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NORTHERN FUR SEAL (*Callorhinus ursinus*): San Miguel Island 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). 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).

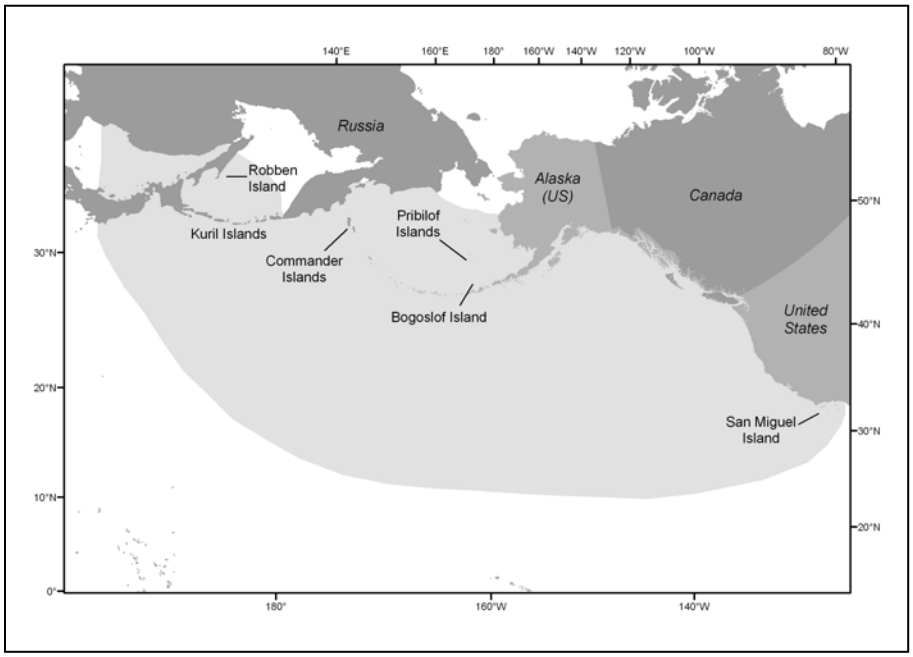

Figure 1. Approximate distribution of northern fur seals in the North Pacific (shaded area).

Due to differing requirements during the annual reproductive season, adult males and females typically occur ashore at different, though overlapping, times. Adult males usually occur on shore during the 4-month period from May-August, though some may be present until November (well after giving up their territories). Adult females are found ashore for as long as six months (June-November). After their respective times ashore, seals of both genders spend the next 7-8 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 Oregon and California offshore waters. Many pups may remain at sea for 22 months before returning to their rookery of birth. 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 San Miguel Island stock. The Eastern Pacific stock is reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

The population estimate for the San Miguel Island stock of northern fur seals 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 the San Miguel Island stock is 4.0, because immigration of recruitment-age 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 by 2007 the total pup count was 2,492 (Melin et al. 2008). Based on the 2007 count and the expansion factor, the most recent population estimate of the San Miguel Island stock is 9,968 (2,492 x 4.0) northern fur seals. Currently, a coefficient of variation (CV) for the expansion factor is unavailable.

Minimum Population Estimate

The survey technique utilized for estimating the abundance of northern fur seals within the San Miguel Island stock is a direct count, with no associated CV, as sites are surveyed only once. Additional estimates of the overall population size (i.e., N_{BEST}) and associated CV are also unavailable. Therefore, the minimum population size for this stock cannot be estimated by calculating the lower 20th percentile of the log-normal distribution of the population estimate. Rather, the minimum population size is estimated as twice the maximum number of pups born in 2007 (to account for the pups and their mothers) plus the maximum number of adult (147) and sub-adult (264) males counted for the 2007 season (Melin et al. 2008), which results in an estimate of 5,395 ((2,492 x 2) + 411). This method provides a very conservative estimate of the northern fur seal population at San Miguel Island.

Current Population Trend

The population of northern fur seals on San Miguel Island originated from the Pribilof Islands and Russian populations 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 Southern Oscillation 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).

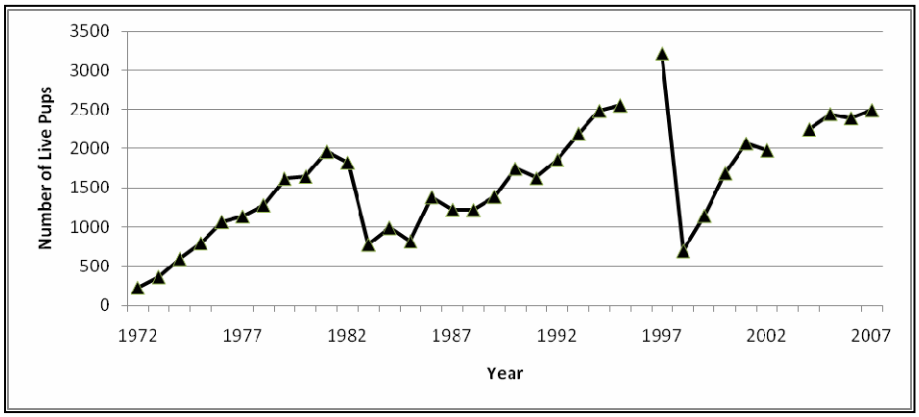

Figure 2. Number of live northern fur seal pups counted on San Miguel Island, 1972-2007.

Specifically, 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 in 1994 (Melin et al. 1996).

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). Although total production increased to 2,492 in 2007 (Melin et al. 2008), the population has not yet recovered. Recovery from the 1998 decline has been slowed by the adult female mortality or emigration which occurred in addition to the high pup mortality in 1997 and 1998 (Melin et al. 2008).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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). In the absence of a reliable estimate of the maximum net productivity rate for the San Miguel Island 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 (5,395) 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 324 San Miguel Island northern fur seals per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

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, it is the intention of NMFS to consider any takes of northern fur seals by commercial fisheries in waters off California, Oregon, and Washington as being from the San Miguel Island stock. Information concerning observed fisheries that may have interacted with northern fur seals is listed in Table 1. There were no observer reports of northern fur seal deaths in any observed fishery along the west coast of the continental U.S. in 2004-2008 (Table 1; Carretta et al. 2005; Carretta and Enriquez 2006, 2007, 2009a, 2009b; NWFSC 2008). The estimated mean mortality rate in observed fisheries is zero northern fur seals per year from this stock.

Table 1. Summary of available information on the incidental mortality and serious injury of northern fur seals (San Miguel Island 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 2004-2008 data unless noted otherwise.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
CA/OR thresher shark/ swordfish drift gillnet	2004	observer data	20.6%	0	0	0 (n/a)
	2005		20.9%	0	0	
	2006		18.5%	0	0	
	2007		16.4%	0	0	
	2008		13.5%	0	0	
CA halibut/white seabass and other species large mesh (>3.5 in) set gillnet	2003	observer data	0%	n/a	n/a	0 (n/a)
	2004		0%	n/a	n/a	
	2005		0%	n/a	n/a	
	2006		0%	n/a	n/a	
	2007		17.8%	0	0	
WA/OR/CA groundfish trawl (Pacific hake at-sea processing component)	2002	observer data	100%[1]	0	0 (0)	0 (0)
	2003		100%[1]	0	0 (0)	
	2004		100%[1]	0	0 (0)	
	2005		100%[1]	0	0 (0)	
	2006		100%[1]	0	0 (0)	
Minimum total annual takes						0 (n/a)

[1]Percent observer coverage equals percent of vessels with observers.

The Marine Mammal Authorization Program (MMAP) fisher self-reports, required of commercial vessel operators by the MMPA, are an additional source of information on the number of northern fur seals killed or seriously injured incidental to commercial fishery operations. There were no fisher self-reports of northern fur seal deaths in any MMAP-listed fishery operating in waters off California, Oregon, or Washington between 2004 and

2008. Although these reports are considered incomplete (see details in Appendix 1), they represent a minimum mortality.

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), no fishery-related strandings were reported between 2004 and 2008. 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).

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. The average annual research-related mortality of northern fur seals from 2004 to 2008 is 0.8 animals.

According to the Marine Mammal Stranding Network records maintained by the NMFS Southwest (NMFS, Southwest Regional Office, unpublished data) and Northwest (NMFS, Northwest Regional Office, unpublished data) Regions, two human-caused northern fur seal deaths were reported from non-fisheries sources in California in 2004-2008. One animal was shot in 2007 and one was entangled in marine debris in 2008, resulting in an estimated annual mortality of 0.4 animals from this stock between 2004 and 2008. 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).

STATUS OF STOCK

The San Miguel Island 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 estimated annual level of total human-caused mortality and serious injury (1.2) does not exceed the PBR (324). Therefore, the San Miguel Island stock of northern fur seals is not classified as a "strategic" stock. The minimum total fishery mortality and serious injury for this stock (0) is not known to exceed 10% of the calculated PBR (32.4) and, therefore, appears to be insignificant and approaching zero mortality and serious injury rate. The stock decreased 80% from 1997 to 1998, began to recover in 1999, and is currently at 77% 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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