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.

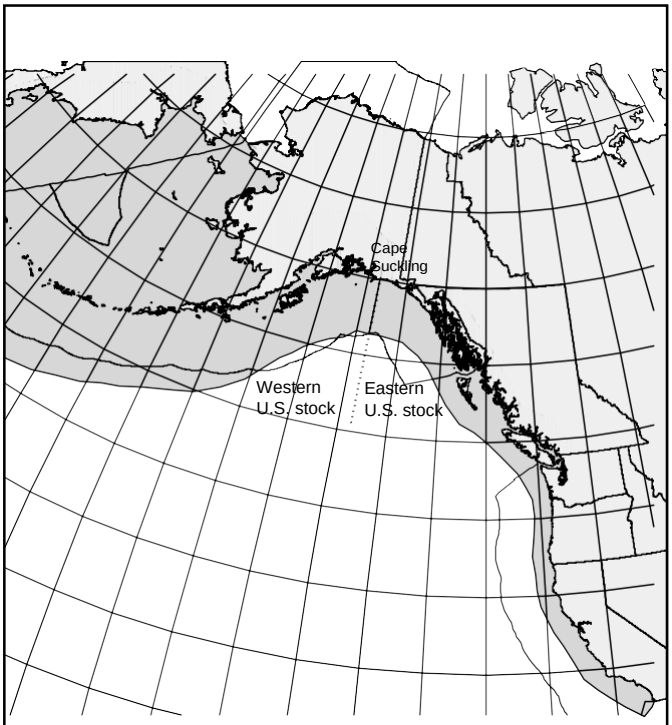

Figure 3. Approximate distribution of Steller sea lions in the eastern North Pacific (shaded areas)

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 previous estimate of Steller sea lion abundance in Southeast Alaska was based on comprehensive aerial surveys performed in June 1996 (Sease et al. 1999, Sease and Loughlin 1999). Data from these surveys represent actual counts of pups and non-pups at all rookeries and major haulout sites in Southeast Alaska. In 1996 a total of 14,621 Steller sea lions were counted in Southeast Alaska, including 10,907 non-pups and 3,714 pups. Aerial surveys in 1998 and 2000 included the trend sites and other major sites. There were some differences between which major sites were surveyed in 1998 and 2000, so the total counts for each survey are not entirely comparable. The counts for 1998 and 2000 were 10,939 and 12,417, respectively (Sease and Loughlin 1999, Sease et al. 2001). Pup counts totaled 4,160 in 1997 and 4,257 in 1998 (Sease and Loughlin 1999). The total count for Southeast Alaska in 1998 is 15,196 (10,939 non-pups plus 4,257 pups); if we assume that the pup count is roughly stable, the total count for 2000 would be 16,674 (12,417 non-pups plus 4,257 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 non-pups 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 non-pups 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, Canada), 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 31,028 (15,196 + 6,555 + 9,277) Steller sea lions in this stock.

Slight changes in the non-pup numbers result from changes in the non-pup count database which occurred since publication of the results from the 1998 aerial survey (Sease and Loughlin 1999). The database underwent considerable review, verification, and editing; the most significant changes related to replicate counts of individual sites. For additional information on the minor changes in the non-pup numbers, see Sease et al. (2001).

The abundance estimate for the eastern U. S. stock is based on counts of all animals (pup and non-pup) 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 (J. Sease, pers. comm., National Marine Fisheries Service). As a result, this represents an underestimate for the total abundance of Steller sea lions in this stock.

Minimum Population Estimate

The minimum population estimate will be calculated by adding 1998 counts from Southeast Alaska (15,196), 1996 counts from WA/OR/CA (6,555), and Canadian counts from 1994 (9,277), which results in an N_{MIN} for the eastern U. S. stock of Steller sea lions of 31,028. Recall that this count has not been corrected for animals which were at sea, and also uses 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).

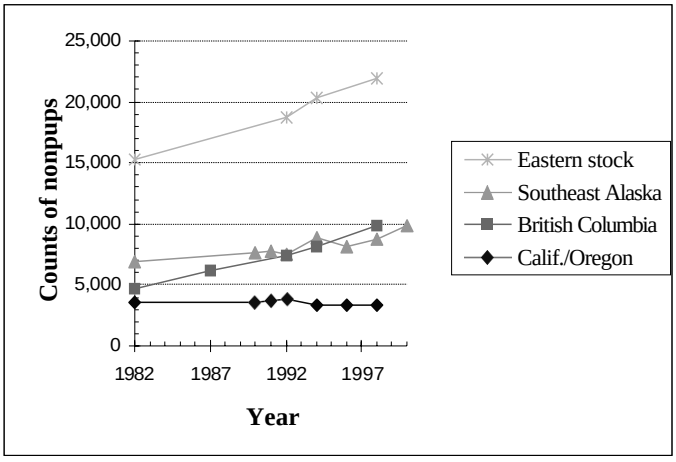

Figure 4. Counts of adult and juvenile Steller sea lions at rookery and haulout trend sites throughout the range of the eastern U.S. stock, 1982-00. Data from British Columbia include all sites.

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%, and haulout trend sites throughout the range of the eastern U.S. remaining between 1,500 and 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., National Marine Fisheries Service). The most recent pup counts at Año Nuevo and the Farallons are 564 for 1999 and 349 in 2000 (M. Lowry, pers. comm). Overall, counts of non-pups 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 30% from 1979-2000 from 6,376 to 9,862 (Merrick et al. 1992, Sease et al. 2001). 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. 1999). A slightly lower increase in pup counts (3.3% per year from 1979-97) is reported by Sease et al. (2001). 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 Station, Canada). Counts of non-pups 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 2000 (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; 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
Central CA	511[1]	655	537	276	512	385	208	349
Northern CA/OR	3,094	2,922	3,180	3,544	2,834	2,988	3,175	n/a
British Columbia	4,711	6,109[2]	no data	7,376	8,091	no data	9,818	n/a
Southeast Alaska	6,898	7,629	8,621	7,555	9,001	8,231	8,693	9,862
Total	15,214	--	--	18,754	20,263	--	21,864	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: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. 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 = 1,396 animals ($31,028 \times 0.06 \times 0.75$).

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, one 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 (1996-2000), the mean annual mortality is zero (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 for 1995-99 of 0.4 (CV = 1.0) 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, and no data are available for 1999. 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 0.6 (CV = 1.0) 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 1990-2000 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 1996-2000 (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.

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	90-00	obs data	4-27%	0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0	0, 0, 7, 0, 6, 0, 0, 0, 0, 0, 0	0
WA/OR/CA groundfish trawl (Pacific whiting component)	90-00	obs data	44-72%	0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 0	0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 1*	0.5 (CV = 1.0)
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						0.7 (CV = 1.0)
				Reported mortalities		
Southeast Alaska salmon drift gillnet	90-00	self reports	n/a	0, 1, 2, 2, n/a, n/a, n/a, n/a, n/a, n/a, n/a	n/a	[;;. 1.25]
Alaska salmon troll	92-00	strand data	n/a	0, 0, 0, 1, 0, 0, n/a, n/a	n/a	[;;. 0.2]

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
British Columbia aquaculture predator control program	91-00	permit reports	n/a	14, 8, 10, 11, 6, 13, 34, 63, 91, na , na	n/a	41.4
Minimum total annual incidental mortality (includes an estimate of 0.8 fishery-related strandings per year; see text)						2.85 (CV = 1.0)
Minimum total annual mortality (includes intentional mortalites in the BC predator control program)						44.3 (CV = 1.0)

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 one 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 7 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 1995 to 1999 there were 4 fishery-related strandings in Southeast Alaska. One of these strandings has been attributed to the Alaska salmon troll fishery and has been included in Table 4. Details regarding which fishery may be responsible for other fishery-related strandings between 1994-99 is not available at this time. In 2000, there were reports of 3 Steller sea lions observed in southeast Alaska with "flashers" lodged in their mouths and one animal entangled in fishing line; all animals were alive when seen. It is not clear whether these entanglements resulted from the commercial or recreational fisheries, nor is it clear whether the interactions resulted in mortality. However, based on Angliss and DeMaster (1998), it would be appropriate to call these "serious injuries". During the 5-year period from 1996-2000, there were 6 fishery-related strandings; this results in an estimated annual mortality of 1.2 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 3.35 sea

lions per year, based on observer data (0.7), self-reported fisheries information (1.25), and stranding data (0.2 + 1.2 = 1.4).

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. 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 one 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

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 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 1995-99: the cases involved the illegal shooting of one Steller sea lion near Sitka in 1998, and 3 Steller sea lions in Petersburg. Both cases were successfully prosecuted (NMFS, Alaska Enforcement Division).

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 44 Steller sea lions from this stock over the period from 1995 to 1999 (P. Olesiuk, pers. comm., Pacific Biological Station, Canada). 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. The take of Steller sea lions has increased in recent years because of recent changes in sea lion distribution which have likely occurred in response to a shift in herring distribution (P. Olesiuk, pers. comm).

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 1996-99 human-related strandings of animals with gunshot wounds from this stock occurred in Oregon, Washington, and Alaska in 1996 (2 animals), 1997 (3 animals), 1998 (1 animal), and 1999 (2 animals), resulting in an estimated annual mortality of 2.0 Steller sea lions from this stock during 1996-99. 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 been included in the above estimates. However, 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). 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.

Stranding data may also provide information on additional sources of potential mortality. In 2000, 4 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" tire. All of these animals were alive when sighted; the animal entangled in the tire was successfully released. It is not clear whether the occurrence of these interactions in stranding data in 2000 but not in previous years reflects an increase in these types of interactions or an increase in reporting. If the number of interactions is averaged over 5 years, the "other" interaction rate would be a minimum of one animal per year.

STATUS OF STOCK

Based on currently available data, the minimum estimated fishery mortality and serious injury for this stock (0.7 + 1.25 + 0.2 + 41.4 + 1.2 = 45.5) is less than that 10% of the calculated PBR (140) 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 (44 + 0 + 2 = 46) does not exceed the PBR (1,396) 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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