Revised 6/25/99

STELLER SEA LION (*Eumetopias jubatus*): Western U. S. Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Steller sea lions range along the North Pacific Rim from northern Japan to California (Loughlin et al. 1984), with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands, respectively. The species is not known to migrate, but individuals disperse widely outside of the breeding season (late May-early July), thus potentially intermixing with animals from other areas. Despite the wide ranging movements of juveniles and adult males in particular, exchange between rookeries by breeding adult females and males (other than between adjoining rookeries) appears low (NMFS 1995); however, resighting data from branded animals have not yet been analyzed.

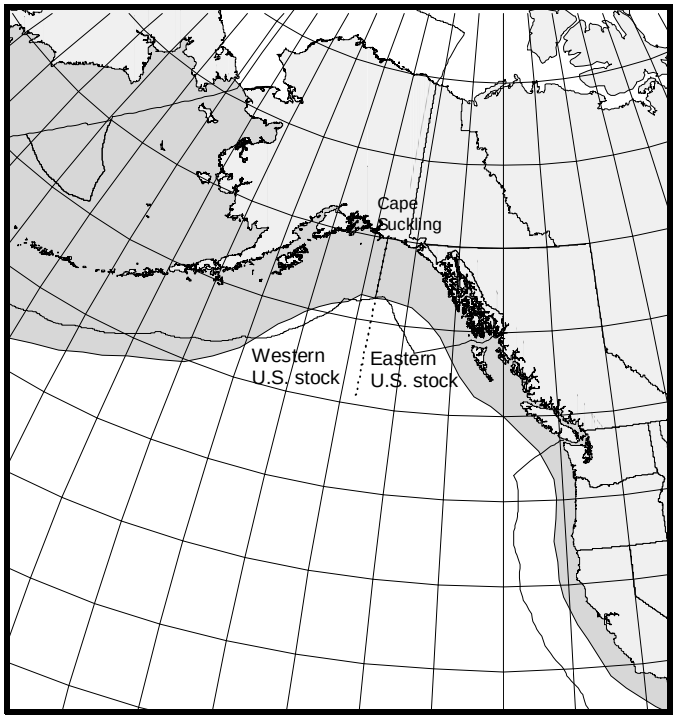

Figure 1. Approximate distribution of Steller sea lions in the eastern North Pacific (shaded area).

Loughlin (1997) considered the following information when classifying stock structure based on the phylogeographic approach of Dizon et al. (1992): 1) Distributional data: geographic distribution continuous, yet a high degree of natal site fidelity and low (<10%) exchange rate of breeding animals between rookeries; 2) Population response data: substantial differences in population dynamics (York et al. 1996); 3) Phenotypic data: unknown; and 4) Genotypic data: substantial differences in mitochondrial DNA (Bickham et al. 1996). Based on this information, two separate stocks of Steller sea lions are now recognized within U. S. waters: an eastern U. S. stock, which includes animals east of Cape Suckling, Alaska (144/W), and a western U. S. stock, which includes animals at and west of Cape Suckling (Loughlin 1997, Fig. 1).

POPULATION SIZE

The most recent estimate of Steller sea lion abundance in Alaska is based on aerial surveys performed in June and ground based pup counts in June and July 1998 from Southeast Alaska to the western Aleutian Islands (Sease and Loughlin 1999). Data from these surveys represent actual counts of pups and nonpups at all rookeries and major haulout sites in Alaska. During the 1998 survey, a total of 28,658 nonpups were counted in the Gulf of Alaska (12,299) and the Bering Sea/Aleutian Islands (16,359). Note that the 1998 counts for the Gulf of Alaska (12,299) were incomplete because only three of the 25 sites in the eastern Gulf of Alaska were surveyed during 1998. These three sites, however, are major rookeries and included a majority of the animals counted in the eastern Gulf subarea during the 1994 and 1996 surveys (52% and 60%, respectively). It is estimated that 1,000 animals were not counted in the 22 un-surveyed sites (Sease and Loughlin 1999).

The pup counts were conducted at all known rookeries for this stock during 1998. There were 4,058 pups counted in the Gulf of Alaska and 5,315 pups counted in the Bering Sea/Aleutian Islands for a total of 9,373 for the stock. Combining the pup count data (9,373), nonpup count data (28,658), and estimate for un-surveyed sites (1,000) results in a minimum abundance estimate of 39,031 Steller sea lions in the western U. S. stock in 1998.

Minimum Population Estimate

The 1998 total count (39,031) will be used as the minimum population estimate (N_{MIN}) for the western U. S. stock of Steller sea lion (Wade and Angliss 1997). This count data is considered a minimum estimate because it has not been corrected to account for animals which were at sea during the surveys.

Current Population Trend

The first reported trend counts (an index to examine population trends) of Steller sea lions in Alaska were made in 1956-60. Those counts indicated that there were at least 140,000 (no correction factors applied) sea lions in the Gulf of Alaska and Aleutian Islands (Merrick et al. 1987). Subsequent surveys indicated a major population decrease, first detected in the eastern Aleutian Islands in the mid-1970s (Braham et al. 1980). Counts from 1976 to 1979 indicated about 110,000 sea lions (no correction factors applied, Table 1). The decline appears to have spread eastward to the Kodiak Island area during the late 1970s and early 1980s, and then westward to the central and western Aleutian Islands during the early and mid-1980s (Merrick et al. 1987, Byrd 1989). The greatest declines occurred in the eastern Aleutian Islands and western Gulf of Alaska, but declines also occurred in the central Gulf of Alaska and central Aleutian Islands. More recently, counts of Steller sea lions at trend sites for the western U. S. stock decreased 27% from 1990 to 1996 (Table 1). Counts at trend sites during 1998 indicate that the number of sea lions in the Bering Sea/Aleutian Island regions has continued to decline (7.8% since 1996, Table 1, Fig. 2).

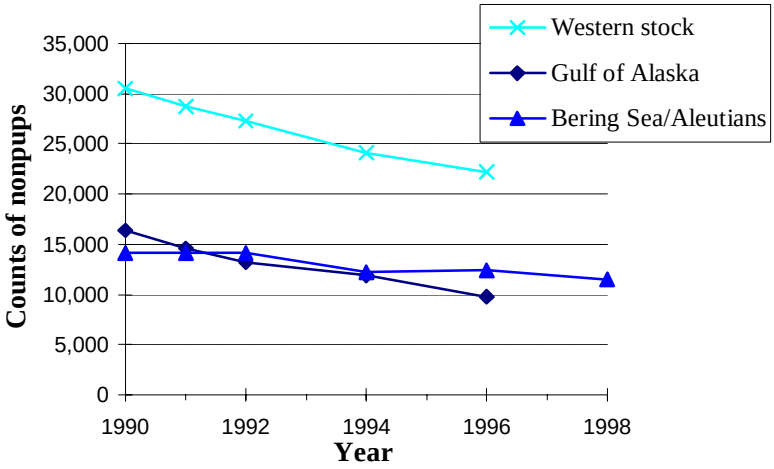

Figure 2. Counts of adult and juvenile Steller sea lions at rookery and haulout trend sites throughout the range of the western U. S. stock, 1990-98. Because not all sites in the eastern Gulf of Alaska were surveyed during 1998, those data have not been included in the figure.

Table 1. Counts of adult and juvenile Steller sea lions observed at rookery and haulout trend sites by year and geographical area for the western U. S. stock from the late 1970s through 1998 (NMFS 1995, Strick et al. 1997, Sease et al. 1999, Sease and Loughlin 1999). Counts from 1976-79 (NMFS 1995) were combined to produce complete regional counts which are comparable to the 1990-98 data. n/a indicates that data are not available due to an incomplete survey (see text).

Area	late 1970s	1990	1991	1992	1994	1996	1998
Gulf of Alaska	65,296	16,409	14,603	13,179	11,871	9,789	n/a
Bering Sea/ Aleutians	44,584	14,116	14,141	14,107	12,248	12,434	11,521
Total	109,880	30,525	28,744	27,286	24,119	22,223	n/a

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no estimates of maximum net productivity rate for Steller sea lions. Hence, until additional data become available, it is recommended that the theoretical maximum net productivity rate (R_{MAX}) for pinnipeds of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. However, it should be noted that the PBR management approach was developed with the understanding that human-related mortalities would be the primary reason for observed declines in abundance for marine mammal stocks in U. S. waters. For at least this stock, this assumption seems unwarranted. The recovery factor (F_R) for this stock is 0.1, the default value for stocks listed as endangered under the Endangered Species Act (Wade and Angliss 1997). Thus, for the western U. S. stock of Steller sea lions, PBR = 234 animals ($39{,}031 \times 0.06 \times 0.1$).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating within the range of the western U. S. stock of Steller sea lions were monitored for incidental take by fishery observers during 1990-97: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No sea lion mortality was observed by fishery observers in either pot fishery. For the fisheries with observed takes, the range of observer coverage over the 8-year period, as well as the annual observed and estimated mortalities, are presented in Table 2a. The mean annual (total) mortality for the most recent 5-year period was 6.8 (CV=0.23) for the Bering Sea groundfish trawl fishery, 1.2 (CV=0.61) for the Gulf of Alaska groundfish trawl fishery, 0.2 (CV=1.0) for the Bering Sea groundfish longline fishery, and 1.0 (CV=0.77) for the Gulf of Alaska groundfish longline fishery. In 1996 (66% observer coverage), only 2 of the 4 observed mortalities in the Bering Sea trawl fishery occurred during monitored hauls, leading to an underestimate (3) of the extrapolated mortality for that fishery. As a result, 4 mortalities were used as both the observed and estimated mortalities for that year (Table 2a). The observed mortality in the 1993 Bering Sea longline fishery (30% observer coverage) also occurred during an unmonitored haul and therefore could not be used to estimate mortality for the entire fishery. Therefore, 1 mortality was used as both the observed mortality and estimated mortality in 1993 for that fishery, and should be considered a minimum estimate.

Observers also monitored the Prince William Sound salmon drift gillnet fishery in 1990 and 1991, recording 2 mortalities in 1991, extrapolated to 29 (95% CI 1-108) kills for the entire fishery (Wynne et al. 1992). No mortalities were observed during 1990 for this fishery (Wynne et al. 1991), resulting in a mean kill rate of 14.5 (CV=1.0) animals per year for 1990 and 1991. In 1990, observers boarded 300 (57.3%) of the 524 vessels that fished in the Prince William Sound salmon drift gillnet fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet. In 1991, observers boarded 531 (86.9%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet (Wynne et al. 1992). Fisher self-reports from this fishery detail 12, 5, 1, and 23 Steller sea lion mortalities in 1990, 1991, 1992, and 1993, respectively. The extrapolated (estimated) observer mortality accounts for these self-reported mortalities, so they do not appear in Table 2a. The Alaska Peninsula and Aleutian Islands salmon drift gillnet fishery was also monitored during 1990 (roughly 4% observer coverage) and no Steller sea lion mortalities were observed. Combining the mortality estimates from the Bering Sea and Gulf of Alaska groundfish trawl and longline fisheries presented above (6.8+1.2+0.2+1.0=9.2) with the mortality estimate from the Prince William Sound salmon drift gillnet fishery (14.5) results in an estimated mean annual mortality rate in the observed fisheries of 23.7 (CV=0.62) sea lions per year from this stock.

Table 2a. Summary of incidental mortality of Steller sea lions (western U. S. stock) due to commercial fisheries from 1990 through 1997 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from self-reported fisheries information. Data from 1993 to 1997 (or the most recent 5 years of available data) are used in the mortality calculation when more than 5 years of data are provided for a particular fishery. n/a indicates that data are not available.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSAI) groundfish trawl	90-97	obs data	53-74%	13, 13, 15, 4, 9, 2, 4, 6	13, 19, 21, 6, 11, 3, 4, 10	6.8 (CV=0.23)
Gulf of Alaska (GOA) groundfish trawl	90-97	obs data	33-55%	2, 0, 0, 1, 1, 0, 0, 0	4, 0, 0, 3, 3, 0, 0, 0	1.2 (CV=0.61)
BSAI groundfish longline (incl. misc. finfish and sablefish fisheries)	90-97	obs data	27-80%	0, 0, 0, 1, 0, 0, 0, 0	0, 0, 0, 1, 0, 0, 0, 0	0.2 (CV=1.0)
GOA groundfish longline (incl. misc. finfish and sablefish fisheries)	90-97	obs data	8-21%	1, 0, 0, 0, 0, 1, 0, 0	2, 0, 0, 0, 1, 4, 0, 0	1.0 (CV=0.77)
Prince William Sound salmon drift gillnet	90-91	obs data	4-5%	0, 2	0, 29	14.5 (CV=1.0)
Prince William Sound salmon set gillnet	90	obs data	3%	0	0	0
Alaska Peninsula/Aleutian Islands salmon drift gillnet	90	obs data	4%	0	0	0
Observer program total						23.7 (CV=0.62)
				Reported mortalities		
Alaska Peninsula/Aleutian Islands salmon set gillnet	90-97	self reports	n/a	0, 1, 1, 1, n/a n/a, n/a, n/a	n/a	[$0.75]
Cook Inlet salmon drift gillnet	90-97	self reports	n/a	0, 0, 0, 2, n/a n/a, n/a, n/a	n/a	[$0.5]
Bristol Bay salmon drift gillnet	90-97	self reports	n/a	0, 4, 2, 8, n/a n/a, n/a, n/a	n/a	[$3.5]
Prince William Sound set gillnet	90-97	self reports	n/a	0, 0, 2, 0, n/a n/a, n/a, n/a	n/a	[$0.5]
Alaska miscellaneous finfish set gillnet	90-97	self reports	n/a	0, 1, 0, 0, n/a n/a, n/a, n/a	n/a	[$0.25]
Alaska halibut longline (state and federal waters)	90-97	self reports	n/a	0, 0, 0, 0, 1 n/a, n/a, n/a	n/a	[$0.2]
Alaska sport salmon troll (non-commercial)	93-97	strand	n/a	0, 0, 0, 0, 1	n/a	[$0.2]
Minimum total annual mortality						$29.6 (CV=0.62)

An additional source of information on the number of Steller sea lions killed or injured incidental to commercial fishing operations is the self-reported fisheries information required of vessel operators by the MMPA. Some incidental takes of sea lions reported in the Gulf of Alaska fisheries were listed as "unknown species", indicating the animals could have been either Steller or California sea lions. Based on all logbook reports for both species within the Gulf of Alaska, California sea lions represented only 2.2% of all interactions. Thus, the reports of injured and killed "unknown" sea lions were considered to be Steller sea lions. During the period between 1990 and 1997, fisher self-reports from 6 unobserved fisheries (see Table 2a) resulted in an annual mean of 5.7 mortalities from interactions with commercial fishing gear. However, because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. These totals are based on all available self-reports for Alaska fisheries, except the groundfish trawl and longline fisheries in the Bering Sea, Aleutian Islands, and Gulf of Alaska, and the Prince William Sound salmon drift gillnet fishery for which observer data were presented above. The Bristol Bay salmon drift gillnet and set gillnet fisheries accounted for the majority of the reported incidental take in unobserved fisheries. Self-reported fisheries data are incomplete for 1994, not available for 1995, and considered unreliable after 1995 (see Appendix 4).

Strandings of Steller sea lions entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. During the 5-year period from 1993 to 1997 the only fishery-related Steller sea lion stranding was reported in August of 1997 in Prince William Sound. The animal had troll gear in its mouth and down its throat (considered a serious injury; see Angliss and DeMaster 1998). It is likely that this mortality occurred as a result of a sport fishery, not a commercial fishery (Table 2a). Fishery-related strandings during 1993-97 result in an estimated annual mortality of 0.2 animals from this stock. This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found or reported.

NMFS studies using satellite tracking devices attached to Steller sea lions suggest that they rarely go beyond the U.S. Exclusive Economic Zone into international waters. Given that the high-seas gillnet fisheries have been prohibited and other net fisheries in international waters are minimal, the probability that Steller sea lions are taken incidentally in commercial fisheries in international waters is very low. NMFS concludes that the number of Steller sea lions taken incidental to commercial fisheries in international waters is insignificant.

The minimum estimated mortality rate incidental to commercial fisheries is 30 sea lions per year, based on observer data (23.7) and self-reported fisheries information (5.7) or stranding data (0.2) where observer data were not available. No observers have been assigned to several fisheries that are known to interact with this stock (self-reported data from these fisheries are provided in Table 2), making the estimated mortality a minimum estimate.

Subsistence/Native Harvest Information

The 1992-96 subsistence harvest of Steller sea lions in Alaska was estimated by the Alaska Department of Fish and Game, under contract with the NMFS (Table 2b: Wolfe and Mishler 1993, 1994, 1995, 1996, 1997). In each year, data were collected through systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the geographic range of the Steller sea lion in Alaska. Between 1992-95 approximately 43 of the interviewed communities lie within the range of the western U. S. stock. The majority (79%) of sea lions were taken by Aleut hunters in the Aleutian and Pribilof Islands. Details concerning the subsistence harvest of Steller sea lions from the western U. S. stock are provided in Table 2b. The great majority (approximately 99%) of the statewide subsistence take was from the western U. S. stock. The mean annual subsistence take from this stock over the 3-year period from 1993 to 1995 was 412 sea lions. The reported average age-specific kill of the harvest across all years was 31% adults, 62% juveniles, 3% pups, and 4% unknown age. The reported average sex-specific kill of the harvest was approximately 64% males, 19% females, and 17% of unknown sex. The 1993-95 subsistence harvest data were used in the mortality rate calculation because 1996 data for Steller sea lion takes for several communities in the Pribilof Islands are in dispute and the 1997 subsistence harvest data are considered preliminary at this time as they have not been reviewed.

Other Mortality

Shooting of sea lions was thought to be a potentially significant source of mortality prior to the listing of sea lions as “threatened” under the U.S. Endangered Species Act (ESA) in 1990. Such shooting has been illegal since the species was listed as threatened. (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except where imminently necessary to protect human life).

Table 2b. Summary of the subsistence harvest data for the western U. S. stock of Steller sea lions, 1992-97. Brackets indicate that the 1996 data are in dispute and the 1997 data are preliminary.

Year	Estimated total number taken	95% confidence interval	Number harvested	Number struck and lost
1992	549	452-712	370	179
1993	487	390-629	348	139
1994	416	330-554	336	80
1995	339	258-465	307	32
1996	[179]	[158-219]	[149]	[30]
1997	[164]	[129-227]	[146]	[18]
Mean annual take (1993-95)	412			

STATUS OF STOCK

The current annual level of incidental mortality (30) exceeds 10% of the PBR (24) and, therefore, cannot be considered insignificant and approaching a zero mortality and serious injury rate. Based on available data, the estimated annual level of total human-caused mortality and serious injury (30 + 412 = 442) is known to exceed the PBR (234) for this stock. The western U. S. stock of Steller sea lion is also currently listed as "endangered" under the ESA, and therefore designated as "depleted" under the MMPA. As a result, the stock is classified as a strategic stock. However, given that the population is declining for unknown reasons that are not explained by the level of direct human-caused mortality, there is no guarantee that limiting those mortalities to the level of the PBR will reverse the decline.

A number of management actions have been implemented since 1990 to safeguard the western U. S. stock of Steller sea lions including 3 nautical mile no-entry zones around rookeries, prohibition of groundfish trawling within 10-20 nautical miles of certain rookeries, and spatial and temporal allocation of Gulf of Alaska pollock total allowable catch. More recent modifications recommended by the North Pacific Fisheries Management Council include reductions in removals of Atka mackerel within areas designated as critical habitat in the central and western Aleutian Islands.

Habitat Concerns

The unprecedented decline in the western U. S. stock of Steller sea lion has caused a recent change in the listing status of the stock from "threatened" to" endangered" under the U. S. Endangered Species Act (ESA) of 1973. There is currently no sign that the decline in the population has slowed or stopped. Although many theories have been suggested (overfishing, environmental change, disease, killer whale predation, etc.) it is not clear what factor or factors are most important in causing the decline.

Regarding the possible adverse impacts of commercial groundfish fisheries in Alaska on the western U. S. stock of Steller sea lion, NMFS has completed (September 1998) a draft Supplemental Environmental Impact Statement (SEIS) and has solicited public comment on it. The draft SEIS supplements the original EIS for the initial Fishery Management Plans for groundfish fisheries in the Bering Sea Aleutian Islands (1981) and the Gulf of Alaska (1978). Of the 26 marine mammal species inhabiting Alaskan waters, only a subset have been shown to consume groundfish species as a large part of their diet, and to potentially do so in areas coincident with groundfish harvest operations: Steller sea lion, northern fur seal, and harbor seal. Based on the potential for indirect interactions, NMFS has determined that the current practices involved in the management of the groundfish fishery in Alaska "may have adverse impacts on the western U. S. stock of Steller sea lions, northern fur seals in the Bering Sea, and both the GOA and western stocks of harbor seals" (Draft SEIS September 1998). In addition, in October of 1998 the NMFS developed a draft Biological Opinion, as required under Section 7(2) of the ESA, that describes potential affects on Steller sea lions by three separate actions: 1) authorization of an Atka mackerel fishery under the Bering Sea and Aleutian Islands (BSAI) groundfish

fishery management plan between 1999 and 2002, 2) authorization of a walleye pollock fishery under the BSAI groundfish fishery management plan between 1999 and 2002, and 3) authorization of a walleye pollock fishery under the Gulf of Alaska (GOA) groundfish fishery management plan between 1999 and 2002. The NMFS previously issued biological opinions on the groundfish fisheries off Alaska in 1991 and 1996. Those earlier opinions concluded that the fisheries were not likely to jeopardize the continued existence and recovery of the Steller sea lion. However, the most recent evidence on food habits suggests that the decline of sea lions may be due to lack of available prey. A Biological Opinion was issued December 3, 1998.

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