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NORTHERN FUR SEAL (*Callorhinus ursinus*): California Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Northern fur seals occur from southern California north to the Bering Sea and west to the Okhotsk Sea and Honshu Island, Japan (Fig. 1). During the breeding season, approximately 74% of the worldwide population is found on the Pribilof Islands in the southern Bering Sea, with the remaining animals spread throughout the North Pacific Ocean (Lander and Kajimura 1982). Of the seals in U.S. waters outside of the Pribilofs, approximately 1% of the population is found on Bogoslof Island in the southern Bering Sea, and San Miguel Island off southern California (NMFS 2007), and the Farallon Islands off central California. Northern fur seals may temporarily haul out on land at other sites in Alaska, British Columbia, and on islets along the coast of the continental United States, but generally this occurs outside of the breeding season (Fiscus 1983).

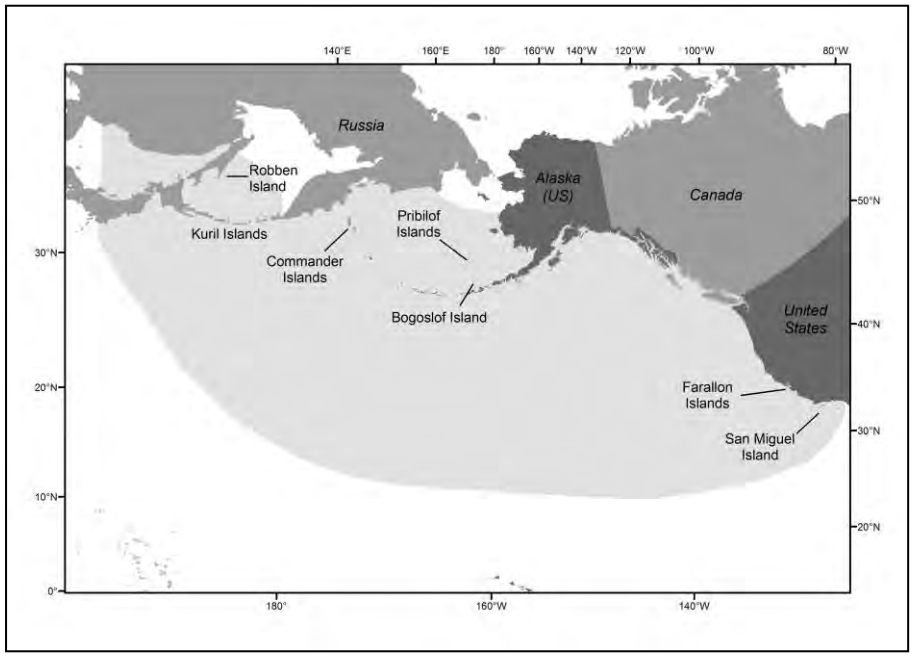

Figure 1. Approximate distribution of northern fur seals in the North Pacific (shaded area).

Due to differing requirements during the annual reproductive season, adult males and females typically occur ashore at different, though overlapping, times. Adult males occur ashore and defend reproductive territories during a 3-month period from June through August, though some may be present until November (well after giving up their territories). Adult females are found ashore for as long as 6 months (June-November). After their respective times ashore, fur seals of both sexes spend the next 7 to 8 months at sea (Roppel 1984). Adult females and pups from the Pribilof Islands migrate through the Aleutian Islands into the North Pacific Ocean, often to waters off Washington, Oregon, and California. Many pups may remain at sea for 22 months before returning to their natal rookery. Adult males from the Pribilof Islands generally migrate only as far south as the Gulf of Alaska (Kajimura 1984). There is considerable interchange of individuals between rookeries.

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: continuous geographic distribution during feeding, geographic separation during the breeding season, and high natal site fidelity (DeLong 1982); 2) Population response data: substantial differences in population dynamics between the Pribilofs and San Miguel Island (DeLong 1982, DeLong and Antonelis 1991, NMFS 2007); 3) Phenotypic data: unknown; and 4) Genotypic data: little evidence of genetic differentiation among breeding islands (Ream 2002). Based on this information, two separate stocks of northern fur seals are recognized within U.S. waters: an Eastern Pacific stock and a California stock (including San Miguel Island and the Farallon Islands). The Eastern Pacific stock is reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

The population estimate for northern fur seals on San Miguel Island is calculated as the estimated number of pups at rookeries multiplied by an expansion factor. Based on research conducted on the Eastern Pacific stock of northern fur seals, Lander's (1981) life table analysis was used to estimate the number of yearlings, two-year-olds, three-year-olds, and animals at least four years old. The resulting population estimate was equal to the pup count multiplied by 4.475. The expansion factors are based on a sex and age distribution estimated after the commercial harvest of juvenile males was terminated in 1984. A more appropriate expansion factor for San Miguel Island is 4.0, because immigration of recruitment-aged females is occurring in the population (DeLong 1982), as well as mortality and possible emigration of adults associated with the El Niño Southern Oscillation events in 1982-1983 and 1997-1998 (Melin et al. 2008). A 1998 pup count resulted in an 80% decrease from the 1997 count (Melin et al. 2005). In 1999, the population began to recover, and in 2010 the highest total pup count of 3,574 was recorded (Orr et al. 2012). A possible cause for the decline in total pup counts from 2010 to 2011 was a combination of oceanographic events that occurred in the California Current in 2009, a coastal upwelling relaxation event in May and June and an El Niño event from Fall 2009 to Spring 2010. The oceanographic events caused fewer reproductive males and females to return to San Miguel Island to breed in 2010. A maximum of 65 territorial bulls was observed in 2010 compared to 116 in 2009 and 148 in 2011. Fewer pups were born in 2011 because fewer animals were ashore to breed the previous year. During 2011, the total pup count decreased 13.5% from 2010 levels to 3,092. Based on the 2011 count and the expansion factor, the most recent population estimate of northern fur seals at San Miguel Island is 12,368 (3,092 x 4.0) northern fur seals. Currently, a coefficient of variation (CV) for the expansion factor is unavailable; however, studies are underway to determine the accuracy and precision of the expansion factor.

The population estimate for northern fur seals on the Farallon Islands is calculated as the highest number of pups, juveniles, and adults counted at the rookery. The long-term population estimate at the Farallon Islands should be regarded an index of abundance rather than a precise indicator of population size for several reasons: 1) Population censuses are incomplete because researchers do not enter rookery areas until the end of the breeding/pupping season in order to reduce human disturbance to other breeding pinnipeds and nesting seabirds; 2) mortality occurring early in the season is not accounted for; and 3) estimates of the number of pups is compromised because by the time counts are conducted, many pups have learned to swim and may not be present at the rookery. Additionally, yearlings may be present at rookeries and misidentified as pups. Keeping these factors in mind, the peak counts of northern fur seals increased steadily from 1995 to 2006 and have increased exponentially from 2008 to 2011 (Tietz 2012). Based solely on the count, the most recent population estimate of northern fur seals at the Farallon Islands is 476.

Incorporating estimates of numbers from San Miguel Island and the Farallon Islands, the most recent population estimate of the California stock is 12,844.

Minimum Population Estimate

Minimum population size is calculated as the sum of the minimum number of animals at San Miguel Island and the Farallon Islands in 2011 (Orr et al. 2012, Tietz 2012). The minimum number of animals at San Miguel Island is twice the pup count (3,092 x 2 = 6,184), to account for pups and mothers, plus the number of males (247) counted the same year, or 6,431 animals. The minimum number at the Farallon Islands is twice the pup count (122 x 2 = 244), plus the number of males (47), or 291 animals. The total minimum population size is the sum of minimum population sizes at San Miguel Island (6,431) and Farallon Island (291) in 2011, or 6,722.

Current Population Trend

Northern fur seals were extirpated on San Miguel Island and the Farallon Islands during the late 1700s and early 1800s. Immigrants from the Pribilof Islands and Russian populations recolonized San Miguel Island during the late 1950s or early 1960s (DeLong 1982). The colony has increased steadily, since its discovery in 1968, except for severe declines in 1983 and 1998 associated with El Niño events in 1982-1983 and 1997-1998 (DeLong and Antonelis 1991, Melin et al. 2005). El Niño events, which occur periodically along the California coast, impact population growth of northern fur seals at San Miguel Island and are an important regulatory mechanism for this population (DeLong and Antonelis 1991; Melin and DeLong 1994, 2000; Melin et al. 1996, 2005, 2008; Orr et al. 2012).

Live pup counts increased about 24% annually from 1972 through 1982 (Fig. 2), an increase due, in part, to immigration of females from the Bering Sea and the western North Pacific Ocean (DeLong 1982). The 1982-1983 El Niño event resulted in a 60.3% decline in the northern fur seal population at San Miguel Island (DeLong and Antonelis 1991). It took the population 7 years to recover from this decline, because adult female mortality or emigration occurred in addition to pup mortality (Melin and DeLong 1994). The 1992-1993 El Niño conditions resulted in reduced pup production in 1992, but the population recovered in 1993 and increased during during 1994 (Melin et al. 1996).

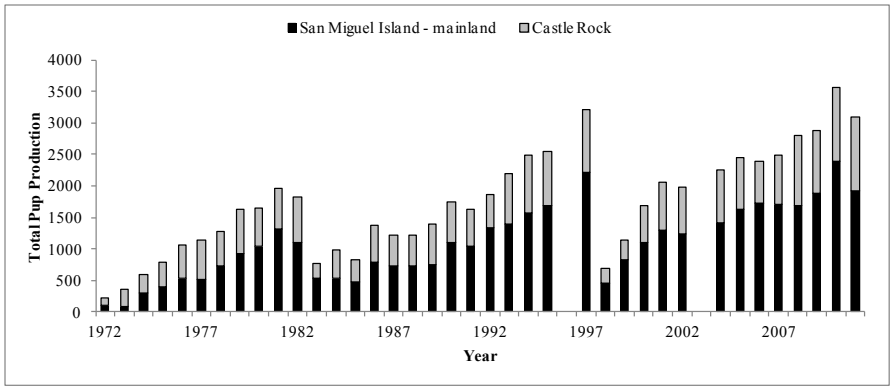

Figure 2. Total production of northern fur seal pups counted on San Miguel Island (including the mainland and the offshore islet Castle Rock), 1972-2011.

From July 1997 through May 1998, the most severe El Niño event in recorded history affected California coastal waters (Lynn et al. 1998). In 1997, total fur seal pup production was the highest recorded since the colony has been monitored. However, it appears that up to 87% of the pups born in 1997 died before weaning, and total production in 1998 declined 80% from 1997 (Melin et al. 2005). Total production increased to 3,574 in 2010 but decreased to 3,092 in 2011 (Orr et al. 2012). The northern fur seal population appears to be greatly affected by El Niño events. These events cause changes in marine communities by altering sea-level height, sea-surface temperature, thermocline and nutricline depths, current-flow patterns, and upwelling strength. Fur seal prey generally move to more productive areas farther north and deeper in the water column and, thereby, become less accessible for fur seals. Consequently, fur seals at San Miguel Island are in poor physical condition during El Niño events and the population experiences reduced reproductive success and high mortality of pups and, occasionally, adults. Because El Niño events occur periodically along the California coast, and impact the population growth of fur seals at San Miguel Island, they directly influence the dynamics of this population. It appears that the San Miguel Island population has recovered from the 1997-98 El Niño event. However, the population is still below the highest number recorded (in 1997), and does not appear to be at carrying capacity.

Compared to San Miguel Island, less information is known about the population of northern fur seals on the Farallon Islands. Based on tag-resight data, it appears that the population originated from emigrants from San Miguel Island. The first pup was observed on the Farallon Islands in 1996 (Pyle et al. 2001). After this discovery, annual ground surveys were conducted in early fall to document population trends of the colony (Tietz 2012). The colony increased steadily from 1996 to the early 2000s. However, the population has grown exponentially during the past several years, with an occasional decline (Tietz 2012). Because counts are conducted during the fall after the breeding season, population trends and demographic information is less clear than for San Miguel Island.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Currently, productivity rates for northern fur seals on the Farallon Islands are unavailable. A growth rate of 20% was calculated for northern fur seals on San Miguel Island in 1972-1982 by linear regression of the natural logarithm of pup count against year. However, it is clear that this rate of increase was due in part to immigration of females from Russian and Pribilof Islands populations (DeLong 1982). Immigration was also occurring from the early 1980s to 1997 and from 1998 to 2010. In the absence of a reliable estimate of the maximum net productivity rate for the California stock of northern fur seals, the pinniped default maximum theoretical net productivity rate (R_{MAX}) of 12% (Wade and Angliss 1997) is used as a conservative estimate of R_{MAX}.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population estimate (6,722) times one-half the default maximum net growth rate (½ of 12%) times a recovery factor of 1.0 (for stocks of unknown status that are increasing in size: Wade and Angliss 1997), resulting in a PBR of 403 northern fur seals from the California stock per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998, Andersen *et al*. 2008, NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

Northern fur seals taken during the winter/spring along the west coast of the continental U.S. could be from the Eastern Pacific stock. However, NMFS considers any takes of northern fur seals by commercial fisheries in waters off California, Oregon, and Washington as being from the California stock. There were no observer reports of northern fur seal deaths in any observed fishery along the west coast of the continental U.S. in 2007-2011 (Carretta and Enriquez 2009a, 2009b, 2010, 2012a, 2012b; Jannot et al. 2011).

Table 1. Summary of available information on the incidental mortality and serious injury of northern fur seals (California stock) in commercial fisheries that might take this species and calculation of the mean annual mortality rate; n/a indicates that data are not available. Mean annual takes are based on 2007-2011 data unless noted otherwise.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
Unknown West Coast fisheries	2007-2011	stranding data	n/a	0, 0, 1, 0, 1	n/a	>0.4 (n/a)
Minimum total annual takes						>0.4 (n/a)

Strandings of northern fur seals entangled in fishing gear or with serious injuries caused by interactions with gear are a final source of fishery-related mortality information. According to Marine Mammal Stranding Network records, maintained for California by the NMFS Southwest Region (NMFS, Southwest Regional Office, unpublished data) and for Oregon and Washington by the NMFS Northwest Region (NMFS, Northwest Regional Office, unpublished data), two fishery-related deaths (net entanglements) were reported between 2007 and 2011 (Table 1), resulting in a mean annual mortality of 0.4 northern fur seals. This estimate is considered a minimum because not all stranded animals are found, reported, or examined for cause of death (via necropsy by trained personnel). One northern fur seal stranded in 2008 with serious injuries related to a hook and line fishery interaction and was treated and released with non-serious injuries (Carretta et al. 2013).

Other Mortality

In 2007 and 2008, four northern fur seals were incidentally killed in California waters during scientific sardine trawling operations conducted by NMFS (NMFS, Southwest Regional Office, unpublished data): one death occurred in 2007 and three in 2008. After marine mammal deaths, including one northern fur seal, occurred in April 2008 trawls, NMFS scientists met to discuss and implement a mitigation plan to avoid future mortality. The initial mitigation plan included use of 162 dB acoustic pingers, a marine mammal watch, and scheduling trawls to occur when the ship first arrived on station to avoid attracting animals to a stationary vessel. Two additional northern fur seals were killed in subsequent 2008 trawls, including one in July and one in August. In 2009, a marine mammal excluder device was added to the trawls and no additional deaths were observed during 42 trawls. However, one northern fur seal was killed in a scientific rockfish trawling operation conducted by NMFS (NMFS, Southwest Regional Office, unpublished data) in California waters in 2009. The mean annual research-related mortality of northern fur seals from 2007 to 2011 is 1.0 animal.

According to the Marine Mammal Stranding Network records maintained by the NMFS Southwest (NMFS, Southwest Regional Office, unpublished data) and Northwest Regions (NMFS, Northwest Regional Office, unpublished data), six human-caused northern fur seal deaths were reported from non-fisheries sources in 2007-2011. One animal was shot (in 2007) and five were entangled in marine debris (1 in 2008, 3 in 2009, and 1 in 2011), resulting in a mean annual mortality of 1.2 animals from this stock between 2007 and 2011. This estimate is considered a minimum because not all stranded animals are found, reported, or examined for cause of death (via

necropsy by trained personnel). Two additional northern fur seals were disentangled from marine debris in 2008, treated at a rehabilitation facilities, and released with non-serious injuries (Carretta et al. 2013).

STATUS OF STOCK

The California northern fur seal stock is not considered to be "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Based on currently available data, the minimum annual level of total human-caused mortality and serious injury (2.6) does not exceed the PBR (403). Therefore, the California stock of northern fur seals is not classified as a "strategic" stock. The minimum annual fishery mortality and serious injury for this stock (0.4) is not known to exceed 10% of the calculated PBR (40.3) and, therefore, appears to be insignificant and approaching zero mortality and serious injury rate. The stock (based on San Miguel Island data) decreased 80% from 1997 to 1998, began to recover in 1999, and is currently at 96% of the 1997 level. The status of this stock relative to its Optimum Sustainable Population (OSP) level is unknown, unlike the Eastern Pacific northern fur seal stock which is formally listed as "depleted" under the MMPA.

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