Revised 10/16/2006

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).

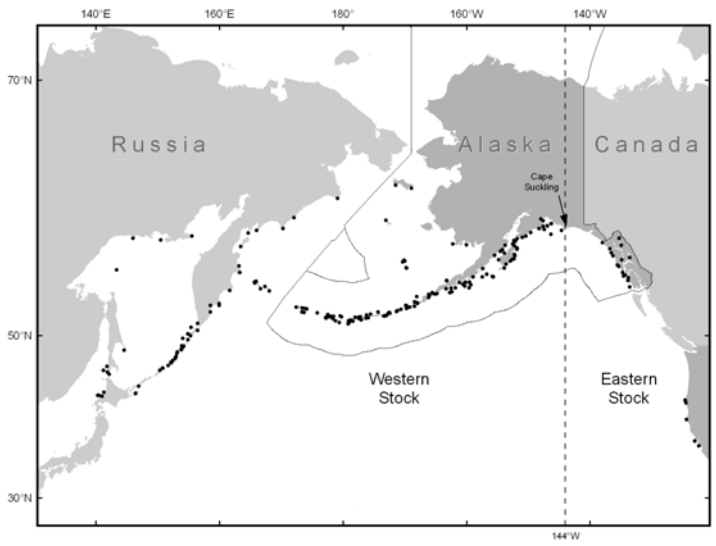

Figure 1. Approximate distribution of Steller sea lions in the North Pacific. Major U.S. haulouts and rookeries (50 CFR 226.202, 27 August 1993) and active Asian haulouts and rookeries (Burkanov and Loughlin, 2005) are depicted (points). Black dashed line (144° W) indicates stock boundary (Loughlin 1997). Note: Haulouts and rookeries in British Columbia are not shown.

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 were 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).

Steller sea lions that breed in Asia have been considered part of the western stock. While Steller sea lions seasonally inhabit coastal waters of Japan in the winter, breeding rookeries are currently only located in Russia (Burkanov and Loughlin, 2005). Analyses of genetic data differ in their interpretation of separation between Asian and Alaskan sea lions. Based on analysis of mitochondrial DNA, Baker et al. (2005) concluded that there was evidence for an additional Asian stock and that Commander Island (Russia) was genetically within the western U.S. stock. However, Hoffman et al. (2006) did not support an Asian/western stock split based on their analysis of nuclear microsatellite markers, which indicated high rates of male gene flow. The Baker et al. (2005) and Hoffman et al. (2006) results are consistent with a social structure in which there is stronger breeding site fidelity for females compared to males (Hoffman et al. 2006). In addition, Hoffman et al. (2006) did conclude that "the three Asian regions are closely related and form a branch separate from all other populations." Further analysis will be needed to determine if designation of an Asian stock is warranted.

POPULATION SIZE

The most recent comprehensive estimate (pups and non-pups) of abundance of the western stock of Steller sea lions in Alaska is based on aerial surveys of non-pups in June 2004 (Fritz and Stinchcomb 2005) and aerial and ground-based pup counts in June and July of 2004 and 2005 (NMML unpublished data). Data from these surveys represent actual counts of pups and non-pups at all rookeries and major haulout sites. During the 2004 aerial survey, a total of 29,037 non-pups were counted at 262 rookeries and haulout sites; 13,892 in the Gulf of Alaska and 15,145 in the Bering Sea/Aleutian Islands (Fritz and Stinchcomb 2005). A composite pup count for 2004 and 2005 includes

counts from 2 sites in 2004, and 57 sites in 2005. There were 4,518 pups counted in the Gulf of Alaska and 5,433 pups counted in the Bering Sea/Aleutian Islands for a total of 9,951 for the stock. Combining the pup count data from 2004-2005 (9,951) and non-pup count data from 2004 (29,037) results in a minimum abundance estimate of 38,988 Steller sea lions in the western U.S. stock in 2004-2005.

An estimate of the total population size of western Steller sea lion in Alaska may be obtained by multiplying the best estimate of total pup production (9,951) by 4.5 (Calkins and Pitcher 1982), which equals 44,780. This would not be a minimum abundance estimate since it is based on extrapolating total population size from pup counts based on survival and fecundity estimates in a life table. The 4.5 multiplier used for estimating the size of the eastern stock of Steller sea lions may not be appropriate for use in estimating the abundance of the western stock, as it is based on a life history table using age-specific fecundity and survival for the stable, mid-1970s population. The demographics of central Gulf of Alaska populations suggest that these rates have changed considerably since the mid-1970s (Holmes and York 2003).

Methods used to survey Steller sea lions in Russia differ from those used in Alaska, with less use of aerial photography and more use of skiff surveys and ground counts. Burkanov and Loughlin (2005) estimated the current (2005) population (pups and non-pups) of Steller sea lions breeding in Russia at about 16,000. This includes approximately 1,000 animals (674 non-pups and 236 pups counted in 2004) on the Commander Islands that are likely members of the same genetic stock as those breeding west of 144°W in Alaska (Baker et al. 2005).

Minimum Population Estimate

The 2004 count of non-pups (29,037) plus the number of pups in 2004-2005 (9,951) is 38,988, which will be used as the minimum population estimate (N_{MIN}) for the U.S. portion of the western stock of Steller sea lion (Wade and Angliss 1997). This is considered a minimum estimate because it has not been corrected to account for animals that 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 since the 1970s 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. Counts of Steller sea lions at trend sites for the western U. S. stock decreased 40% from 1991 to 2000 (Table 1), an average annual decline of 5.4% (Loughlin and York 2000).

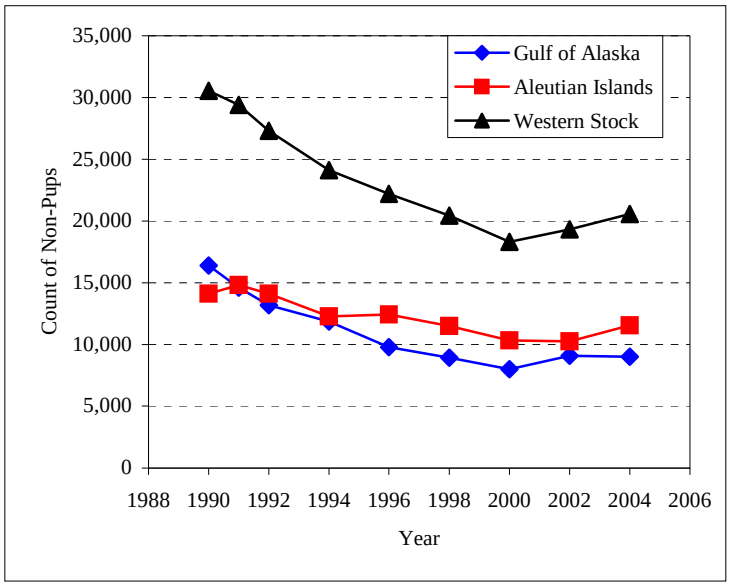

Figure 2. Counts of adult and juvenile Steller sea lions at rookery and haulout trend sites throughout the range of the western U.S. stock, 1990-2004. Correction factor applied to 2004 count for film format differences (Fritz and Stinchcomb 2005).

Recently, counts of non-pup Steller sea lions at trend sites for the western U.S. stock increased 5.5% from 2000 to 2002, and at a similar rate between 2002 and 2004 (Table 1, Fig. 2). These were the first region-wide increases for the western stock since standardized surveys began in the 1970s. However, the 2004 count was still 7.4% below the 1996 count and 32.6% below the 1990 count. The long-term, average decline for 1991-04 is 3.1%

per year (NMML unpublished data). Counts of non-pups in 2006 were only obtained from a portion of trend sites due to a court-ordered cessation of research causing a delayed aerial survey start date, and also to subsequent bad weather. Thus, there is no new information to update non-pup abundance trends for the entire western stock of Steller sea lions in Alaska. Counts in 2006 from complete trend-site coverage within the eastern Gulf of Alaska and eastern Aleutian Islands sub-areas, and nearly-complete coverage in the western Gulf of Alaska were nearly unchanged relative to 2004 counts, which may indicate that the decline has stabilized (Fritz et al. 2006). A decline of 19% since 2004 was detected in the western Aleutian Islands (based on a nearly-complete count), suggesting a continued decline (Fritz et al. 2006).

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 2004 (NMFS 1995, Sease et al. 2001, NMML unpublished data). Counts from 1976 to 1979 (NMFS 1995) were combined to produce complete regional counts that are comparable to the 1990-2004 data. Data from 2004 reflect a 3.5% reduction from actual counts to account for improvements in survey protocol in 2004 relative to previous years. Actual 2004 trend site counts were: Gulf of Alaska – 9,332; Bering Sea/Aleutian Islands – 11,977; Total – 21,309.

Area	late 1970s	1990	1991	1992	1994	1996	1998	2000	2002	2004
Gulf of Alaska	65,296	16,409	14,598	13,193	11,862	9,784	8,937[1]	7,995	9,087	9,005
Bering Sea/Aleutians	44,584	14,116	14,807	14,106	12,274	12.426	11,501	10,330	10,253	11,558
Total	109,880	30,525	29,405	27,299	24,136	22,210	20,438[1]	18,325	19,340	20,563

[1] Identifies 637 non-pups counted at six trend sites in 1999 in the eastern Gulf of Alaska which were not surveyed in 1998.

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 reauthorized 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: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. 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 U.S. portion of the western stock of Steller sea lions, PBR = 234 animals ($38{,}988 \times 0.06 \times 0.1$). When Steller sea lions on the Commander Islands are included, PBR = 239 animals ($39{,}898 \times 0.06 \times 0.1$).

The PBR levels for some stocks of marine mammals in the U.S. have been called "undetermined" (e.g., PBR levels for Cook Inlet beluga whales, Hawaiian monk seals); this has not been proposed for the western stock of Steller sea lions. The PBR management approach was developed with the assumption that direct 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. Because direct human-related mortalities are at a low level and are unlikely to either be responsible for the decline or to contribute substantially towards extinction risk, calling the PBR level "undetermined" is unnecessarily conservative for this population of nearly 40,000 animals.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Until 2003, there were six different federally regulated commercial fisheries in Alaska that could have interacted with Steller sea lions. These fisheries were monitored for incidental mortality by fishery observers. As of 2003, changes in fishery definitions in the List of Fisheries have resulted in separating these 6 fisheries into 22 fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. Between 1999-2003, there were incidental serious injuries and mortalities of western Steller sea lions in the following fisheries: Bering Sea/Aleutian Islands Atka mackerel trawl, Bering Sea/Aleutian Islands flatfish trawl, Bering Sea/Aleutian Islands Pacific cod trawl, Bering Sea/Aleutian Islands pollock trawl, Gulf of Alaska Pacific cod trawl, Gulf of Alaska pollock trawl, and Bering Sea/Aleutian

Islands Pacific cod longline (Table 2). Estimates of marine mammal serious injury/mortality in each of these observed fisheries are provided in Perez (2006) and Perez (unpubl. ms.).

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). 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. It is not known whether these incidental mortality levels are representative of the current incidental mortality levels in these fisheries.

An observer program for the Cook Inlet salmon set and drift gillnet fisheries was implemented in 1999 and 2000 in response to the concern that there may be significant numbers of marine mammal injuries and mortalities that occur incidental to these fisheries. Observer coverage in the Cook Inlet drift gillnet fishery was 1.75% and 3.73% in 1999 and 2000, respectively. The observer coverage in the Cook Inlet set gillnet fishery was 7.3% and 8.3% in 1999 and 2000, respectively (Manly in review). There were no mortalities of Steller sea lions observed in the set or drift gillnet fisheries in either 1999 or 2000 (Manly in review). An observer program conducted for a portion of the Kodiak drift gillnet fishery in 2002 did not observe any serious injuries or mortalities of Steller sea lions, although Steller sea lions were frequently observed in the vicinity of the gear (Manly et al. 2003).

Combining the mortality estimates from the Bering Sea and Gulf of Alaska groundfish trawl and Gulf of Alaska longline fisheries presented above (9.7) 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 24.2 (CV = 0.60) sea lions per year from this stock (Table 2).

Table 2. Summary of incidental mortality of Steller sea lions (western U. S. stock) due to fisheries from 2001 through 2005 (or most recent data available) and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from stranding data. 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. Details of how percent observer coverage is measured is included in Appendix 6.

Fishery name	Years	Data type	Observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is.	2001	obs	82.4	1	1.2	0.49
Atka mackerel trawl	2002	data	98.3	0	0	(CV = 0.31)
	2003		95.3	1	1.2	
	2004		95.6	0	0	
	2005		97.8	0	0	
Bering Sea/Aleutian Is.	2001	obs	57.6	4	6.4	2.78
flatfish trawl	2002	data	58.4	1	1.6	(CV = 0.20)
	2003		64.1	2	2.7	
	2004		64.3	2	3.1	
	2005		68.3	0	0	
Bering Sea/Aleutian Is.	2001	obs	57.8	0	0	0.85
Pacific cod trawl	2002	data	47.4	0	0	(CV = 0.73)
	2003		49.9	2	4.3	
	2004		50.4	0	0	
	2005		52.8	0	0	
Bering Sea/Aleutian Is.	2001	obs	79.0	2	3.3	2.58
pollock trawl	2002	data	80.0	3	3.4	(CV = 0.14)
	2003		82.2	0	0	
	2004		81.2	1	1	
	2005		77.3	4	5.2	

Fishery name	Years	Data type	Observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Gulf of Alaska Pacific cod trawl	2001 2002 2003 2004 2005	obs data	20.3 23.2 27.3 27.0 21.4	1 0 0 0 0	4.7 0 0 0 0	0.94 (CV = 0.83)
Gulf of Alaska pollock trawl	2001 2002 2003 2004 2005	obs data	17.6 26.0 31.2 27.4 24.2	0 0 1 0 1	0 0 2.4 0 4.2	1.33 (CV = 0.66)
Bering Sea/Aleutian Is. Pacific cod longline	2001 2002 2003 2004 2005	obs data	29.5 29.6 29.9 23.8 24.6	0 1 0 0 0	0 3.7 0 0 0	0.74 (CV = 0.86)
Prince William Sound salmon drift gillnet	1990-1991	obs data	4-5%	0 2	0 29	14.5 (CV = 1.0)
Prince William Sound salmon set gillnet	1990	obs data	3%	0	0	0
Alaska Peninsula/Aleutian Islands salmon drift gillnet	1990	obs data	4%	0	0	0
Cook Inlet salmon set gillnet[1]	1999-2000	obs data	2-5%	0 0	0, 0	0
Cook Inlet salmon drift gillnet[1]	1999-2000	obs data	2-5%	0 0	0, 0	0
Kodiak Island salmon set gillnet	2002	obs data	6.0%	0	0	0
Observer program total						24.2 (CV = 0.60)
				Reported mortalities		
Alaska sport salmon troll (non-commercial)	1993-2005	strand	N/A	0, 0, 0, 0, 0, 1, N/A, N/A, N/A, 1, N/A, N/A, N/A	N/A	[0.2]
Miscellaneous fishing gear	2001-2005	strand	N/A	N/A, N/A, 1, N/A, N/A	N/A	[0.2]
Minimum total annual mortality						24.6 (CV = 0.60)

[1] Data from the 1999 Cook Inlet observer program are preliminary.

Reports from the NMFS stranding database 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 2001 to 2005, there was only one confirmed fishery-related Steller sea lion stranding in the range of the western stock. This sighting involved an animal at Round Island with netting or rope around its neck; no more specific information is available on the type of fishing gear involved. In addition to this incident, a Steller sea lion was entangled in a large flasher/spoon in 1998. It is likely that this injury occurred as a result of a sport fishery, not a commercial fishery (Table 2). There are sport fisheries for both salmon and shark in this area; there is no way to distinguish between them since both fisheries use a similar type of gear (J. Gauvin, Groundfish Forum, Inc., pers. comm.). Fishery-related strandings during 2001-2005 result in an estimated annual mortality of 0.4 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. Steller sea lions reported in the stranding database as shot are not included in this estimate, as they may result from animals struck and lost in the Alaska Native subsistence harvest.

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 U. S. commercial fisheries is 24.6 sea lions per year, based on observer data (24.2) and stranding data (0.4) where observer data were not available. No observers have been assigned to several fisheries that are known to interact with this stock making the estimated mortality a minimum estimate.

Subsistence/Native Harvest Information

Information on the subsistence harvest of Steller sea lions comes via two sources: the Alaska Department of Fish and Game (ADFG) and the Ecosystem Conservation Office (ECO) of the Aleut Community of St. Paul. The ADFG conducts systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the range of the Steller sea lion in Alaska (Wolfe et al. 2004). The interviews are conducted once per year in the winter (January to March), and cover hunter activities for the previous calendar year. The ECO collects data on the harvest in near real-time on St. Paul Island, and records hunter activities within 36 hours of the harvest (Zavadil et al. 2004). Information on subsistence harvest levels is provided in Table 3a; data from ECO (e.g., Zavadil et al. 2004) are relied upon as the source of data for St. Paul Island and all other data are from the ADFG (e.g., Wolfe et al. 2004).

The mean annual subsistence take from this stock over the 5-year period from 2001 through 2005 was 198 Steller sea lions/year (Table 3a).

Table 3a. Summary of the subsistence harvest data for the western U. S. stock of Steller sea lions, 2001-2005.

	All areas except St. Paul Island			St. Paul Island	
Year	**Number harvested**	**Number struck and lost**	**Total**	**Number harvested + struck and lost**	**Total take**
2001	144.1	30.2	174.3[1]	24[6]	198
2002	118.9	22.9	141.8[2]	36[7]	178
2003	149.7	36.9	186.6[3]	18[8]	205
2004	136.8	49.1	185.9[4]	18[9]	204
2005	153.2	27.6	180.8[5]	22[10]	203
Mean annual take (2001-2005)					198

[1] Wolfe et al. 2002; [2] Wolfe et al. 2003; [3] Wolfe et al. 2004; [4] Wolfe et al. 2005; [5] Wolfe et al. 2006; [6] Lestenkof et al. 2003; [7] Zavadil et al. 2003; [8] Zavadil et al. 2004; [9] Zavadil et al. 2005; [10] Lestenkof and Zavadil 2006

Other Mortality

Illegal 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 for subsistence take by Alaska Natives or where imminently necessary to protect human life). Records from NMFS enforcement indicate that there were two cases of illegal shootings of Steller sea lions in the Kodiak area in 1998, both of which were successfully prosecuted (NMFS, Alaska Enforcement Division). There have been no cases of successfully prosecuted illegal shootings between 1999 and 2003 (NMFS, Alaska Enforcement Division).

Mortalities may occasionally occur incidental to research activities authorized under MMPA permits issued to a variety of government, academic, and other research organizations. Between 2000-2005, there was a total of 5 mortalities resulting from research on the western stock of Steller sea lions, which results in an average of 0.8 mortalities per year from this stock. The 5-year average for the years 2001-2005 is 1 mortality per year.

STATUS OF STOCK

The current annual level of incidental U. S. commercial fishery-related mortality (24.6) 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 (24.6 + 198 + 1 = 223.6) is below the PBR level (234) for this stock. The western U. S. stock of Steller sea lion is 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, if in fact the population is still declining.

A number of management actions were implemented between 1990 and 1998 to promote the recovery of the western U. S. stock of Steller sea lions, including 3 nautical mile (nmi) no-entry zones around rookeries, prohibition of groundfish trawling within 10-20 nmi of certain rookeries, and spatial and temporal allocation of Gulf of Alaska pollock and Aleutian Island Atka mackerel total allowable catch. Recent modifications finalized in 2002 involve a complex set of regulations that changed the temporal and spatial distribution of the pollock, Pacific cod and Atka mackerel fisheries throughout the range of the western stock in U.S waters. These measures were reviewed by NMFS (2003).

Habitat Concerns

The unprecedented decline in the western U. S. stock of Steller sea lion caused a change in the listing status of the stock in 1997 from "threatened" to" endangered" under the U. S. Endangered Species Act of 1973. Survey data collected since 2000 suggest that the decline has slowed or stopped in most of the range of the western U. S. stock. Many factors have been suggested as causes of the decline, (e.g., overfishing, environmental change, disease, killer whale predation.) but it is not clear which single or combination of factors are most important in causing the decline. However, predation by killer whales and nutritional stress related to competition with commercial fisheries or environmental change have been identified as potentially high threats to recovery (NMFS 2006). Additional potential threats to Steller sea lion recovery can be found in Table 3b.

Table 3b. Potential threats and impacts to Steller sea lion recovery and associated references. Threats and impact to recovery as described by the Draft Steller Sea Lion Recovery Plan (NMFS 2006). Reference examples identify research related to corresponding threats and may or may not support the underlying hypotheses.

Threat	Impact to Recovery	Reference Examples
Predation by killer whales	Potentially high	DeMaster et al. 2006, Trites et al. 2007, Williams et al. 2004, Springer et al. 2003
Environmental variability	Potentially high	Fritz and Hinckley 2005, Trites and Donnelly 2003
Competition with fisheries	Potentially high	Dillingham et al. 2006, Fritz and Brown 2005, Hennen 2004, Fritz and Ferrero 1998
Incidental take by fisheries	Medium	Perez 2006, Nikulin and Burkanov 2000, Wynne et al. 1992
Toxic substances	Medium	Albers and Loughlin 2003, Lee et al. 1996, Calkins et al. 1994
Subsistence harvest	Low	Wolfe et al. 2005, Loughlin and York 2000, Haynes and Mishler 1991
Illegal shooting	Low	NMFS 2001, Loughlin and York 2000
Entanglement in marine debris	Low	Calkins 1985
Disease and parasitism	Low	Burek et al. 2005
Disturbance from vessel traffic and tourism	Low	Kucey and Trites 2006
Disturbance due to research activities	Low	Kucey and Trites 2006, Kucey 2005, Loughlin and York 2000, Calkins and Pitcher 1982

NMFS developed a Biological Opinion (BO) on the groundfish fisheries in the Bering Sea/Aleutian Islands and Gulf of Alaska regions in 2000. In this BO, NMFS determined that the continued prosecution of the groundfish fisheries as described in the Fishery Management Plan for Bering Sea/Aleutian Islands Groundfish and in the

Fishery Management Plan for Gulf of Alaska Groundfish was likely to jeopardize the continued existence of the western population of Steller sea lion and to adversely modify critical habitat. NMFS also identified several other factors that could contribute to the decline of the population, including a shift in a large-scale weather regime and predation. To avoid jeopardy, NMFS identified a Reasonable and Prudent Alternative that included components such as 1) adoption of a more precautionary rule for setting "global" harvest limits, 2) extension of 3 nmi protective zones around rookeries and haulouts not currently protected, 3) closures of many areas around rookeries and haulouts to 20 nmi, 4) establishment of 4 seasonal and area catch limits, and 5) establishment of a procedure ("fishing in proportion to biomass") for setting seasonal catch limits on removal levels in critical habitat based on the biomass of the target species residing in critical habitat.

NMFS completed a draft Supplemental Environmental Impact Statement (SEIS) in September 2000 for the groundfish fisheries in the Bering Sea Aleutian Islands and the Gulf of Alaska. Based on the potential for indirect interactions between the groundfish fisheries and Steller sea lions, northern fur seals, and harbor seals, NMFS 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". However, the SEIS was determined to be incomplete in a Federal District Court ruling and remanded back to NMFS for further development.

In 2001, NMFS developed a programmatic SEIS to consider the impacts on Steller sea lions of different management regimes for the Alaska groundfish fisheries. A committee composed of 21 members from fishing groups, processor groups, Alaska communities, environmental advocacy groups, and NMFS representatives met to recommend conservation measures for Steller sea lions and to develop a "preferred alternative" for the SEIS. Although consensus was not reached, a "preferred alternative" was identified and included in the SEIS. The preferred alternative included complicated, area-specific management measures (e.g., area restrictions and closures) designed to reduce direct and indirect interactions between the Atka mackerel, pollock, and Pacific cod fisheries and Steller sea lions, particularly in waters within 10 nmi of haulouts and rookeries. The suite of conservation measures, which were implemented in 2002, were developed after working with the: 1) State of Alaska to explore whether there are potential adverse effects of state fisheries on Steller sea lions, and 2) the North Pacific Fishery Management Council (Council) to further minimize overcapitalization of fisheries and concentration of fisheries in time and space. NMFS reinitiated consultation on the groundfish fisheries in 2006 and expects to finalize the BO in fall 2008.

NMFS reconstituted the Steller Sea Lion Recovery Team in 2002 to write a recovery plan for the eastern and western U.S. stocks. The Team's draft plan was reviewed by five independent reviewers in February 2006, prior to its delivery to NMFS, who then released the Plan for public review in May 2006. NMFS addressed the peer and public review comments and released the second draft Plan for another round of public and independent peer (one by the Council of Independent Experts and another commissioned by the Council) review in May 2007.

CITATIONS

Albers, P. H., and T. R. Loughlin. 2003. Effects of PAHs on marine birds, mammals, and reptiles. Pp. 243-261 *In*: P. E. T. Douben (ed.) PAHs: An ecotoxicological perspective. John Wiley and Sons, London.

Baker, A. R., T. R. Loughlin, V. Burkanov, C. W. Matson, T. G. Trujillo, D. G. Calkins, J. K. Wickliffe, and J. W. Bickham. 2005. Variation of mitochondrial control region sequences of Steller sea lions: the three-stock hypothesis. J. Mammal. 86:1075-1084.

Bickham, J. W., J. C. Patton, and T. R. Loughlin. 1996. High variability for control-region sequences in a marine mammal: Implications for conservation and biogeography of Steller sea lions (*Eumetopias jubatus*). J. Mammal. 77:95-108.

Braham, H. W., R. D. Everitt, and D. J. Rugh. 1980. Northern sea lion decline in the eastern Aleutian Islands. J. Wildl. Manage. 44:25-33.

Burek, K. A., F. M. D. Gulland, G. Sheffield, K. B. Beckmen, E. Keyes, T. R. Spraker, A. W. Smith, D. E. Skilling, J. F. Evermann, J. L. Stott, J. T. Saliki, and A. W. Trites. 2005. Infectious disease and the decline of the Steller sea lions (*Eumetopias jubatus*) in Alaska, USA: insights from serologic data. J. Wildl. Dis. 41(3):512-524.

Burkanov, V., and T. R. Loughlin. 2005. Distribution and abundance of Steller sea lions on the Asian coast, 1720's – 2005. Mar. Fish. Rev. 67(2):1-62.

Byrd, G. V. 1989. Observations of northern sea lions at Ugamak, Buldir, and Agattu Islands, Alaska in 1989. Unpubl. rep., U.S. Fish and Wildlife Service. Alaska Maritime National Wildlife Refuge, P.O. Box 5251, NSA Adak, FPO Seattle, WA 98791.

Calkins, D. G., and K. W. Pitcher. 1982. Population assessment, ecology and trophic relationships of Steller sea lions in the Gulf of Alaska. Environmental Assessment of the Alaskan Continental Shelf. Final reports 19:455-546.

Calkins, D. G. 1985. Steller sea lion entanglement in marine debris. Pp. 308-314 *In* R. S. Shomura and H. O. Yoshida (editors), Proceedings of the workshop on the fate and impact of marine debris, 27-29 November 1984, Honolulu, Hawaii. U. S. Dep. Commer., NOAA Technical Memo. NMFS-SWFC-54.

Calkins, D. G., E. Becker, T. R. Spraker, and T. R. Loughlin. 1994. Impacts on Steller sea lions. Pp. 119-139 *In* T. R. Loughlin (ed.), Marine Mammals and the *Exxon Valdez*. Academic Press, N.Y.

DeMaster, D. P., A. W. Trites, P. Clapham, S. Mizroch, P. Wade, R. J. Small, and J. V. Hoef. 2006. The sequential megafaunal collapse hypothesis: Testing with existing data. Prog. Oceanogr. 68(2-4): 329-342.

Dillingham, P. W., J. R. Skalski, and K. E. Ryding. 2006. Fine-scale geographic interactions between Steller sea lion (*Eumetopias jubatus*) trends and local fisheries. Can. J. Fish. Aquat. Sci. 63:107-119.

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conserv. Biol. 6:24-36.

Fritz, L. W., and Ferrero, R. C. 1998. Options in Steller sea lion recovery and groundfish fishery management. Biosphere Conserv. 1(1): 7–19.

Fritz, L. W., and E. S. Brown. 2005. Survey-and fishery-derived estimates of Pacific cod (*Gadus macrocephalus*) biomass: implications for strategies to reduce interactions between groundfish fisheries and Steller sea lions (*Eumetopias jubatus*). Fish. Bull. 103:501-515.

Fritz, L. W., and S. Hinckley. 2005. A critical review of the regime shift -"junk food"- nutritional stress hypothesis for the decline of the western stock of Steller sea lion. Mar. Mamm. Sci. 21(3):476-518.

Fritz, L. W., and C. Stinchcomb. 2005. Aerial, ship and land-based surveys of Steller sea lions (*Eumetopias jubatus*) in the western stock in Alaska, June and July 2003 and 2004. U. S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-153. 56 pp.

Fritz, L., T. Gelatt, M. Lynn, and W. Perryman. 2006. Survey of adult and juvenile Steller sea lions, June 2006. Memorandum for the Record, September 25, 2006, Available AFSC, National Marine Mammal Laboratory, NOAA, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115. 9 pp.

Haynes, T. L., and C. Mishler. 1991. The subsistence harvest and use of Steller sea lions in Alaska. Alaska Dep. Fish and Game Technical Paper No. 198, 44 pp.

Hennen, D. R. 2004. The Steller sea lion (*Eumetopias jubatus*) decline and the Gulf of Alaska/Bering Sea commercial fishery. Unpubl. Ph.D. dissertation, Montana State University, Bozeman, MT. 224 pp.

Hoffman, J. I., C. W. Matson, W. Amos, T. R. Loughlin, and J. W. Bickham. 2006. Deep genetic subdivision within a continuously distributed and highly vagile marine mammal, the Steller's sea lion (*Eumetopias jubatus*). Mol. Ecol. 15:2821-2832.

Holmes, E. E., and A. E. York. 2003. Using age structure to detect impacts on threatened populations case study using Steller sea lions. Cons. Biol. 17:1794-1806.

Kucey, L. 2005. Human disturbance and the hauling out behaviour of Steller sea lions (*Eumetopias jubatus*). M.Sc. thesis, University of British Columbia, Vancouver. 67 pp.

Kucey, L., and A.W. Trites. 2006. A review of the potential effects of disturbance on sea lions: assessing response and recovery. *In* A.W. Trites, S. Atkinson, D.P. DeMaster, L.W. Fritz, T.S. Gelatt, L.D. Rea, and K. Wynne (eds.) Sea lions of the World, Alaska Sea Grant Program AK-SG-06-01.

Lee, J. S., S. Tanabe, H. Umino, R. Tatsukawa, T. R. Loughlin and D. C. Calkins. 1996. Persistent organochlorines in Steller sea lion (*Eumetopias jubatus*) from the bulk of Alaska and the Bering Sea, 1976-1981. Mar. Pollut. Bull. 32(7):535-544.

Lestenkof, A. D., and P. A. Zavadil. 2006. 2005 subsistence harvest of Steller sea lion on St. Paul Island. Memorandum for the Record, August 31, 2006, Aleut Community of St. Paul, Tribal Government, Ecosystem Conservation Office. St. Paul Island, Pribilof Islands, Alaska.

Lestenkof, A. D., P. A. Zavadil, and M. T. Williams. 2003. The subsistence harvest of Steller sea lions on St. Paul Island in 2001. Unpublished report. Available from Aleut Community of St. Paul, Tribal Government, Ecosystem Conservation Office. St. Paul Island, Pribilof Islands, Alaska.

Loughlin, T. R. 1997. Using the phylogeographic method to identify Steller sea lion stocks. Pp. 329-341 *In* A. Dizon, S. J. Chivers, and W. Perrin (eds.), Molecular genetics of marine mammals, incorporating the proceedings of a workshop on the analysis of genetic data to address problems of stock identity as related to management of marine mammals. Soc. Mar. Mammal., Spec. Rep. No. 3.

Loughlin, T. R., D. J. Rugh, and C. H. Fiscus. 1984. Northern sea lion distribution and abundance: 1956-1980. J. Wildl. Manage. 48:729-740.

Loughlin, T.R., and A.E. York. 2000. An accounting of the sources of Steller sea lion mortality. Mar. Fish. Rev. 62(4):40-45.

Manly, B. F. J. In review. Incidental catch and interactions of marine mammals and birds in the Cook Inlet salmon driftnet and setnet fisheries, 1999-2000. Draft report to NMFS Alaska Region. 83 pp.

Manly, B. F. J., A. S. Van Atten, K. J. Kuletz, and C. Nations. 2003. Incidental catch of marine mammals and birds in the Kodiak Island set gillnet fishery in 2002. Final report to NMFS Alaska Region. 91 pp.

Merrick, R. L., T. R. Loughlin, and D. G. Calkins. 1987. Decline in abundance of the northern sea lion, *Eumetopias jubatus*, in 1956-86. Fish. Bull., U.S. 85:351-365.

National Marine Fisheries Service. 1995. Status review of the United States Steller sea lion (*Eumetopias jubatus*) population. Prepared by the National Marine Mammal Laboratory, AFSC, NMFS, NOAA, 7600 Sand Point Way NE, Seattle, WA 98115. 61 pp.

National Marine Fisheries Service. 2001. Endangered Species Act, Section 7 Consultation Biological Opinion and Incidental Take Statement on the authorization of the Bering Sea/Aleutian Islands and Gulf of Alaska Groundfish Fishery Management Plan Amendments 61and 70. NMFS Alaska Region, Protected Resources Division, Juneau, AK.

National Marine Fisheries Service. 2003. Supplement to the Endangered Species Act, Section 7 Consultation, Biological Opinion and Incidental Take Statement of October 2001. NMFS Alaska Region, Protected Resources Division. Juneau AK. 179 pp.

National Marine Fisheries Service. 2006. Draft Revised Recovery Plan for the Steller sea lion (*Eumetopias jubatus*). National Marine Fisheries Service, Silver Spring, MD. 285 pp.

Nikulin, V. S., and V. N. Burkanov. 2000. Species composition of marine mammal by-catch during Japanese driftnet salmon fishery in southwestern Bering Sea. Unpubl. manuscript, 2 pp. Available, National Marine Mammal Laboratory, AFSC, 7600 Sand Point Way, NE, Seattle, WA 98115.

Perez, M. A. 2006. Analysis of marine mammal bycatch data from the trawl, longline, and pot groundfish fisheries of Alaska, 1998-2004, defined by geographic area, gear type, and target groundfish catch species. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-167.

Perez, M. A. Unpubl. ms. Bycatch of marine mammals by the groundfish fisheries in the U.S. EEZ of Alaska, 2005. 67 pp. Available NMML-AFSC.

Sease, J. L., W. P. Taylor, T. R. Loughlin, and K. W. Pitcher. 2001. Aerial and land-based surveys of Steller sea lions (*Eumetopias jubatus*) in Alaska, June and July 1999 and 2000. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-122, 52 pp.

Springer, A. M., J. A. Estes, G. B. van Vliet, T. M. Williams, D. F. Doak, E. M. Danner, K.A. Forney and B. Pfister. 2003. Sequential megafaunal collapse in the North Pacific Ocean: an ongoing legacy of industrial whaling? Proc. Natl. Acad. Sci. 100: 12223-12228.

Trites, A. W., and C. P. Donnelly. 2003. The decline of Steller sea lions in Alaska: a review of the nutritional stress hypothesis. Mamm. Rev. 33: 3-28.

Trites, A. W., V. B. Deecke, E. J. Gregr, J. K. B. Ford, and P. F. Olesiuk. 2007. Killer whales, whaling and sequential megafaunal collapse in the North Pacific: a comparative analysis of the dynamics of marine mammals in Alaska and British Columbia following commercial whaling. Mar. Mamm. Sci. 23(4):751-765.

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

Williams, T. M., J. A. Estes, D. F. Doak, and A. M. Springer. 2004. Killer appetites: assessing the role of predators in ecological communities. Ecology 85(12):3373-3384.

Wolfe, R. J., J. A. Fall, and R. T. Stanek. 2002. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 2001. Alaska Dep. Fish and Game, Division of Subsistence Technical Paper No. 273. Juneau, AK.

Wolfe, R. J., J. A. Fall, and R. T. Stanek. 2003. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 2002. Alaska Dep. Fish and Game, Division of Subsistence Technical Paper No. 277. Juneau, AK.

Wolfe, R. J., J. A. Fall, and R. T. Stanek. 2004. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 2003. Alaska Dep. Fish and Game, Division of Subsistence Technical Paper No. 291. Juneau, AK.

Wolfe, R. J., J. A. Fall, and R. T. Stanek. 2005. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 2004. Alaska Dep. Fish and Game, Juneau, AK, Subsistence Div. Tech. Paper No. 303. Juneau, AK.

Wolfe, R. J., J. A. Fall, and R. T. Stanek. 2006. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 2005. Alaska Dep. Fish and Game, Juneau, AK, Subsistence Div. Tech. Paper No. 319. Juneau, AK.

Wynne, K. M., D. Hicks, and N. Munro. 1991. 1990 salmon gillnet fisheries observer programs in Prince William Sound and South Unimak Alaska. Annual Rept. NMFS/NOAA Contract 50ABNF000036. 65 pp. NMFS, Alaska Region, Office of Marine Mammals, P.O. Box 21668, Juneau, AK 99802.

Wynne, K. M., D. Hicks, and N. Munro. 1992. 1991 Marine mammal observer program for the salmon driftnet fishery of Prince William Sound Alaska. Annual Rept. NMFS/NOAA Contract 50ABNF000036. 53 pp. NMFS, Alaska Region, Office of Marine Mammals, P.O. Box 21668, Juneau, AK 99802.

York, A. E., R. L. Merrick, and T. R. Loughlin. 1996. An analysis of the Steller sea lion metapopulation in Alaska. Chapter 12, Pp. 259-292 *In* D. R. McCullough (ed.), Metapopulations and wildlife conservation. Island Press, Covelo, California.

Zavadil, P. A., A. D. Lestenkof, M. T. Williams, and S. A. MacLean. 2003. The subsistence harvest of Steller sea lions on St. Paul Island in 2002. Unpublished report. Available from Aleut Community of St. Paul Island, Tribal Government, Ecosystem Conservation Office. St. Paul Island, Pribilof Islands, Alaska.

Zavadil, P. A., A. D. Lestenkof, D. Jones, P. G. Tetof, and M. T. Williams. 2004. The subsistence harvest of Steller sea lions on St. Paul Island in 2003. Unpublished report. Available from Aleut Community of St. Paul Island, Tribal Government, Ecosystem Conservation Office. St. Paul Island, Pribilof Islands, Alaska.

Zavadil, P.A., D. Jones, A. D. Lestenkof, P. G. Tetoff, and B. W. Robson. 2005. The subsistence harvest of Steller sea lions on St. Paul Island in 2004. Unpublished report. Available from Aleut Community of St. Paul Island, Tribal Government, Ecosystem Conservation Office. St. Paul Island, Pribilof Islands, Alaska.