Revised 5/10/2024

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

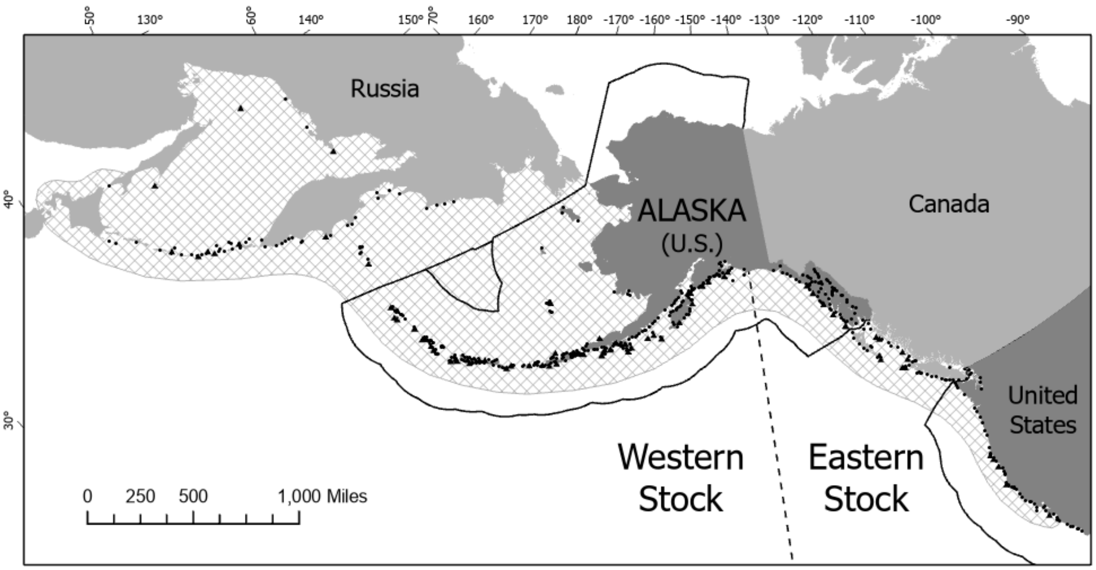

Figure 1. Generalized distribution (crosshatched area) of Steller sea lions in the North Pacific and major U.S. haulouts and rookeries (50 CFR 226.202, 27 August 1993), as well as active Asian and Canadian (British Columbia) haulouts and rookeries (points: Burkanov and Loughlin 2005; Olesiuk 2018). A black dashed line (144°W) indicates the stock boundary (Loughlin 1997) and a black line delineates the U.S. Exclusive Economic Zone.

Steller sea lions range along the North Pacific Rim from northern Japan to California (Loughlin et al. 1984) (Fig. 1). Large numbers of individuals disperse widely outside of the breeding season (late May to July), probably to access seasonally important prey resources. This results in marked seasonal patterns of abundance in some parts of the range and potential for intermixing in foraging areas of animals that were born in different areas (Sease and York 2003). There is an exchange of sea lions across the stock boundary (144°W; dashed line in Fig. 1), especially due to the wide-ranging seasonal movements of juveniles and adult males (Baker et al. 2005; Jemison et al. 2013, 2018; Hastings et al. 2020). The Eastern stock is transboundary, extending from southeast Alaska, south through Canada, and down the west coast of the U.S. into California. During the breeding season, Steller sea lions, especially adult females, typically return to their natal rookery or a nearby breeding rookery to breed and pup (Raum-Suryan et al. 2002, Hastings et al. 2017). However, mixing of mostly breeding females from Prince William Sound (Western stock) to Southeast Alaska began in the 1990s and two new, mixed-stock rookeries were established (Gelatt et al. 2007; Jemison et al. 2013, 2018; O'Corry-Crowe et al. 2014).

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 among rookeries; 2) Population response data: substantial differences in population dynamics (York et al. 1996); 3) Phenotypic data: differences in pup mass (Merrick et al. 1995, Loughlin 1997); and 4) Genotypic data: substantial differences in mitochondrial DNA (Bickham et al. 1996). Based on this information, two stocks of Steller sea lions were recognized: the Eastern stock, which includes animals born east of Cape Suckling, Alaska (144°W), and the Western stock, which includes animals born at and west of Cape Suckling (Loughlin 1997; Fig. 1). These stocks are equivalent to the eastern and western distinct population segments (DPSs) identified under the Endangered Species Act (62 FR 24345, 62 FR 30772).

All genetic analyses (Baker et al. 2005; Harlin-Cognato et al. 2006; Hoffman et al. 2006, 2009; O'Corry-Crowe et al. 2006) confirm a strong separation between Western and Eastern stocks, and there may be sufficient morphological differentiation to support elevating the two recognized stocks to subspecies (Phillips et al. 2009), although a review by Berta and Churchill (2012) characterized the status of these subspecies assignments as "tentative" and requiring further attention before their status can be determined. Work by Phillips et al. (2011) addressed the effect of climate change, in the form of glacial events, on the evolution of Steller sea lions and reported that the effective population size at the time of the event determines the impact of change on the population. The results suggested that during historic glacial periods, dispersal events were correlated with historically low effective population sizes, whereas range fragmentation type events were correlated with larger effective population sizes. This work again reinforced the separation of the Western and Eastern stocks by noting that ancient population subdivision likely led to the sequestering of most mtDNA haplotypes as stock or subspecies-specific (Phillips et al. 2011).

Observations of marked sea lions indicate there is regular movement of Steller sea lions across the stock boundary outside the breeding season, especially by juveniles and males (Jemison et al. 2013, 2018; Hastings et al. 2020). During the breeding season, an equal proportion of male and female Western stock Steller sea lions have been observed in the Eastern stock area, while Eastern stock sea lions observed moving west have been almost exclusively male (Jemison et al. 2013, 2018; Hastings et al. 2020). In 1998 a single Steller sea lion pup was observed on Graves Rock just north of Cross Sound in Southeast Alaska, and within 15 years (2013) pup counts had increased to 551 (DeMaster 2014). Mitochondrial and microsatellite analysis of pup tissue samples collected in 2002 revealed that approximately 70% of the pups had mtDNA haplotypes that were consistent with those found in the western stock (Gelatt et al. 2007). Similarly, a rookery to the south on the White Sisters Islands, where pups were first noted in 1990, was also sampled in 2002 and approximately 45% of those pups had western stock haplotypes (O'Corry-Crowe et al. 2014). Collectively, this information demonstrates that these two most recently established rookeries in northern Southeast Alaska have been partially to predominantly established by western stock females (Jemison et al. 2013, 2018; Rehberg et al. 2018).

While movements of animals marked as pups in both stocks support these genetic results (Jemison et al. 2013, 2018; Hastings et al. 2020), overall the observations of marked Steller sea lion movements corroborate the extensive genetic research findings for a strong separation between the two currently recognized stocks. O'Corry-Crowe et al. (2014) concluded that the results of their study of the genetic characteristics of pups born on these new rookeries "demonstrates that resource limitation may trigger an exodus of breeding animals from declining populations, with substantial impacts on distribution and patterns of genetic variation. It also revealed that this event is rare because colonists dispersed across an evolutionary boundary, suggesting that the causative factors behind recent declines are unusual or of larger magnitude than normally occur."

Thus, although recent colonization events in the northern part of the Eastern stock area indicate movement of Western stock Steller sea lions (especially adult females) into this area, the mixed part of the range remains geographically distinct (Jemison et al. 2013), and the overall discreteness of the Eastern from the Western stock remains distinct. Hybridization among subspecies and species along a contact zone such as now occurs near the stock boundary is not unexpected, as the ability to interbreed is a primitive condition whereas reproductive isolation would be derived. The level of differentiation indicates long-term reproductive isolation resulting from four glacial refugia events 60,000 to 180,000 years before present (BP) (Harlin-Cognato et al. 2006). The fundamental concept overlying this distinctiveness is the collection of morphological, ecological, behavioral, and genetic evidence for stock differences initially described by Bickham et al. (1996) and Loughlin (1997) and supported by Baker et al. (2005), Harlin-Cognato et al. (2006), Hoffman et al. (2006, 2009), O'Corry-Crowe et al. (2006), Phillips et al. (2009, 2011), and Hastings et al. (2020). As stated by NMFS and the U.S. Fish and Wildlife Service (USFWS) in a 1996 response to a previous comment regarding their joint "DPS" policy (61 FR 4722), "The Services do not consider it appropriate to require absolute reproductive isolation as a prerequisite to recognizing a distinct population segment" or stock.

POPULATION SIZE

The Eastern stock of Steller sea lions has historically bred on rookeries located in Southeast Alaska, British Columbia (Canada), Oregon, and California. However, within the last several years a new rookery has become established on the outer Washington coast at the Carroll Island and Sea Lion Rock complex (Stocking and Wiles 2021). Abundance surveys to count Steller sea lions are conducted in late June through mid-July starting approximately 10 days after the mean pup birth dates in the survey area (4-14 June) after approximately 95% of all pups are born (Pitcher et al. 2001, Kuhn et al. 2017). Researchers collaborated on a range-wide Eastern stock survey in 2021. The dates of the most recent aerial photographic and land-based surveys of eastern Steller sea lions have varied by region. Southeast Alaska was last surveyed in June and July 2021 (Sweeney et al. 2022), while counts used in population analyses for the contiguous U.S. are from 2015-2022 surveys in Washington (NMFS and Washington Department of Fish and Wildlife, unpubl. data), Oregon (Oregon Department of Fish and Game, unpubl. data), and California (NMFS, unpubl. data). Counts from British Columbia are from the 2013 survey (Olesiuk 2018). Counts from subsequent surveys in Canada in 2015 and 2021 were not yet publicly available to include in this report.

An updated agTrend model (R package; Johnson and Fritz 2014, Gaos et al. 2021) was used to estimate counts and trends by augmenting missing counts. The updated agTrend model uses the penalized spline model to reduce variance for years where missing data is interpolated (Gaos et al. 2021). This model improves upon the previous method, which used a random walk-time series model (Johnson and Fritz 2014), providing more precise estimates. Non-pup counts do not account for animals at sea and therefore cannot be used as an abundance estimate. Pup counts are considered a census (i.e., total pup production), however, these counts do not account for pups that are born, or die, after the surveys.

Demographic multipliers (e.g., pup production multiplied by 4.5) and corrections for proportions of each age-sex class that are hauled out during the day in the breeding season (when aerial surveys are conducted) have been proposed as methods to estimate total population size from pup and/or non-pup counts (Calkins and Pitcher 1982, Higgins et al. 1988, Milette and Trites 2003, Maniscalco et al. 2006). There are several factors that make using demographic multipliers problematic, including the large variability in abundance trends across the range of the species and the fact that such correction factors have been calculated for the Western stock and not the Eastern.

The 2022 estimated total Eastern stock (including Canada) pup count was 31,289 (95% credible interval of 21,264-44,298). The 2022 estimated total Eastern stock non-pup count was 66,150 (95% credible interval of 49,688-84,914). These are count estimates and cannot be used as an abundance estimate as they do not account for animals at sea.

Minimum Population Estimate

Steller sea lion non-pups from the Western stock occur in Southeast Alaska, east of the stock boundary (O'Corry-Crowe et al. 2006; Jemison et al. 2013, 2018; O'Corry-Crowe et al. 2014; Hastings et al. 2020). Hastings et al. (2020) reported 7-8% of non-pups that occurred in Southeast Alaska in the summer were born in the Western stock area. They principally occurred in the north outer coast (identified as population mixing zone “F,” Table 1; Fig. 2) and Glacier Bay (G), and at lower proportions in Lynn Canal (H), Frederick Sound (E), and the Central Outer Coast (D). Using the Hastings et al. (2020) proportions for Western stock non-pups in Southeast Alaska allows for apportionment of modeled counts to the corresponding stock by adjusting the minimum population estimate (N_{MIN}) to help account for movement between stocks.

AgTrend modeled non-pup predicted counts by site were aggregated into the population mixing zones, and the Western stock proportion was applied to calculate the number of Western stock non-pups in Southeast Alaska (Table 1; Hastings et al. 2020). This total number of Western stock non-pups in Southeast Alaska was subtracted from the total Eastern stock count of pups and non-pups. As discussed above, the current population size (N) is unknown as there is no method for deriving abundance estimates from agTrend modeled counts and modeled counts are considered “minimum” estimates of population size. Pup counts are considered a census (i.e., total pup production) however, these counts do not account for pups that are born, or die, after the surveys.

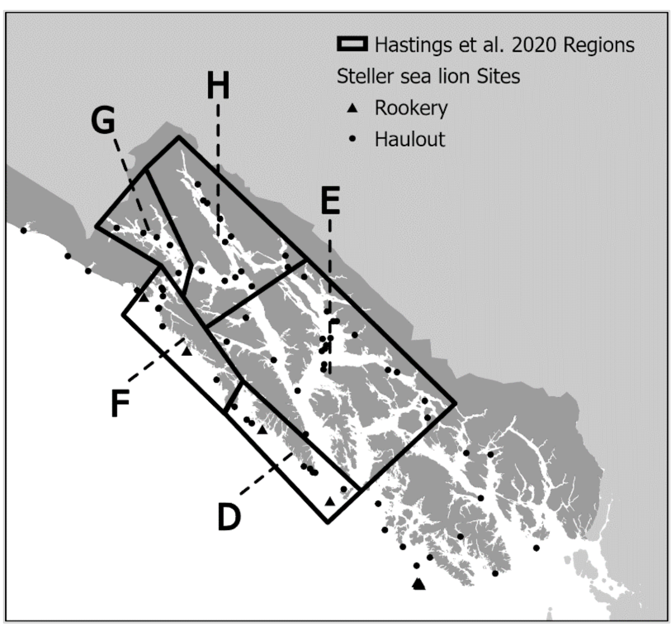

Figure 2. Hastings et al. (2020) mixing zones where non-pups born in the western stock area were reported to inhabit in different proportions, with most in the North Outer Coast (F) and Glacier Bay (G), and at lower proportions in Lynn Canal (H), Frederick Sound (E), and the Central Outer Coast (D) (Table 1).

As the most recent counts from Canada are almost a decade old and analyses have not been conducted to adjust the counts to account for potential abundance changes that may have occurred since the 2013 survey (NMFS 2023), we report only the N_{MIN} estimate for the U.S. portion of the Eastern Steller sea lion stock (excluding Canada and Western stock non-pups): 36,308 (summing 26,158 non-pups and 10,667 pup, and subtracting 517 Western stock non-pups in the Eastern stock area).

Table 1. Steller sea lion non-pup apportionment to stock using the Hastings et al. (2020) proportions of Western stock non-pups in Southeast Alaska. Proportions were applied to agTrend modeled predicted counts to estimate the number of western- and eastern-born non-pups in the Hastings et al. (2020) population mixing zones.

Southeast Alaska Area	Population Mixing Zone	Western Stock Non-Pup Proportion	Modeled Non-Pup Count	Western Stock Non-Pup Count	Eastern Stock Non-Pup Count
Central Outer Coast	D	0.022	3,131	69	3,062
Frederick Sound	E	0.012	1,850	22	1,828
North Outer Coast	F	0.082	3,826	314	3,512
Glacier Bay	G	0.073	1,423	104	1,319
Lynn Canal	H	0.014	578	8	570
Remaining Southeast Alaska	I, B, C	-	6,298	-	6,298
TOTAL			17,106	517	16,589

Current Population Trend

Using the updated agTrend model, count data from 1971 to 2022 were modeled to estimate annual trends from 1992 to 2022 (30-year period). The transboundary Eastern stock of Steller sea lion pups increased 5.08% per year (95% credible intervals of 4.30-6.08%) between 1992 and 2022 (Table 2, Figs. 3 and 4). Non-pups increased an estimated 3.54% per year during the same time period (95% credible intervals of 2.83-4.36%: Table 2). The Eastern stock increase has been driven by growth in pup counts in all regions, including the new rookery in Washington (NMFS 2013; NMFS unpubl. data; Stocking and Wiles 2021).

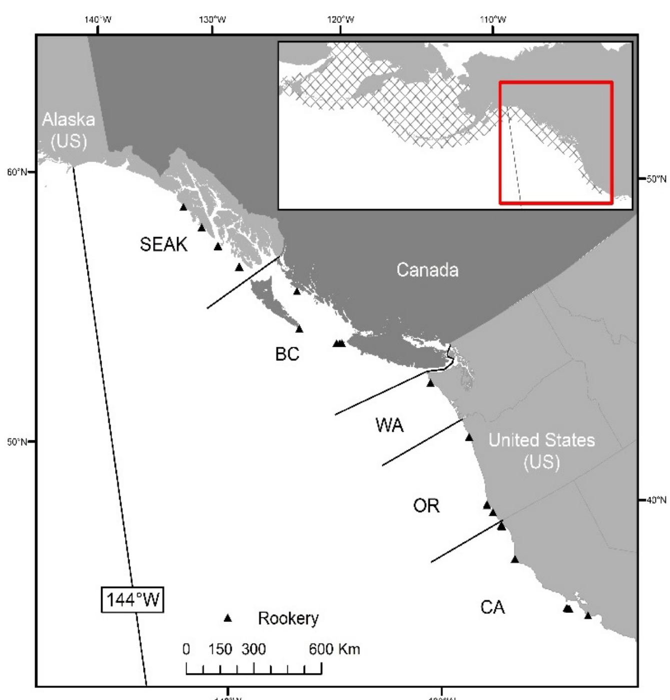

Figure 3. The Eastern Steller sea lion rookery sites by region: Southeast Alaska (SEAK), British Columbia, Canada (BC), Washington State (WA), Oregon State (OR), and California State (CA).

Table 2. Trends (annual rates of change expressed as % per year with 95% credible interval) of Eastern Steller sea lion non-pups (adults and juveniles) and pups, by region and total population (Johnson and Fritz 2014, Gaos et al. 2021, Sweeney et al. 2022). California, Oregon, Washington, and Southeast Alaska trends are for the 1992-2022 time period, British Columbia trends are for 1992-2013.

	Non-Pup			**Pup**		
Region	**Trend**	**-95%**	**+95%**	**Trend**	**-95%**	**+95%**
California, U.S.	1.66	0.55	2.68	2.94	2.39	3.55
Oregon, U.S.	1.61	0.78	2.41	3.79	3.31	4.25
Washington, U.S.*	5.69	3.99	7.36	16.17	5.58	26.78
British Columbia, Canada	4.93	4.07	5.83	8.03	7.23	8.82
Southeast Alaska, U.S.	2.08	1.56	2.60	2.51	2.27	2.76
Total Eastern Stock	3.54	2.83	4.36	5.08	4.30	6.08

* NMFS had not observed Steller sea lion pups born on known sites in Washington until a new rookery was established on the outer Washington coast (at the Carroll Island and Sea Lion Rock complex).

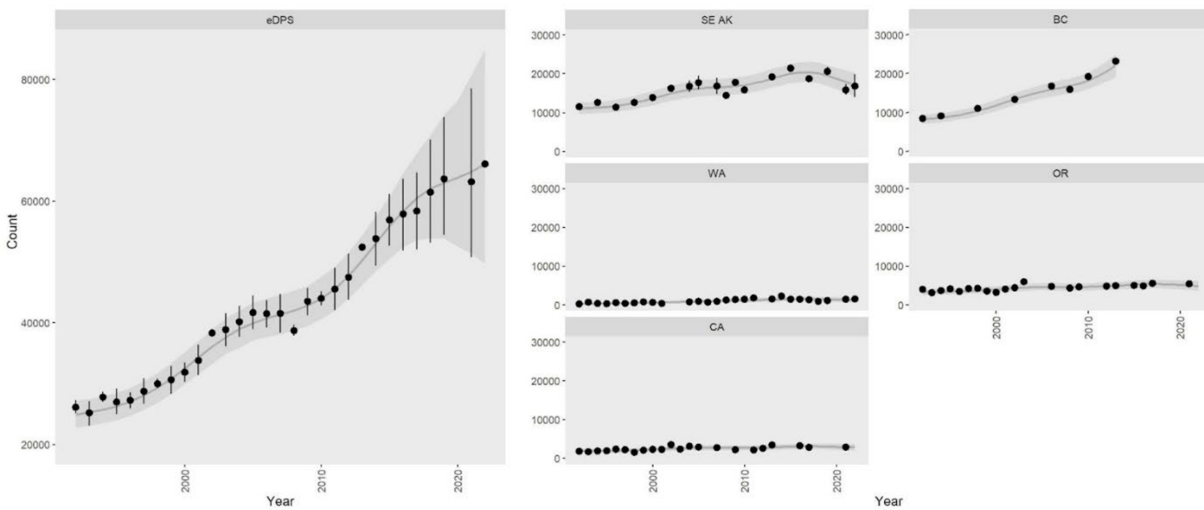

Figure 4. Estimated counts (modeled with agTrend) of Steller sea lion non-pups (adults and juveniles) for the Eastern stock and the five regions: Southeast Alaska (SEAK), British Columbia, Canada (BC), Washington (WA), Oregon (OR), and California (CA) for 1992-2022 (Gaos et al. 2021, Sweeney et al. 2021).

While the Eastern stock of Steller sea lions has been increasing in most regions from 1990 to 2022, the most significant continued growth has been observed in British Columbia, Canada (Fig. 4). The Southeast Alaska region was increasing from 1990 to 2017 but has appeared to level out since 2017. An abrupt decline of adult female Steller sea lion survival occurred in Southeast Alaska, Prince William Sound, and Chiswell Island during and following the severe North Pacific marine heatwave of 2014-2017 (Hastings et al. 2023). Southeast Alaska and British Columbia comprise almost 87% of the total Eastern stock count. Non-pups in Oregon and Washington have been increasing since 1990, though at a lower rate. Non-pup counts in California ranged between 4,000 and 6,000 with no apparent trend from 1927 to 1947 and then subsequently declined. At Año Nuevo Island off central California, a steady decline in abundance began in 1970 and there was an 85% reduction in the breeding population by 1987 (Le Boeuf et al. 1991). Non-pup counts increased slightly from 1989 to 2022, ranging from approximately 2,000 to 3,200.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no estimates of the maximum net productivity rate (R_{MAX}) for Steller sea lions. Until additional data become available, the maximum theoretical net productivity rate for pinnipeds of 12% will be used for this stock (NMFS 2023).

POTENTIAL BIOLOGICAL REMOVAL

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: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. On 4 December

2013, the Eastern DPS of Steller sea lions was removed from the list of threatened species under the Endangered Species Act (ESA; 78 FR 66140, 4 November 2013). NMFS' decision to delist this population was based on the information presented in the Status Review (NMFS 2013), the factors for delisting in section 4(a)(1) of the ESA, the biological and threats-based recovery criteria in the 2008 Recovery Plan (NMFS 2008), the continuing efforts to protect the species, and information received during public comment and peer review. NMFS' consideration of this information led to a determination that the Eastern DPS has recovered and no longer meets the definition of a threatened species under the ESA. As noted within the humpback whale ESA listing final rule (81 FR 62259, 8 September 2016), in the case of a species or stock that achieved its depleted status solely on the basis of its ESA status, such as the Eastern stock of Steller sea lions, the species or stock would cease to qualify as depleted under the terms of the definition set forth in Marine Mammal Protection Act (MMPA) Section 3(1) if the species or stock is no longer listed as threatened or endangered. Therefore, NMFS considers this stock not to be depleted and the recovery factor is 1.0 (recovery factor for a stock of unknown status that is known to be increasing). As discussed above, a range-wide count estimate is available, but the most recent counts from Canada are almost a decade old and analyses have not been conducted to adjust the counts to account for potential abundance changes that may have occurred since the 2013 survey, so only the N_{MIN} estimate for the U.S. portion of the Eastern Steller sea lion stock (excluding Canada and Western stock non-pups) is reported. Thus, we calculate PBR for only the U.S. portion of the Eastern stock. The PBR for the U.S. portion of the Eastern stock of Steller sea lions is 2,178 (36,308 × 0.06 × 1.0). Excluding Western stock non-pups reduced the PBR by 32 sea lions.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Information for each human-caused mortality, serious injury, and non-serious injury reported for NMFS-managed Alaska marine mammals between 2017 and 2021 is listed, by marine mammal stock, in Freed et al. (2023); however, only the mortality and serious injury (M/SI) data are included in the Stock Assessment Reports. The minimum estimated mean annual level of human-caused M/SI for the U.S. portion of the Eastern Steller sea lion stock between 2017 and 2021 is 92.3 sea lions: 20.5 in U.S. commercial fisheries, 2.3 in Washington tribal treaty fisheries, 0.4 in Alaska subsistence fisheries, 0.2 in Southeast Alaska salmon hatchery pens, 15.1 in unknown (commercial, recreational, Washington tribal, or Alaska subsistence) fisheries, 15.6 in marine debris, 27.2 due to other causes (illegally shot, and euthanized under NMFS-authorized MMPA section 120(f) permit), and 11 in the Alaska Native subsistence harvest (from the 2005 to 2008 and 2012 data, which are the most recent data available). The number of human-caused mortalities and serious injuries of Eastern Steller sea lions in Canada is unknown. Additional potential threats most likely to result in direct human-caused mortality or serious injury of this stock include incidental take in unmonitored fisheries, unreported entanglement in marine debris, and disturbance at rookeries that could cause stampedes.

Fisheries Information

<u>Commercial fisheries</u>

Information for federally-managed and state-managed U.S. commercial fisheries is available in Appendix 3 of the Alaska Stock Assessment Reports (for fisheries in Alaska waters) and Appendix 1 of the U.S. Pacific Stock Assessment Reports (for fisheries in Washington, Oregon, and California waters) and in the NMFS List of Fisheries (LOF) and the fact sheets linked to fishery names in the LOF (observer coverage and reported incidental takes of marine mammals: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries, accessed May 2024).

Between 2017 and 2021, incidental mortality of an eastern Steller sea lion was observed in one of the federally-managed U.S. commercial fisheries in Alaska that are monitored for incidental M/SI by fisheries observers: the Gulf of Alaska sablefish longline fishery in 2017 (Table 3; Breiwick 2013; MML, unpubl. data). In addition, one mortality of an Eastern Steller sea lion was reported in this fishery via a Marine Mammal Authorization Program (MMAP) fisherman self-report in 2020. Because there were no observed mortalities or serious injuries of this stock in the Gulf of Alaska sablefish longline fishery in 2020, the MMAP-reported mortality is considered to be a minimum estimate for the stock in the fishery for 2020 (Table 4; Freed et al. 2023).

Mortality and serious injury of Eastern Steller sea lions was also observed or recorded via electronic monitoring in six of the federally-managed U.S. commercial fisheries monitored by U.S. West Coast groundfish fisheries observers in 2015-2019 (the most recent years for which bycatch estimates are available): the Washington/Oregon/California (WA/OR/CA) groundfish bottom trawl (catch shares), WA/OR/CA groundfish bottom and midwater trawl (catch shares with electronic monitoring), WA/OR/CA groundfish midwater trawl (at-sea hake catcher-processor sector), WA/OR/CA groundfish midwater trawl (at-sea hake mothership catcher vessel sector), WA/OR/CA sablefish hook and line (limited entry), and California halibut bottom trawl (open access) fisheries (Table 3; Jannot et al. 2022).

Table 3. Summary of incidental M/SI of Eastern stock Steller sea lions due to observed or electronically monitored U.S. commercial fisheries between 2017 and 2021 (or the most recent data available) and calculation of the mean annual M/SI rate for Alaska fisheries (Breiwick 2013; MML, unpubl. data) and WA/OR/CA fisheries (Jannot et al. 2022).

Fishery name	Years	Data type	Percent observer coverage	Observed M/SI	Estimated M/SI	Mean estimated annual M/SI
Gulf of Alaska sablefish longline	2017	obs data	10	1	15	3.0 (CV = 0.97)
	2018		9	0	0	
	2019		12	0	0	
	2020		7	0	0	
	2021		11	0	0	
WA/OR/CA groundfish (bottom trawl - catch shares)	2015	obs data	100	8[a]	8[a]	1.8
	2016		100	0	0	
	2017		100	1[a]	1[a]	
	2018		100	0[a]	0[a]	
	2019		100	0	0	
WA/OR/CA groundfish (bottom and midwater trawl – catch shares with electronic monitoring)	2015	electronic monitoring data	100	0	0	0.4
	2016		100	0	0	
	2017		100	1	1	
	2018		100	0[a]	0[a]	
	2019		100	1	1	
WA/OR/CA groundfish (midwater trawl - at-sea hake catcher-processor sector)	2015	obs data	100	0	0	5.2
	2016		100	21	21	
	2017		100	1	1	
	2018		100	4	4	
	2019		100	0	0	
WA/OR/CA groundfish (midwater trawl - at-sea hake mothership catcher vessel sector)	2015	obs data	100	0	0	3.6
	2016		100	2	2	
	2017		100	8	8	
	2018		100	8	8	
	2019		99	0	0	
WA/OR/CA sablefish (hook and line - limited entry)	2015	obs data	42	0	0.2	0.7 (CV = 0.37)
	2016		33	2	2.3	
	2017		37	0	0.4	
	2018		46	0	0.3	
	2019		39	0	0.3	
California halibut (bottom trawl - open access)	2015	obs data	33	3	6.8	5.6 (CV = 0.17)
	2016		31	3	6.8	
	2017		26	1	5.2	
	2018		26	0[b]	0	
	2019		27	4	9.4	
Minimum total estimated annual mortality						20.3 (CV = 0.15)

[a]Jannot et al. (2022) misreport this value; the value in this table is correct.
[b]Following publication of Jannot et al.(2022), genetic species identification confirmed that the observed mortality in this fishery in 2018 was a California sea lion, not a Steller sea lion.

Commercial fishery-related serious injuries averted (i.e., human intervention or self-release lessened the severity of the initial serious injury, leaving the animal with only non-serious or no injuries) and non-serious injuries are not included in the total estimate of annual human-caused M/SI that is compared to PBR, but are used to develop the LOF under Section 118 of the MMPA and inform management (e.g., take reduction planning and negligible impact determinations). No serious injuries were averted in U.S. commercial fishery interactions between 2017 and 2021. Additionally, there were no U.S. commercial fisheries with only non-serious injuries of Eastern Steller sea lions between 2017 and 2021.

The minimum estimated mean annual M/SI rate incidental to U.S. commercial fisheries between 2017 and 2021 is 20.5 Eastern Steller sea lions, based on observer, electronic monitoring, and MMAP data (Tables 3 and 4). 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.

Non-commercial, tribal, and unknown fisheries

Entanglement in marine debris and interactions with fisheries are a contributing factor in Steller sea lion injury and mortality (Allyn and Scordino 2020, Raum-Suryan and Suryan 2022). Reports to the NMFS West Coast Region and Alaska Region stranding networks and the Alaska Department of Fish and Game (ADF&G) of Steller sea lions entangled in fishing gear or with injuries caused by interactions with gear provide additional information on fishery-related M/SI (Table 4; Freed et al. 2023). In addition, NMFS receives reports from the Northwest Indian Fisheries Commission of Steller sea lions taken in association with Washington tribal treaty fisheries (Table 4; NWIFC unpubl. data, Freed et al. 2023).

The minimum mean annual M/SI rate due to all non-commercial, tribal, and unknown fishery interactions reported between 2017 and 2021 is 16.8 eastern Steller sea lions: 2.3 in association with Washington tribal treaty fisheries + 0.4 in Alaska subsistence fisheries + 0.2 in the Southeast Alaska salmon hatchery pens + 15.1 in unknown (commercial, recreational, Washington tribal, or Alaska subsistence) fisheries (Table 4; Freed et al. 2023). These M/SI estimates result from an actual count of verified human-caused deaths and serious injuries and are minimums because not all entangled animals strand or are self-reported nor are all stranded animals found, reported, or have the cause of death determined.

An additional two Steller sea lions in the Eastern and Western stock mixing area of Southeast Alaska that were initially considered seriously injured due to hooking by unknown salmon hook and line gear (one in 2017 and one in 2018) were disentangled and released, or were presumed to have self-released, with non-serious injuries (Freed et al. 2023). None of these serious injuries averted were included in the average annual M/SI rate for 2017 to 2021.

Table 4. Summary of Eastern stock Steller sea lion M/SI in U.S. waters, by year and type, reported to the NMFS Alaska Region marine mammal stranding network, Northwest Indian Fisheries Commission, and ADF&G, and by fishermen self-reports, between 2017 and 2021 (Freed et al. 2023). Sea lions euthanized in response to their predation on endangered salmon and steelhead stocks in the Columbia River under an MMPA section 120(f) permit are also included in this table. In areas of Southeast Alaska where the Western (wSSL) and Eastern (eSSL) populations mix, the mean annual mortality of both stocks (wSSL + eSSL) was multiplied by the mixing zone-specific proportion of Western stock non-pups (Table 1; Hastings et al. 2020) and subtracted from the total to produce estimates for the Eastern stock (eSSL only).

Cause of injury					**2017**	**2018**	**2019**	**2020**	**2021**	**Mean annual M/SI**	
										wSSL + eSSL	eSSL only
Southeast Alaska – Mixing Zone D											
Hooked by Alaska subsistence halibut longline gear					0	0	0	0	1	0.2	0.2
Hooked by salmon hook and line gear*					4	0	1	1	3	1.8	1.8
Hooked by unknown hook and line gear*					0	1	0	0	0	0.2	0.2
Entangled in Southeast Alaska salmon hatchery pen					0	0	0	1	0	0.2	0.2
Entangled in unknown fishery gear*					0	0	1	0	0	0.2	0.2
Entangled in marine debris					3	3	2	0	0	1.6	1.6
Illegally shot					0	0	1	0	0	0.2	0.2
Southeast Alaska – Mixing Zone E											
Hooked by halibut hook and line gear*					0	1	0	0	0	0.2	0.2
Hooked by salmon hook and line gear*					4	0	1	0	0	1.0	1.0
Entangled in marine debris					3	2	1	0	0	1.2	1.2
Southeast Alaska – Mixing Zone F											
Hooked or entangled by salmon hook and line gear*					8	8	4	0	6	5.2	4.8
Hooked by unknown hook and line gear*					2	1	2	0	0	1.0	0.9
Entangled in unknown fishery gear*					0	0	0	1	0	0.2	0.2
Entangled in marine debris					2	8	1	0	3	2.8	2.6
Dependent pup of animal seriously injured by marine debris					0	1	0	0	0	0.2	0.2
Southeast Alaska – Mixing Zone G											
Hooked by salmon hook and line gear*					1	1	2	0	0	0.8	0.7
Entangled in marine debris					3	3	0	0	0	1.2	1.1

Southeast Alaska – Mixing Zone H											
Hooked by salmon hook and line gear*					3	0	1	1	1	1.2	1.2
Entangled in marine debris					3	2	1	0	1	1.4	1.4
All Other Areas in Eastern Stock Range											
Hooked by AK Gulf of Alaska sablefish longline gear					0	0	0	1[a]	0	-	0.2
Hooked by Alaska subsistence halibut longline gear					1	0	0	0	0	-	0.2
Hooked by salmon hook and line gear*					5	1	2	1	3	-	2.4
Washington tribal treaty salmon hook and line fishery[b]							0	5	0	-	1.7[c]
Washington tribal treaty salmon set gillnet fishery[b]							1	0	0	-	0.3[c]
Washington tribal treaty sablefish longline fishery[b]							1	0	0	-	0.3[c]
Hooked by unknown hook and line gear*					0	1	1	0	1	-	0.6
Entangled in unknown trawl gear*					1	0	0	0	0	-	0.2
Entangled in unidentified fishing gear*					0	1	3	0	0	-	0.8
Entangled in marine debris					15	11	8	0	2	-	7.2
Dependent pup of animal seriously injured by marine debris					0	2	0	0	0	-	0.4
Illegally shot					1	2	8	9	5	-	5.0
Euthanized under NMFS-authorized MMPA section 120(f) permit								6	38	-	22[d]
Total in commercial fisheries											0.2
Total in Washington tribal fisheries											2.3
Total in Alaska subsistence fisheries											0.4
Total in Southeast Alaska salmon hatchery pen											0.2
*Total in unknown (commercial, recreational, Washington tribal, or Alaska subsistence) fisheries											15.1
Total in marine debris (including dependent pup(s) of animal(s) seriously injured or killed by marine debris)											15.6
Total due to other sources (illegally shot, euthanized under NMFS-authorized MMPA section 120(f) permit)											27.2

[a] Marine Mammal Authorization Program (MMAP) fisherman self report.
[b] Interactions reported by the NWIFC lack details on whether each interaction involved bycatch or lethal removal to prevent interference with fishing gear and/or catch. For purposes of this stock assessment report, these animals are considered to have been incidentally killed in association with Washington tribal treaty fishing operations.
[c] A 3-year average (using 2019-2021 data) was calculated for this category because data were not received from the NWIFC in 2017-2018.
[d] A 2-year average (using 2020-2021 data) was calculated for this category because intentional lethal take of eastern Steller sea lions on the waters of the Columbia River and its tributaries under MMPA Section 120(f) was not authorized prior to 2020.

<u>All fisheries</u>

In summary, the minimum estimated mean annual M/SI rate incidental to all fisheries in U.S. waters between 2017 and 2021 is 38.5 Eastern stock Steller sea lions: 20.5 in U.S. commercial fisheries + 2.3 in Washington tribal treaty fisheries + 0.4 in Alaska subsistence fisheries + 0.2 in Southeast Alaska salmon hatchery pens + 15.1 in unknown (commercial, recreational, Washington tribal, or Alaska subsistence) fisheries.

Alaska Native Subsistence/Harvest Information

Information on the subsistence harvest of Steller sea lions is provided by the ADF&G. The ADF&G conducted 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 in 2005-2008 (Wolfe et al. 2006, 2008, 2009a, 2009b). The interviews were conducted once per year in the winter (January to March) and covered hunter activities for the previous calendar year. Approximately 16 of the interviewed communities lie within the range of the Eastern stock. As of 2009, annual statewide data on community subsistence harvests are no longer being consistently collected. Data are being collected periodically in subareas. Between 2010 and 2017, monitoring occurred only in 2012 (Wolfe et al. 2013), when one animal was landed and eight animals were struck and lost. Therefore, the most recent 5 years of data (2005 to 2008 and 2012) will be used for calculating an annual M/SI estimate. The average number of animals harvested plus struck and lost is 11 animals per year during this 5-year period (Table 5). Since the cessation of ADF&G monitoring, there is an incomplete understanding of harvest levels statewide.

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 (Fisheries and Oceans Canada 2010). 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 management of the stock.

Table 5. Summary of the Alaska Native subsistence harvest data for Eastern stock Steller sea lions from 2005 to 2008 and in 2012. As of 2009, data on community subsistence harvests are no longer being consistently collected at a statewide level. Therefore, the most recent 5 years of data (2005 to 2008 and 2012) will be used for calculating an annual M/SI estimate.

Year	Number harvested	Number struck and lost	Estimated total number taken
2005	0	19	19[a]
2006	2.5	10.1	12.6[b]
2007	0	6.1	6.1[c]
2008	1.7	8.0	9.7[d]
2012	1	8	9[e]
Mean annual take (2005-2008 and 2012)	1.0	10	11

[a]Wolfe et al. (2006); [b]Wolfe et al. (2008); [c]Wolfe et al. (2009a); [d]Wolfe et al. (2009b); [e]Wolfe et al. (2013).

Other Mortality

Steller sea lions were killed in British Columbia during commercial salmon farming operations. Preliminary figures from the British Columbia Aquaculture Predator Control Program indicated a mean annual mortality of 45.8 Steller sea lions from the Eastern stock from 1999 to 2003 (Olesiuk 2004). Starting in 2004, aquaculture facilities were no longer permitted to shoot Steller sea lions (P. Olesiuk, Pacific Biological Station, BC, Canada, pers. comm.). However, Fisheries and Oceans Canada (2010) summarized that "illegal and undocumented killing of Steller Sea Lions is likely to occur in B.C." and reported "[s]everal cases of illegal kills have been documented (Fisheries and Oceans Canada, unpubl. data), and mortality may also occur outside of the legal parameters assigned to permit holders (e.g., for predator control or subsistence harvest)" but "…data on these activities are currently lacking."

Illegal shooting of Steller sea lions in U.S. waters was thought to be a potentially significant source of mortality prior to the listing of Steller sea lions as threatened under the ESA in 1990. Steller sea lion M/SI caused by gunshot wounds is reported to the NMFS Alaska Region and the NMFS West Coast Region stranding networks. Between 2017 and 2021, 26 animals with gunshot wounds within the range of the Eastern stock (including one in the population mixing zone in Southeast Alaska) were reported to the NMFS West Coast Region and Alaska Region stranding networks, resulting in a minimum mean annual M/SI rate of 5.2 Eastern Steller sea lions illegally shot from this stock (Table 4; Freed et al. 2023). The Steller sea lions reported to the NMFS Alaska Region stranding network were considered to be illegal shootings, not animals that were struck and lost during Alaska Native subsistence hunting.

Other non-fishery human-caused M/SI of Steller sea lions reported to the NMFS Alaska Region stranding network between 2017 and 2021 (and the resulting minimum mean annual M/SI rates) were due to entanglement in marine debris (15), dependent pups of animals seriously injured by marine debris (0.6), and euthanized (22) in response to their predation on endangered salmon and steelhead stocks in the Columbia River as authorized under a NMFS MMPA section 120(f) permit (Table 4; Freed et al. 2023). These estimates result from an actual count of verified human-caused deaths and serious injuries and are minimums because not all animals strand or are self-reported nor are all stranded animals found, reported, or have the cause of death determined (via necropsy by trained personnel), and human-related stranding data are not available for British Columbia.

An additional six Steller sea lions in the Eastern and Western stock mixing area of Southeast Alaska that were initially considered seriously injured in marine debris (four in 2017, one in 2018, and one in 2019) were disentangled and released, or were presumed to have self-released, with non-serious injuries (Freed et al. 2023). None of these serious injuries averted were included in the average annual M/SI rate for 2017 to 2021.

STATUS OF STOCK

Based on currently available data, the minimum estimated mean annual U.S. commercial fishery-related M/SI rate for this stock (20.5 sea lions) is less than 10% of the U.S. PBR (10% of PBR = 218) and, therefore, can be considered to be insignificant and approaching a zero M/SI rate. For the U.S. portion of the Eastern stock, the minimum estimated mean annual level of U.S. human-caused M/SI (92.3 sea lions) does not exceed the U.S. PBR (2,178) for this stock. The Eastern stock of Steller sea lions is not listed under the ESA and is not considered depleted under the MMPA. This stock is not classified as strategic. Because the counts of Eastern stock Steller sea lions have steadily increased over a 30+ year period, this stock is likely within its Optimum Sustainable Population (OSP); however, no determination of its status relative to OSP has been made.

There are key uncertainties in the assessment of the Eastern stock of Steller sea lions. The population is based on counts of visible animals; the calculated N_{MIN} and PBR levels, reported only for the U.S. portion of the stock, are conservative because there are no data available to correct for animals not visible during the visual surveys. Information on human-caused M/SI is currently only available for the U.S. portion of the stock's range. There are multiple nearshore commercial fisheries operating within the stock's range that are not observed; thus, there is likely to be unreported fishery-related M/SI of Steller sea lions. Estimates of human-caused M/SI from stranding data are negatively biased because not all animals strand nor are all stranded animals found, reported, or have the cause of death determined.

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