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STELLER SEA LION (*Eumetopias jubatus*): Eastern 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).

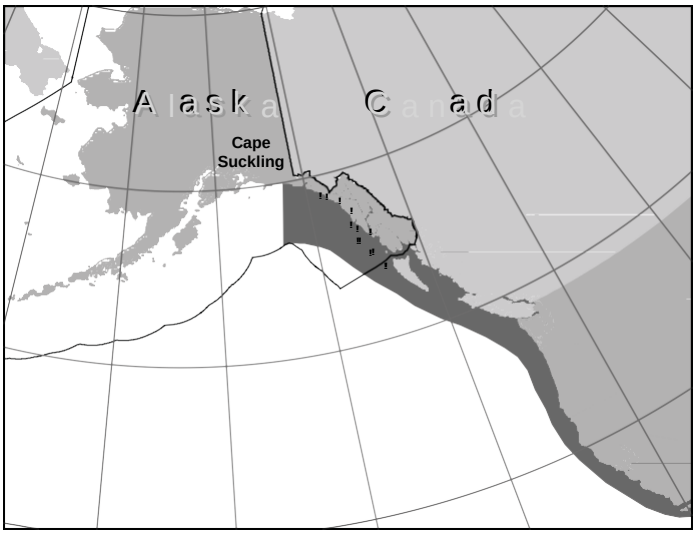

Figure 3. Approximate distribution of Steller sea lions in the eastern U.S. stock (shaded area). Major haulouts and rookeries are also depicted (points). Note: Haulouts and rookeries in British Columbia are not shown.

Loughlin (1997) considered the following information when classifying stock structure based upon 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. 3).

POPULATION SIZE

The eastern stock of Steller sea lions breeds on rookeries located in southeast Alaska, British Columbia, Oregon, and California; there are no rookeries located in Washington. Counts of pups on rookeries conducted near the end of the birthing season are nearly complete counts of pup production. Calkins and Pitcher (1982) concluded that the total Steller sea lion population could be estimated by multiplying the pup counts by a factor of 4.5, which was based on the birth rate, and the sex and age structure of the western Steller sea lion population in the central Gulf of Alaska. Using the most recent (2002) pup counts from aerial surveys from across the range of the eastern stock, the total population of the eastern stock of Steller sea lions is estimated to be 44,996. This is based on multiplying the total number of pups counted in southeast Alaska (4,877; Pitcher, ADF&G, unpublished data), British Columbia (3,281; Pitcher, ADF&G, unpublished data), Oregon (1,128; Pitcher, ADF&G, unpublished data), and California (713; Pitcher, ADF&G, unpublished data) by 4.5. This is not a minimum population estimate, since it is extrapolated from pup counts from photographs taken in 2002, and demographic parameters of a stable non-pup population that were estimated for the western Steller sea lion in the mid-1970s (Calkins and Pitcher 1982).

The 4.5 multiplier is used for estimating the size of the eastern stock of Steller sea lions, but not the western stock. The 4.5 multiplier is based on a life history table using age-specific fecundity and survival for a stable population. Clearly, because the western stock has declined drastically, the assumption of a stable population is not valid. Because the eastern stock is increasing within most of its range, using the 4.5 multiplier is a reasonable approach to estimating abundance from pup counts.

Minimum Population Estimate

The minimum population estimate will be calculated by adding non-pup counts from 2002 (not trend counts) from Southeast Alaska (15,283), 1996 from WA/OR/CA (6,555), Canada counts from 1998 (11,891), and pup counts from throughout the range from 2002 (9,999), which results in an N_{MIN} for the eastern U. S. stock of Steller sea lions of 43,728. This count has not been corrected for animals which were at sea.

Current Population Trend

Trend counts (an index to examine population trends) for Steller sea lions in Oregon were relatively stable in the 1980s, with uncorrected counts in the range of 2,000-3,000 sea lions (NMFS 1992). Counts in Oregon have shown a gradual increase since 1976, as the adult and juvenile state-wide count for that year was 1,486 compared to 3,648 in 2001 (Brown and Reimer 1992; Brown et al. 2002).

Steller sea lion numbers in California, especially in southern and central California, have declined from historic numbers. Counts in California between 1927 and 1947 ranged between 5,000 and 7,000 non-pups with no apparent trend, but have subsequently declined by over 50%, remaining between 1,500 and 2,000 non-pups during 1980-2001. Limited information suggests that counts in northern California appear to be stable (NMFS 1995). At Año Nuevo Island off central California, a steady decline in ground counts started around 1970, resulting in an 85% reduction in the breeding population by 1987 (LeBoeuf et al. 1991). In vertical aerial photographic counts conducted at Año Nuevo, pups declined at a rate of 9.9% from 1990 to 1993, while non-pups declined at a rate of 31.5% over the same time period (Westlake et al. 1997). Pup counts at Año Nuevo have been steadily declining at about 5% annually since 1990 (W. Perryman, NMFS-SWFSC, pers. comm.). The most recent pup counts at Año Nuevo and the Farallons are 349 in 2000 and 287 in 2001 (M. Lowry, NMFS-SWFSC, pers. comm.). Overall, counts of non-pups at trend sites in California and Oregon have been relatively stable since the 1980s (Table 4, Fig. 4).

In Southeast Alaska, counts (no correction factors applied) of non-pups at trend sites increased by 56% from 1979-2002 from 6,376 to 9,951 (Merrick et al. 1992; Sease et al. 2001; K. Pitcher, ADF&G, pers. comm.). During 1979-2001, counts of pups on the three rookeries in Southeast Alaska increased a total of 114%. In British Columbia, counts of non-pups throughout the Province increased at a rate of 2.8% annually during 1971-98 (Table 4, Fig. 4; P. Olesiuk, Pacific Biological Station, Canada, pers. comm.). Counts of non-pups at trend sites throughout the range of the eastern U. S. Steller sea lion stock are shown in Figure 4.

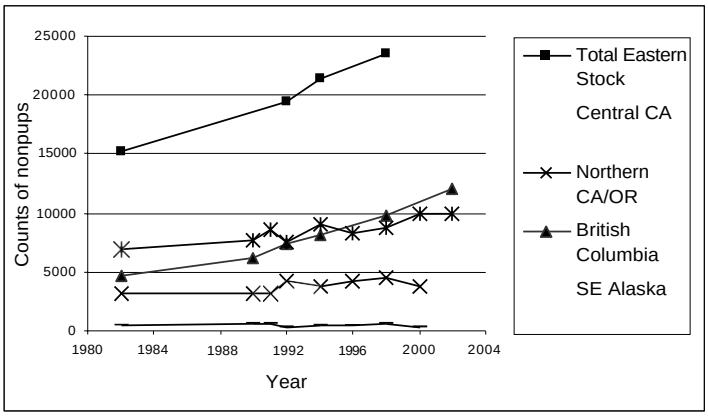

Figure 4. Counts of adult and juvenile Steller sea lions at rookery and haulout trend sites throughout the range of the eastern U.S. stock, 1982-2003. Data from British Columbia include all sites.

Table 4. Counts of adult and juvenile Steller sea lions observed at rookery and haulout trend sites by year and geographical area for the eastern U. S. stock from the 1982 through 2002 (NMFS 1995, Strick et al. 1997, Sease et al. 1999, Sease and Loughlin 1999; Olesiuk 2003; ODF&W unpubl. data, 7118 NE Vandenberg Ave., Corvallis, OR 97330; Point Reyes Bird Observatory, unpubl. data, 4990 Shoreline Hwy., Stinson Beach, CA 94970; Sease et al. 2001). Central California data include only Año Nuevo and Farallon Islands. Trend site counts in northern California/Oregon include St. George, Rogue, and Orford Reefs. British Columbia data include counts from all sites.

Area	1982	1990	1991	1992	1994	1996	1998	2000	2002
Central CA	511[1]	655	537	276	508	382	564	349	N/A
Northern CA/OR	3,094	3,088	3,180	4,274	3,831	4,192	4,464	3,793	N/A
British Columbia	4,726	6,122[2]	no data	7,378	8,104	no data	9,818	N/A	12,121
Southeast Alaska	6,898	7,629	8,621	7,555	9,001	8,231	8,693	9,892	9,951
Total	15,229	--	--	19,483	21,444	--	23,539	N/A	N/A

[1] This count includes a 1983 count from Año Nuevo. [2] This count was conducted in 1987.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no estimates of maximum net productivity rates for Steller sea lions. Hence, until additional data become available, it is recommended that the pinniped maximum theoretical net productivity rate (R_{MAX}) 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: $PBR = N_{MIN} + 0.5R_{MAX} + F_R$. The default recovery factor (F_R) for stocks listed as "threatened" under the Endangered Species Act (ESA) is 0.5 (Wade and Angliss 1997). However, as total population estimates for the eastern U. S. stock have remained stable or increased over the last 20 years, the recovery factor is set at 0.75; midway between 0.5 (recovery factor for a "threatened" stock) and 1.0 (recovery factor for a stock within its optimal sustainable population level). This approach is consistent with recommendations of the Alaska Scientific Review Group. Thus, for the eastern U. S. stock of Steller sea lions, PBR = 1,967 animals (43,728 + 0.06 + 0.75).

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 and 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 six 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.

Fishery observers monitored four commercial fisheries during the period from 1990 to 2003 in which Steller sea lions from this stock were taken incidentally: the California (CA)/Oregon (OR) thresher shark and swordfish drift gillnet, WA/OR/CA groundfish trawl, Northern Washington (WA) marine set gillnet, and Gulf of Alaska sablefish longline fisheries. The best data available on the rates of serious injury and mortality incidental to these fisheries is presented in Table 5 (Perez in review). There have been no observed serious injuries or mortalities incidental to the CA/OR thresher shark and swordfish drift gillnet fishery in recent years (Carretta 2002, Carretta and Chivers 2003, Carretta and Chivers 2004). In the WA/OR/CA groundfish trawl one Steller sea lion was observed killed in each year in 2001-03; these observed takes in combination with a mortality that occurred in an unmonitored haul resulted in a mean estimated annual mortality level of 0.6 (Table 5). No data are available after 1998 for the northern Washington marine set gillnet fishery. One Steller sea lion mortality was observed in the Gulf of Alaska sablefish longline in 2000. These mortalities result in a mean annual mortality rate of 1.97 (CV = 0.64) Steller sea lions. No mortalities were reported by fishery observers monitoring drift gillnet and set gillnet fisheries in Washington and Oregon this decade; though, mortalities have been reported in the past.

Table 5. Summary of incidental mortality of Steller sea lions (eastern U. S. stock) due to commercial and tribal fisheries from 1990 to 2003 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from self-reported fisheries information or stranding data. Data from 1997 to 2001 (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. * indicates a mortality seen by an observer, but during an unmonitored haul; because the haul was not monitored, no extrapolation can be done. ** Aquaculture facilities are no longer permitted to shoot Steller sea lions.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Gulf of Alaska sablefish longline	1999	obs data	5.0	0	0	1.37 (CV = 0.92)
	2000		6.0	1	7	
	2001		5.9	0	0	
	2002		6.1	0	0	
	2003		4.1	0	0	

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
WA/OR/CA groundfish trawl (Pacific whiting component)	1999 2000 2001 2002 2003	obs data	68.5 80.3 96.2 66.8 85.5	0 0 1 1 1	0 1* 1 1 1	0.8 (CV = 0.02)
Northern WA marine set gillnet (tribal fishery)	99-03	obs data		0	0	0
Observer program total						2.17 (CV = 0.64)
				Reported mortalities		
Southeast Alaska salmon drift gillnet	90-03	self reports	N/A	0, 1, 2, 2, N/A, N/A, N/A, N/A, N/A, N/A, N/A,	N/A	[Ķ1.25]
Alaska salmon troll	92-03	strand data	N/A	0, 0, 0, 1, 0, 0, N/A, N/A, 1, 1, N/A, N/A	N/A	[Ķ0.4]
British Columbia aquaculture predator control program	1999 2000 2001 2002 2003	permit reports	N/A	91 50 27 15 N/A**	N/A	0
Minimum total annual incidental mortality (estimate from observer programs plus estimates from self reports and stranding data; see text)						3.82 (CV = 0.64)

An additional source of information on the number of Steller sea lions killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the period between 1990 and 2003, fisher self-reports from the Southeast Alaska salmon drift gillnet fishery (Table 5) resulted in an annual mean of 1.25 mortalities from interactions with commercial fishing gear. This total is based on all available fisher self-reports for U. S. fisheries within the range of the stock, except the three fisheries for which observer data were presented above. 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. During 1990, 11 Steller sea lion injuries incidental to the Alaska salmon troll fishery and 1 Steller sea lion injury incidental to the CA/OR/WA salmon troll fishery were reported. These injuries were not deemed serious (Angliss and DeMaster 1998) and have not been included in the Table 5. Logbook data are available for part of 1989-1994, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-95 phase-in period are fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 for details).

Strandings of Steller sea lions provide additional information on the level of fishery-related mortality. Estimates of fishery-related mortality from stranding data are considered minimum estimates because not all entangled animals strand, and not all stranded animals are found or reported. In Alaska, during the 5-year period from 1999-2003, there were two situations where a flasher was seen in a Steller sea lion's mouth and one situation where line was hanging from an animal's mouth (NMFS Alaska Region unpublished data). It is not clear whether entanglements with "flashers" involved the recreational or commercial component of the salmon troll fishery. Based on Angliss and DeMaster (1998), it is appropriate to call these entanglements "serious injuries". Based on Alaska stranding records, this information indicates a rate of incidental mortality of at least 0.4/year from the troll fishery. There were no fishery-related strandings of Steller sea lions in Washington, Oregon, or California between 1999-2003.

Due to limited observer program coverage, no data exist on the mortality of marine mammals incidental to Canadian commercial fisheries (i.e., those similar to U.S. fisheries known to take Steller sea lions). As a result, the number of Steller sea lions taken in Canadian waters is not known.

The minimum estimated mortality rate incidental to commercial fisheries (both U.S. and Canadian) is 4.22 sea lions per year, based on observer data (2.17), self-reported fisheries information (1.65), and stranding data (0.4).

Subsistence/Native Harvest Information

The subsistence harvest of Steller sea lions during 2000-03 is summarized in Wolfe et al. (2004). During 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. Approximately 16 of the interviewed communities lie within the range of the eastern U.S. stock. The average number of animals harvested and struck but lost is 4 animals/year (Table 6).

An unknown number of Steller sea lions from this stock are harvested by subsistence hunters in Canada. The magnitude of the Canadian subsistence harvest is believed to be small. Alaska Native subsistence hunters have initiated discussions with Canadian hunters to quantify their respective subsistence harvests, and to identify any effect these harvests may have on the cooperative management process.

Table 6. Summary of the subsistence harvest data for the eastern stock of Steller sea lions, 2000-03 (Wolfe et al. 2004). The number harvested and number struck and lost do not sum to the estimated number taken due to rounding error.

Year	Estimated total number taken	Number harvested	Number struck and lost
2000	2	2	0
2001	0	0	0
2002	7	7	0
2003	7	2	4
Mean annual take (2000-03)	4	2	1

Other Mortality

Illegal shooting of sea lions in U.S. waters was thought to be a potentially significant source of mortality prior to the listing of sea lions as "threatened" under the 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 hunting by Alaska Natives or where imminently necessary to protect human life). Records from NMFS enforcement indicate that there were 2 cases of illegal shootings of Steller sea lions in Southeast Alaska between 1995 and 1999: the cases involved the illegal shooting of one Steller sea lion near Sitka, and 3 Steller sea lions in Petersburg. Both cases were successfully prosecuted (NMFS, Alaska Enforcement Division). For Alaska, NMFS enforcement records provide an indication of the number of Steller sea lions that were illegally shot: no records of illegal shooting of Steller sea lions from the eastern stock are listed in the NMFS enforcement records for 1999-2003 (NMFS, unpublished data).

Steller sea lions are taken in British Columbia during commercial salmon farming operations (Table 5). Preliminary figures from the British Columbia Aquaculture Predator Control Program indicated a mean annual mortality of 45.75 Steller sea lions from this stock over the period from 1999-2003 (Olesiuk 2004). As of 2004, aquaculture facilities are no longer permitted to shoot Steller sea lions (P. Olesiuk, Pacific Biological Station, Canada, pers. comm.).

Strandings of Steller sea lions with gunshot wounds do occur, along with strandings of animals entangled in material that is not fishery-related. During the period from 1999-2003 strandings of animals with gunshot wounds from this stock occurred in Oregon and Washington in 1999 (2 animals) resulting in an estimated annual mortality of 0.2 Steller sea lions from this stock during 1999-2003. This estimate is considered a minimum because not all stranded animals are found, reported, or cause of death determined (via necropsy by trained personnel). In addition, human-related stranding data are not available for British Columbia. Reports of stranded animals in Alaska with gunshot wounds have not been included in the above estimates because it is not possible to tell whether the animal was illegally shot or if the animal was struck and lost by subsistence hunters (in which case the mortality would have been legal and accounted for in the subsistence harvest estimate).

Stranding data may also provide information on additional sources of potential human-related mortality. In 2000, 3 Steller sea lions were sighted entangled in some kind of rope or line that was not necessarily related to a commercial or recreational fishery and one animal was seen entangled in a 14-inch tire. All of these animals were alive when sighted; the animal entangled in the tire was successfully released. In 2001, one Steller sea lion was observed with a propeller or head injury. In 2003, one Steller sea lion was observed with a piece of cargo net around its neck. If the number of interactions (6) is averaged over 5 years, the "other" interaction rate would be a minimum of 1.1 animals per year.

STATUS OF STOCK

Based on currently available data, the minimum estimated fishery mortality and serious injury for this stock (2.17 + 1.65 + 0.4 + 1.1 = 5.32) is less than that 10% of the calculated PBR (197) and, therefore, can be considered to be insignificant and approaching a zero mortality and serious injury rate. The estimated annual level of total human-caused mortality and serious injury from fishery interactions and subsistence harvests (4.02 + 4 + 1.1 = 9.12) does not exceed the PBR (1967) for this stock. The eastern U.S. stock of Steller sea lion is currently listed as "threatened" under the ESA, and therefore designated as "depleted" under the MMPA. As a result, this stock is classified as a strategic stock. Although the stock size has increased in recent years, the status of this stock relative to its Optimum Sustainable Population size is unknown.

Habitat Concerns

Unlike the observed decline in the western U. S. stock of Steller sea lion there has not been a concomitant decline in the eastern U. S. stock. The eastern U. S. stock is stable or increasing throughout the northern portion of its range (Southeast Alaska and British Columbia). The stock has been declining in the southern end of its range (see Current Population Trend; Fig. 4), where habitat concerns include reduced prey availability, contaminants, and disease (Sydeman and Allen 1997).

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