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); however, resighting data from branded animals have not yet been analyzed.

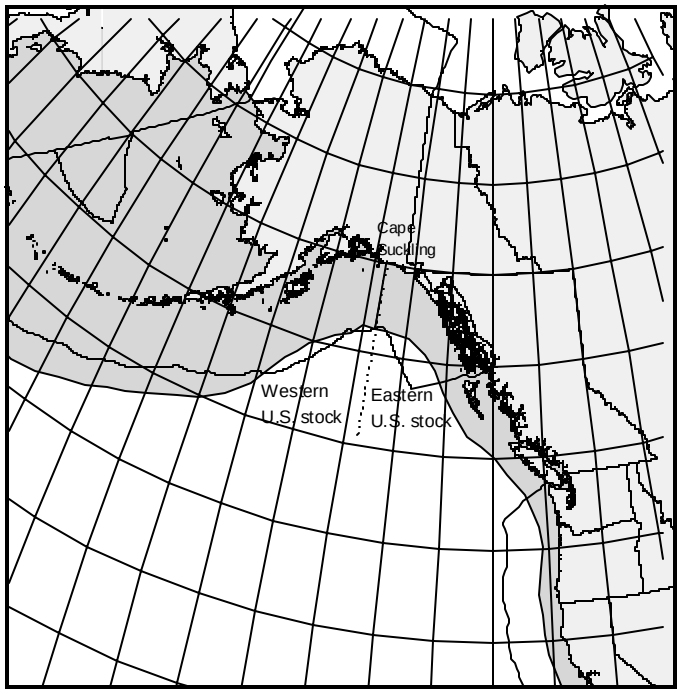

Figure 3. Approximate distribution of Steller sea lions in the eastern North Pacific (shaded area).

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 most recent estimate of Steller sea lion abundance in Southeast Alaska is based on aerial surveys performed in June 1996 (Sease et al. 1999). Data from these surveys represent actual counts of pups and nonpups at all rookeries and major haulout sites in Southeast Alaska. In 1996 a total of 14,571 Steller sea lions were counted in Southeast Alaska, including 10,857 nonpups and 3,714 pups. Aerial surveys and ground counts of California, Oregon, and Washington rookeries and major haulout sites were also conducted during the summer of 1996 (NMFS unpubl. data, National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115; Southwest Fisheries Science Center, P. O. Box 271, La Jolla, CA 90238; ODF&W unpubl. data, Marine Science Drive, Newport, OR 97365). In 1996 a total of 6,555 Steller sea lions were counted in California (2,042), Oregon (3,990), and Washington (523), including 5,464 nonpups and 1,091 pups.

The eastern U. S. stock of Steller sea lions is a transboundary stock, including sea lions from British Columbia rookeries (see Wade and Angliss 1997 for discussion of transboundary stocks). Aerial surveys were last conducted in British Columbia during 1994 and produced counts of 8,091 nonpups and 1,186 pups, for a total count of 9,277 (Dept. Fisheries and Oceans, unpubl. data, Pacific Biological Station, Nanaimo, BC, V9R 5K6). Complete count data are not available for British Columbia in 1996. However, because the number of Steller sea lions in British Columbia is thought to have increased since 1994 (P. Olesiuk, pers. comm., Pacific Biological Station, Nanaimo, BC, V9R 5K6), the 1994 counts represent a conservative estimate for the 1996 counts. Combining the total counts for the three regions results in a minimum estimated abundance of 30,403 (14,571 + 6,555 + 9,277) Steller sea lions in this stock in 1996. The abundance

estimate for the eastern U. S. stock is based on counts of all animals (pup and nonpup) at all sites and has not corrected for animals missed because they were at sea. A reliable correction factor to account for these animals is currently not available, as it is for the western U. S. stock (J. Sease, pers. comm., National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115). As a result, this represents an underestimate for the total abundance of Steller sea lions in this stock.

A range wide survey for Steller sea lions was planned for summer of 1998, but due to unforseen circumstances the survey of Southeast Alaska was incomplete. As a result, the abundance estimate for this stock has not been revised even though data from 1998 surveys are available in the California to British Columbia portion of this stock's range. The 1998 survey data will be used in conjunction with 1999 counts from Southeast Alaska to revise the abundance estimate for this stock.

Minimum Population Estimate

The 1996 total count (30,403) will be used as the minimum population estimate (N_{MIN}) for the eastern U. S. stock of Steller sea lions (Wade and Angliss 1997). Recall that this count has not been corrected for animals which were at sea, and also utilizes the 1994 data from British Columbia where Steller sea lion numbers are thought to have increased since 1994.

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 3,971 for 1998 (Brown and Reimer 1992; ODF&W unpubl. data, 7118 NE Vandenberg Ave., Corvallis, OR 97330). This increase may be an artifact of improved surveys in recent years (NMFS 1995).

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 to 2,000 non-pups during 1980-98. Limited information suggests that counts in northern California appear to be stable (NMFS 1995). At Año Nuevo, (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, pers. comm., Southwest Fisheries Science Center, P. O. Box 271, La Jolla, CA, 92038). Overall, counts of nonpups at trend sites in California and Oregon have been relatively stable since the 1980s (Table 3, Fig. 4).

In Southeast Alaska, counts (no correction factors applied) of non-pups at trend sites increased by 28% during 1979-96 from 6,376 to 8,181 (NMFS 1995, Sease et al. 1999). During 1979-97, counts of pups on the three rookeries in Southeast Alaska increased by an average of 5.9% per year. Since 1989 pup counts on the three rookeries increased at a lower rate (+1.7% per year) than for the entire period (Calkins et al. In press). In British Columbia, counts (no correction factors applied) of non-pups throughout the Province increased at a rate of 2.8% annually during 1971-98 (Table 3, Fig. 4; P. Olesiuk, pers. comm., Pacific Biological

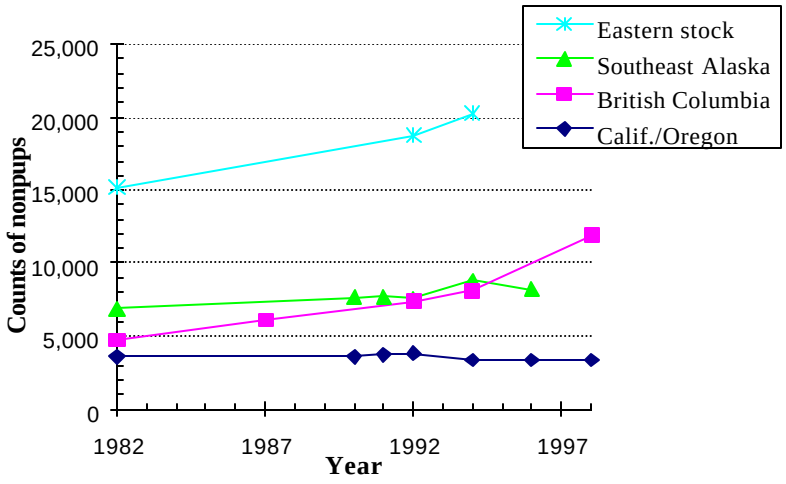

Figure 4. Counts of adult and juvenile Steller sea lions at rookery and haulout trend sites throughout the range of the eastern U. S. stock, 1982-98. Data from British Columbia include all sites.

Station, Nanaimo, BC, V9R 5K6). Counts of nonpups at trend sites throughout the range of the eastern U. S. Steller sea lion stock are shown in Figure 4.

Table 3. 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 1998 (NMFS 1995, Strick et al. 1997, Sease et al. 1999, Sease and Loughlin 1999; P. Olesiuk, unpubl. data, Pacific Biological Station, Nanaimo, BC, V9R 5K6; ODF&W unpubl. data, 7118 NE Vandenberg Ave., Corvallis, OR 97330; Point Reyes Bird Observatory, unpubl. data, 4990 Shoreline Hwy., Stinson Beach, CA 94970). Central California data include only Año Nuevo and Farallon Island. 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
Central CA	511[1]	655	537	276	512	385	208
Northern CA/OR	3,094	2,922	3,180	3,544	2,834	2,988	3,175
British Columbia	4,711	6,109[2]	no data	7,376	8,091	no data	9,818
Southeast Alaska	6,898	7,629	7,715	7,558	8,826	8,231	8,693
Total	15,214	--	--	18,754	20,263	--	21,864

[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 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: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. 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 =1,368 animals ($30,403 \times 0.06 \times 0.75$).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Fishery observers monitored three commercial fisheries during the period from 1990 to 1998 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, and Northern Washington (WA) marine set gillnet fisheries. In 1992 and 1994, 1 Steller sea lion mortality was observed incidental to the CA/OR thresher shark and swordfish drift gillnet fishery. These mortalities extrapolate to estimated total kills of 7 and 6 animals, respectively (Julian 1997, Julian and Beeson 1998). During the most recent 5-year period (1994-98), the mean annual mortality is 1.2 sea lions (CV=1.0) for that fishery (Table 4). One and two Steller sea lion mortalities were observed in the WA/OR/CA groundfish trawl fishery during 1994 (53% observer coverage in 1994) and 1997 (65% observer coverage in 1997), respectively. As these mortalities occurred in unmonitored hauls,

they could not be used to calculate the estimated mortality for the fishery. Therefore, the observed mortalities were used as both the observed and estimated mortalities for that fishery, and should be considered minimum estimates (Table 4). These mortalities result in a mean annual mortality of 0.6 (CV=0.67) Steller sea lions for the WA/OR/CA groundfish trawl fishery. During 1996, one Steller sea lion mortality was observed in the Northern Washington marine set gillnet fishery. The mortality was not extrapolated because the coastal portion of the fishery (the portion of the fishery most likely to interact with Steller sea lions) was monitored with 100% observer coverage during 1996. This single observed mortality results in a mean annual mortality of 0.2 (CV=1.0) Steller sea lions for the Northern Washington marine set gillnet fishery. No observer program occurred during 1994 for this fishery. For the fisheries with observed takes, the ranges of observer coverage since 1990, as well as the annual observed and estimated mortalities, are presented in Table 4. Averaging the incidental take data from these three observed fisheries results in an estimated incidental mortality rate of 2.0 (CV=0.64) Steller sea lions per year from this stock. 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 4. Summary of incidental mortality of Steller sea lions (eastern U. S. stock) due to commercial and tribal fisheries from 1990 through 1998 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 1994 to 1998 (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**
CA/OR thresher shark and swordfish drift gillnet	90-98	obs data	4-27%	0, 0, 1, 0, 1, 0, 0, 0, 0	0, 0, 7, 0, 6, 0, 0, 0, 0	1.2 (CV=1.0)
WA/OR/CA groundfish trawl (Pacific whiting component)	90-98	obs data	44-72%	0, 0, 0, 0, 1, 0, 0, 2, 0	0, 0, 0, 0, 1, 0, 0, 2, 0	0.6 (CV=0.67)
Northern WA marine set gillnet (tribal fishery)	90-98	obs data	47-98%	0, 0, 0, 0, 0, 0, 1, 0, 0	0, 0, 0, 0, 0, 0, 1, 0, 0	0.2 (CV=1.0)
Observer program total						2.0 (CV=0.64)
				Reported mortalities		
Southeast Alaska salmon drift gillnet	90-98	self reports	n/a	0, 1, 2, 2, n/a, n/a, n/a, n/a, n/a	n/a	[$1.25]
Alaska salmon troll	92-98	strand data	n/a	0, 0, 0, 1, 0, 0, n/a	n/a	[$0.2]
British Columbia aquaculture predator control program	91-98	permit reports	n/a	14, 8, 10, 11, 6, 13, 22, n/a	n/a	12.4
Minimum total annual mortality						$15.85 (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 1998, fisher self-reports from the Southeast Alaska salmon drift gillnet fishery (Table 4) 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 4. 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 is 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 4 for details).

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 1998 the only fishery-related Steller sea lion stranding was reported in August of 1995 in Southeast Alaska. The mortality has been attributed to the Alaska salmon troll fishery and has been included in Table 4. Fishery-related strandings during 1993-98 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.

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 16 sea lions per year, based on observer data (2.0) and self-reported fisheries information (1.25), stranding data (0.2), and permit reports (12.4) where observer data were not available.

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 NMFS (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 1992-96 approximately 16 of the interviewed communities lie within the range of the eastern U. S. stock. Only a very small percentage (<1%) of the statewide subsistence take was typically from the eastern U. S. stock. The total subsistence take of Steller sea lions from this stock was estimated at 6, 1, 5, 0, 0, and 0 animals in 1992-97, respectively. These values for total take include 1 animal per year during 1992-94 that was reported struck and lost. The mean annual subsistence take from this stock over the 3-year period from 1995 to 1997 was zero sea lions from this stock.

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.

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 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).

Steller sea lions are taken in British Columbia during commercial salmon farming operations (Table 4). Preliminary figures from the British Columbia Aquaculture Predator Control Program indicated a mean annual mortality of 12.4 Steller sea lions from this stock over the period from 1993 to 1997 (P. Olesiuk, pers. comm., Pacific Biological Station, Nanaimo, BC, V9R 5K6). Note that the 1995 estimate includes one animal reported as an unidentified sea lion and the 1996 estimate is based on data from only the first three-quarters of 1996.

Strandings of Steller sea lions with gunshot wounds do still occur, along with strandings of animals entangled in gear that is not fishery-related. During the period from 1990 to 1997 human-related strandings of animals with gunshot wounds from this stock occurred in Oregon, Washington, and Alaska in 1990 (1 animal), 1993 (9 animals), 1996 (2 animals), and 1997 (3 animals), resulting in an estimated annual mortality of 2.8 Steller sea lions from this stock during 1993-97. 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 because it is not possible to tell if such a report was the result of an animal struck and lost by subsistence hunters (in which case the mortality would have been accounted for in the subsistence harvest estimate). However, one of the two 1996 reports was from Alaska and has been included because there were no subsistence struck and lost reports during that year.

STATUS OF STOCK

Based on currently available data, the minimum estimated fishery mortality and serious injury for this stock (14) is less that 10% of the calculated PBR (137) 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, subsistence harvests, and shootings (16 + 0 + 3 = 19) does not exceed the PBR (1,368) 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. Concerns regarding the possible impacts of commercial groundfish fisheries in the Gulf of Alaska and Bering Sea have been noted previously (see Habitat Concerns section in assessment report for the western U. S. stock). However, the eastern U. S. stock is stable or increasing in 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), where habitat concerns include reduced prey availability, contaminants, and disease (Sydeman and Allen 1997).

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