on the Pribilof Islands in the Bering Sea feeds in, and migrates through, British Columbia waters. This population numbered about 629,000 animals in 2004. Although still relatively large, the population, as inferred from pup counts, has declined by 50-60% over three generations (1974-2004). The rate of decline has been particularly rapid since 1998. Trends in counts of adult males from 1974-2004 are confounded by response to the cessation, in 1984, of the selective commercial harvesting of sub-adult males. These counts have declined rapidly and inexplicably since 1992. The reasons for the population decline are unknown. Entanglement in marine debris, disturbance, pollution, and environmental changes, possibly including a regime shift in the Bering Sea and North Pacific ecosystems, are thought to be contributing factors. Little is known about possible limiting factors in British Columbia and other regions where fur seals forage during their annual migration.</p>	
Applicability of Criteria	
<p>Criterion A: (Declining Total Population): Met criterion for Endangered, A2b. Pup counts are an index of population size and have declined by more than 50% over three generations (1974-2004).</p> <p>Criterion B: (Small Distribution, and Decline or Fluctuation): Met criterion B2ab(v) for Endangered based on total area of occupied habitat on St. Paul, St. George, Bogoslof and San Miguel islands (< 500 km²), because breeding occurs on only those four islands (locations) and because a continuing decline in number of mature individuals is inferred from declining pup counts.</p> <p>Criterion C: (Small Total Population Size and Decline): Does not apply. The number of mature individuals is > 10,000.</p> <p>Criterion D: (Very Small Population or Restricted Distribution): Does not apply. The population is large (> 1,000 mature).</p> <p>Criterion E: (Quantitative Analysis): No quantitative analysis has been undertaken.</p>	

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BIOGRAPHICAL SUMMARY OF REPORT WRITERS

Kate Willis received her Bachelor of Arts degree from Wesleyan University in May 1998, and her Master of Science degree from Texas A&M University in May 2004. For her master's thesis she studied thermoregulation in Steller sea lions (*Eumetopias jubatus*) and worked collaboratively with researchers at the Alaska SeaLife Center in Seward, AK and at the University of British Columbia's Marine Mammal Research Unit in Vancouver, BC. She relocated to Canada in May, 2001. Ms. Willis has worked with numerous pinniped and cetacean species since 1997, and has hands-on and field experience with northern fur seals, Steller sea lions, Australian fur seals, California sea lions, Weddell seals, Hawaiian monk seals, harbour seals, grey seals, bottlenose dolphins, and northern right whales. In the course of her study on Steller sea lions, Ms. Willis gained practical knowledge about the distribution and physiology of northern fur seals, as well as familiarity with relevant literature.

Andrew Trites is Director of the Marine Mammal Unit at the UBC-Fisheries Centre and Research Director of the North Pacific Universities Marine Mammal Research Consortium. Dr. Trites has been studying marine mammals in the North Pacific for over 20 years. His current research is primarily focused on pinnipeds (Steller sea lions, northern fur seals and harbour seals), and involves captive studies, field studies and simulation modelling. Some of his work includes modelling the Bering Sea ecosystem, estimating the extent of competition between marine mammals and fisheries, and evaluating the junk-food hypothesis thought by many to explain the decline of Steller sea lions in Alaska. He trains students and collaborates with researchers specializing in other disciplines (such as nutrition, ecology, physiology and oceanography). Dr. Trites has studied northern fur seals and has published 14 papers on their population biology. He is the leading expert in Canada on northern fur seals.