Revised 12/30/2019

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) (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). During the breeding season, 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 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).

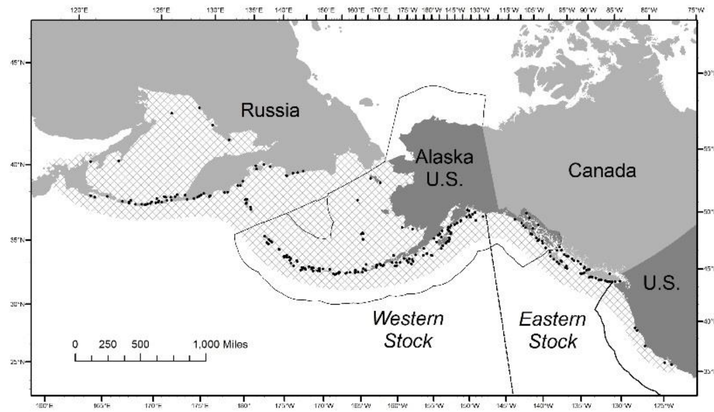

Figure 1. Generalized distribution (crosshatched area) of Steller sea lions in the North Pacific and major U.S. haulouts and rookeries (50 CFR 226.202, 27 August 1993), as well as active Asian and Canadian (British Columbia) haulouts and rookeries (points: Burkanov and Loughlin 2005; S. Majewski, Fisheries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

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 separate stocks of Steller sea lions were recognized within U.S. waters: an Eastern U.S. stock, which includes animals born east of Cape Suckling, Alaska (144°W), and a Western U.S. stock, which includes animals born at and west of Cape Suckling (Loughlin 1997; Fig. 1). However, Jemison et al. (2013, 2018) determined there is regular movement of Steller sea lions from the western Distinct Population Segment (DPS) (males and females equally) and eastern DPS (almost exclusively males) across the DPS boundary. In this report, the western DPS is equivalent to the western stock and the eastern DPS is equivalent to the eastern stock.

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 stock delineation concept by noting that ancient population subdivision likely led to the sequestering of most mtDNA haplotypes as stock or subspecies-specific (Phillips et al. 2011).

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 predominately 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), overall the observations of marked 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 indicate movement of western 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. Movement of western stock sea lions south of these rookeries and eastern stock sea lions moving to the west is less common (Jemison et al. 2013, O'Corry-Crowe et al 2014). 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. In fact, as stated by NMFS and the U.S. Fish and Wildlife Service (USFWS) in a 1996 response to a previous comment regarding stock discreteness policy (61 FR 47222), "*The Services do not consider it appropriate to require absolute reproductive isolation as a prerequisite to recognizing a distinct population segment*" or stock. 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), and Phillips et al. (2009, 2011).

POPULATION SIZE

The eastern stock of Steller sea lions has historically bred on rookeries located in Southeast Alaska, British Columbia, 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), with >100 pups born there in 2015 (R. DeLong and P. Gearin, NMFS-AFSC-MML, pers. comm.). Counts of pups on rookeries conducted near the end of the birthing season are nearly complete counts of pup production. The dates of the most recent aerial photographic and land-based surveys of eastern Steller sea lions have varied by region. Southeast Alaska was surveyed in June and July 2017 (Sweeney et al. 2017; NMFS, unpubl. data), while counts used in population analyses for the contiguous U.S. are from 2014 surveys in Washington (NMFS and Washington Department of Fish and Wildlife, unpubl. data) and 2017 surveys of Oregon and California (NMFS and Oregon Department of Fish and Game, unpubl. data). Counts from Canada (i.e., British Columbia) are from 2013 surveys (Olesiuk 2018; Fisheries and Oceans Canada, unpubl. data). For trend and population estimates, agTrend (an R package; Johnson and Fritz 2014) was used to augment missing counts in order to estimate 2017 counts. The 2017 estimated total eastern stock pup count is 18,450 (95% credible interval of 15,030-22,253). The 2017 estimated total eastern stock non-pup count is 58,699 (95% credible interval of 50,312-68,052). These estimates cannot be used to represent a total population abundance estimate as they do not account for animals at sea.

Minimum Population Estimate

Because current population size (N) and a pup multiplier to estimate N are not known, the best modeled estimates of the total count of eastern Steller sea lions is used as the minimum population estimate (N_{MIN}). These counts are considered minimum estimates of population size because they have not been corrected for animals that are at sea during, or pups born after, the surveys. The agTrend (Johnson and Fritz 2014) total count estimate of pups and non-pups for the entire eastern stock of Steller sea lions (including Canada; Olesiuk 2018) in 2017 is 77,149 (58,699 non-pups plus 18,450 pups). The total count estimate of pups and non-pups for the U.S. portion of the eastern stock of Steller sea lions (excluding Canada) is 43,201 (32,510 non-pups plus 10,691 pups) and is considered to be N_{MIN}.

Current Population Trend

Using agTrend, count data from 1971 to 2017 were modeled to estimate annual trends from 1987 to 2017 (30-year period). This model indicates the eastern stock of Steller sea lions increased at a rate of 4.25% per year (95% credible intervals of 3.77-4.72%) between 1987 and 2017 based on an analysis of pup counts in California, Oregon, Washington, British Columbia, and Southeast Alaska (Table 1, Figs. 2 and 3). A similar analysis of non-pup counts in the same regions yielded an estimate of population increase of 3.22% per year (95% credible intervals of 2.82-3.65%: Table 1). Pitcher et al. (2007) reported that the Eastern U.S. stock increased at a rate of 3.1% per year during a 25-year time period from 1977 to 2002; however, they used a slightly different method to estimate population growth than the methods reported in NMFS (2013). The Eastern U.S. stock increase has been driven by growth in pup counts in all regions (NMFS 2013).

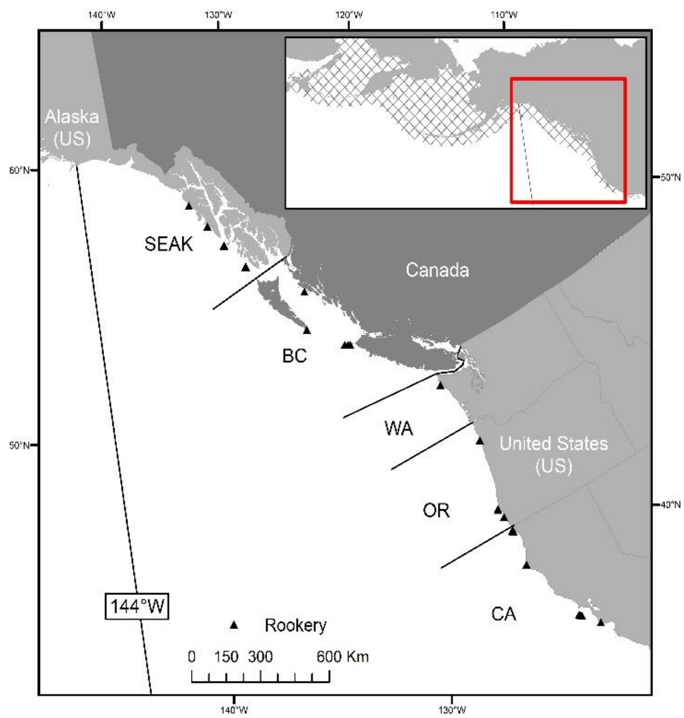

Figure 2. The eastern Steller sea lion rookery sites by region: Southeast Alaska (SEAK), British Columbia, Canada (BC), Washington State (WA), Oregon State (OR), and California State (CA).

Table 1. Trends (annual rates of change expressed as % y^{-1} with 95% credible interval) of eastern Steller sea lion non-pups (adults and juveniles) and pups, by region and total population, for 1987-2017 (Johnson and Fritz 2014, Sweeney et al. 2017).

	Non-Pup			Pup		
Region	**Trend**	**-95%**	**+95%**	**Trend**	**-95%**	**+95%**
California, U.S.	2.01	0.83	3.22	3.44	2.38	4.55
Oregon, U.S.	2.50	1.58	3.41	3.72	2.83	4.48
Washington, U.S.*	9.12	6.06	11.96			
British Columbia, Canada	4.18	3.47	4.96	6.91	5.89	7.91
Southeast Alaska, U.S.	2.45	1.85	3.08	3.04	2.49	3.60
Total Eastern Stock	3.22	2.82	3.65	4.25	3.77	4.72

*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), with a confirmed count of 45 pups in 2013 and >100 pups in 2015 (R. DeLong and P. Gearin, NMFS-AFSC-MML, pers. comm.).

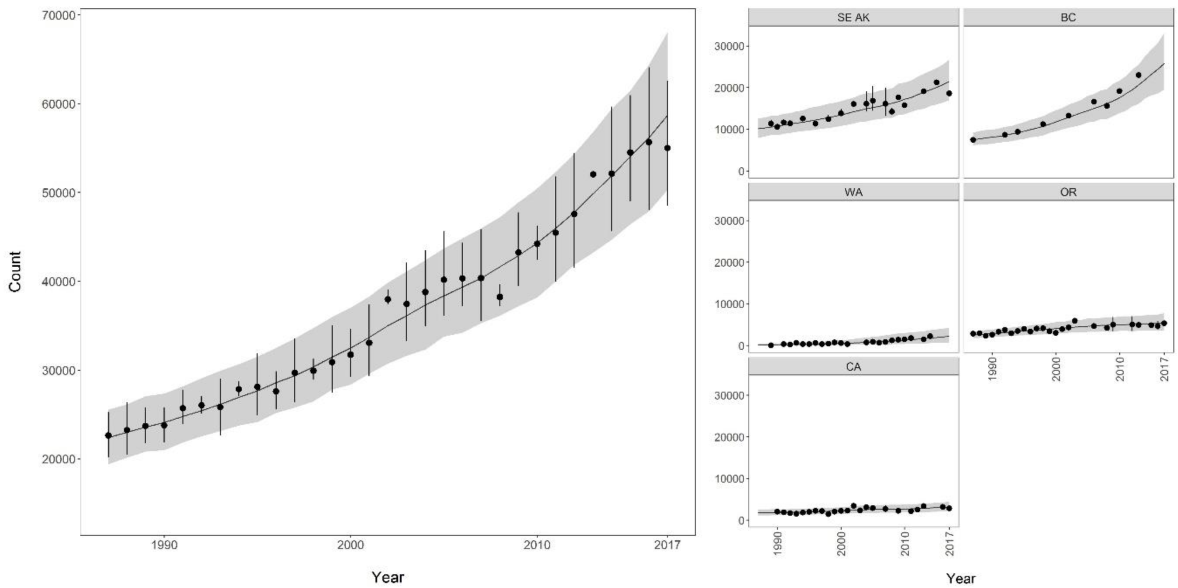

Figure 3. Estimated counts (modeled with agTrend) of Steller sea lion non-pups (adults and juveniles) for the eastern stock and the five regions: Southeast Alaska (SEAK), British Columbia, Canada (BC), Washington (WA), Oregon (OR), and California (CA) for 1987-2017 (Johnson and Fritz 2014, Sweeney et al. 2017).

While the eastern stock of Steller sea lions has been increasing in all regions from 1990 to 2017, the most significant growth has been observed in Southeast Alaska and British Columbia, Canada (Fig. 3). These two regions comprise almost 81% 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 but 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 2017, ranging from approximately 2,000 to 3,100.

Net movement between the eastern and western stocks appears to be small during the breeding season, with an estimated net 75 sea lions moving from east to west in 2016 (Jemison et al. 2013, Fritz et al. 2016). As a result, trends in counts estimated from breeding season surveys should be relatively insensitive to inter-stock movements. Very few females move from Southeast Alaska to the western stock while approximately 500 were estimated to move from west to east (net increase in the east). Males move in both directions but with a net increase in the west. This pattern of movement is supported by mitochondrial DNA evidence that indicated that the newest rookeries in northern Southeast Alaska (eastern stock) were colonized in part by western females (Gelatt et al. 2007, O'Corry-Crowe et al. 2014).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no estimates of the maximum net productivity rate (R_{MAX}) for Steller sea lions. Pitcher et al. (2007) observed a rate of population increase of 3.1% per year for the eastern stock but concluded this rate did not represent a maximum rate of increase. NMFS (2013) estimated that the eastern stock increased at rates of 4.18% per year using pup counts and 2.99% per year using non-pup counts between 1979 and 2009. Here, we estimated that counts of pups and non-pups increased at rates of 4.25% and 3.22% per year, respectively, between 1987 and 2017 (Table 1). Until additional data become available, the maximum theoretical net productivity rate for pinnipeds of 12% will be used for this stock (NMFS 2016).

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 recently 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 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; the recovery factor is 1.0 (recovery factor for a stock of unknown status that is known to be increasing), and the PBR = 2,592 (43,201 × 0.06 × 1.0).

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 2013 and 2017 is listed, by marine mammal stock, in Delean et al. (2020); however, only the mortality and serious injury data are included in the Stock Assessment Reports. The minimum estimated mean annual level of human-caused mortality and serious injury for Eastern U.S. Steller sea lions between 2013 and 2017 is 112 sea lions: 24 in U.S. commercial fisheries, 1.2 in recreational fisheries, 0.2 in subsistence fisheries, 32 in unknown (commercial, recreational, or subsistence) fisheries, 31 in marine debris, 13 due to other causes (illegally shot, explosives, ship strike, and incidental mortality during direct removals of California sea lions under authorization of MMPA Section 120 in response to their predation on endangered salmon and steelhead stocks in the Columbia River), and 11 in the Alaska Native subsistence harvest (from the 2005 to 2008 and 2012 data, which are the most recent data available). 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

Information (including observer programs, observer coverage, and observed incidental takes of marine mammals) for federally-managed and state-managed U.S. commercial fisheries is presented in Appendices 3-6 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).

Between 2013 and 2017, incidental mortality and serious injury of eastern Steller sea lions was observed in two of the federally-managed U.S. commercial fisheries in Alaska that are monitored for incidental mortality and serious injury by fisheries observers: the Gulf of Alaska halibut longline and Gulf of Alaska sablefish longline fisheries (Table 2; Breiwick 2013; MML, unpubl. data).

Mortality and serious injury of eastern Steller sea lions was also observed in six of the federally-managed U.S. commercial fisheries monitored by U.S. West Coast groundfish fisheries observers in 2012-2016: the Washington/Oregon/California (WA/OR/CA) groundfish bottom trawl (catch shares), WA/OR/CA groundfish midwater trawl (shoreside hake sector), 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 2; Jannot et al. 2018; NWFSC, unpubl. data).

Mortality and serious injury of eastern Steller sea lions due to entanglement in Southeast Alaska commercial salmon drift gillnet (one in 2014) and interactions with Southeast Alaska commercial salmon troll gear (three in 2017) was reported by Marine Mammal Authorization Program (MMAP) fisherman self-reports and reports to the NMFS Alaska Region stranding network, respectively, between 2013 and 2017 (Table 3; Delean et al. 2020). Because observer data are not available for the Southeast Alaska commercial salmon drift gillnet and Southeast Alaska commercial salmon troll fisheries, this mortality and serious injury is used to calculate minimum mean annual mortality and serious injury rates of 0.2 and 0.6 eastern Steller sea lions, respectively, for these fisheries (Table 3). These mortality and serious injury 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.

The minimum estimated mean annual mortality and serious injury rate incidental to U.S. commercial fisheries between 2013 and 2017 is 24 eastern Steller sea lions, based on observer data and stranding data (Tables 2 and 3). 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.

Table 2. Summary of incidental mortality and serious injury of Eastern U.S. Steller sea lions due to U.S. commercial fisheries between 2013 and 2017 (or the most recent data available) and calculation of the mean annual mortality and serious injury rate for Alaska fisheries (Breiwick 2013; MML, unpubl. data) and WA/OR/CA fisheries (Jannot et al. 2018; NWFSC, unpubl. data).

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean estimated annual mortality
Gulf of Alaska halibut longline	2013 2014 2015 2016 2017	obs data	4.2 11 9.4 9.5 4.6	0 0 1 0 0	0 0 12 0 0	2.4 (CV = 0.96)
Gulf of Alaska sablefish longline	2013 2014 2015 2016 2017	obs data	14 19 20 14 12	0 0 1 0 1	0 0 6.9 0 11	3.5 (CV = 0.69)
WA/OR/CA groundfish (bottom trawl - catch shares)	2012 2013 2014 2015 2016	obs data	99 100 100 100 100	8 6 5 8 0	8 6 5 8 0	5.4
WA/OR/CA groundfish (midwater trawl - shoreside hake sector)	2012 2013 2014 2015 2016	obs data	100 100 100 100 100	0 0 1 0 0	0 0 1 0 0	0.2
WA/OR/CA groundfish (midwater trawl - at-sea hake catcher-processor sector)	2012 2013 2014 2015 2016	obs data	100 100 100 100 100	1 2 3 0 21	1 2 3 0 21	5.4
WA/OR/CA groundfish (midwater trawl - at-sea hake mothership catcher vessel sector)	2012 2013 2014 2015 2016	obs data	98 100 100 100 100	0 0 1 0 2	0 0 1 0 2	0.6
WA/OR/CA sablefish (hook and line - limited entry)	2012 2013 2014 2015 2016	obs data	22 22 27 42 33	0 0 0 0 2	0.5 0.4 0.4 0.3 2.4	0.8
California halibut (bottom trawl - open access)	2012 2013 2014 2015 2016	obs data	6 6 22 33 30	0 0 0 3 3	2.7 3.4 3.2 6.1 6.1	4.3
Minimum total estimated annual mortality						23 (CV = 0.56)

Entanglement in marine debris and interactions with fisheries are a contributing factor in Steller sea lion injury and mortality (Raum-Suryan et al. 2009). Reports to the NMFS Alaska Region stranding network 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 mortality and serious injury (Table 3;

Delean et al. 2020). Between 2013 and 2017, reports of Steller sea lion interactions with Southeast Alaska recreational salmon troll and Southeast Alaska recreational hook and line fisheries resulted in a minimum mean annual mortality and serious injury rate of 1.2 Steller sea lions in recreational fisheries. One mortality reported in a subsistence halibut longline fishery in 2017 resulted in a mean annual mortality and serious injury rate of 0.2 Steller sea lions in subsistence fisheries between 2013 and 2017. Steller sea lion interactions with troll fisheries between 2013 and 2017 resulted in mean annual mortality and serious injury rates of 3.4 sea lions in the Southeast Alaska salmon troll fishery and 27 in unidentified troll fisheries, including the dependent pup of a seriously injured animal. In all but one case (in which the animal was entangled in gear), the sea lions had either ingested troll gear or were hooked in the mouth; however, it is not clear whether these interactions involved recreational or commercial components of the fisheries. Other fishery-related mortality and serious injury of eastern Steller sea lions between 2013 and 2017 (and the resulting mean annual mortality and serious injury rates) was due to interactions with trawl gear (0.4) and hook and line gear (1.2). The minimum mean annual mortality and serious injury rate due to all non-commercial fishery interactions reported to the NMFS Alaska Region and ADF&G between 2013 and 2017 is 33 eastern Steller sea lions: 1.2 in recreational fisheries + 0.2 in subsistence fisheries + 32 in unknown (commercial, recreational, or subsistence) fisheries (Table 3; Delean et al. 2020). These mortality and serious injury 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 eight Steller sea lions initially considered seriously injured in marine debris (one in 2014, one in 2015, and four in 2017), hook and line gear (one in 2016), and Southeast Alaska salmon troll gear (one in 2017) were disentangled and released with non-serious injuries in Alaska waters, and one Steller sea lion pup with serious injuries caused by human harassment was rehabilitated and released with non-serious injuries in Washington waters in 2014 (Delean et al. 2020). None of these animals were included in the average annual mortality and serious injury rate for 2013 to 2017.

Table 3. Summary of Eastern U.S. Steller sea lion mortality and serious injury, by year and type, reported to the NMFS Alaska Region marine mammal stranding network and ADF&G, and by fishermen self-reports, between 2013 and 2017 (Delean et al. 2020).

Cause of injury	**2013**	**2014**	**2015**	**2016**	**2017**	**Mean annual mortality**
Entangled in Southeast Alaska commercial salmon drift gillnet	0	1[a]	0	0	0	0.2
Hooked by Southeast Alaska commercial salmon troll gear	0	0	0	0	3	0.6
Hooked by SE Alaska recreational salmon troll gear	0	1	0	0	4	1
Hooked by Southeast Alaska recreational hook and line gear	0	0	1	0	0	0.2
Hooked by subsistence halibut longline gear	0	0	0	0	1	0.2
Hooked by Southeast Alaska salmon troll gear*	3	8	6	0	0	3.4
Hooked by troll gear*	3	41	26	42	17	26
Dependent pup of animal seriously injured (hooked) by troll gear*	0	0	0	1	0	0.2
Entangled in troll gear*	0	0	0	1	1	0.4
Entangled in trawl gear*	0	1	0	0	1	0.4
Hooked by hook and line gear*	0	0	0	2	2	0.8
Entangled in hook and line gear*	0	0	1	1	0	0.4
Entangled in marine debris	-	26	26	34	28	29[b]
Dependent pup of animal seriously injured by marine debris	-	3	2	2	0	1.8[b]
Illegally shot[c]	17	13	15	13	1	12

Cause of injury	2013	2014	2015	2016	2017	Mean annual mortality
Dependent pup of animal illegally shot[c]	0	1	0	0	0	0.2
Explosives	0	1	0	0	0	0.2
Ship strike	0	0	0	1	0	0.2
Incidental mortality during direct removals of California sea lions	0	0	1	0	0	0.2
Total in commercial fisheries						0.8
Total in recreational fisheries						1.2
Total in subsistence fisheries						0.2
*Total in unknown (commercial, recreational, or subsistence) fisheries						32
Total in marine debris						31
Total due to other sources (illegally shot, explosives, ship strike, incidental mortality during direct removals of California sea lions)						13

[a]Marine Mammal Authorization Program (MMAP) fisherman self report.
[b]A 4-year average (using 2014 to 2017 data) was calculated for this category, since we did not receive data on mortality and serious injury due to marine debris entanglement from the ADF&G in 2013.
[c]Only animals reported to the NMFS West Coast Region are included in this table because animals reported to the NMFS Alaska Region are likely accounted for as "struck and lost" in the Alaska Native harvest.

The minimum estimated mean annual mortality and serious injury rate incidental to all fisheries between 2013 and 2017 is 57 Steller sea lions: 24 in U.S. commercial fisheries + 1.2 in recreational fisheries + 0.2 in subsistence fisheries + 32 in unknown (commercial, recreational, or 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 U.S. 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 mortality and serious injury estimate. The average number of animals harvested plus struck and lost is 11 animals per year during this 5-year period (Table 4).

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 4. Summary of the subsistence harvest data for Eastern U.S. 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 mortality and serious injury 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 taken 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 this 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 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. Steller sea lion mortality and serious injury caused by gunshot wounds is reported to the NMFS Alaska Region and the NMFS West Coast Region stranding networks. Between 2013 and 2017, 59 animals with gunshot wounds were reported to the NMFS West Coast Region stranding network, resulting in a minimum mean annual mortality and serious injury rate of 12 Steller sea lions illegally shot from this stock plus 0.2 dependent pups of seriously injured animals (Table 3; Delean et al. 2020). An additional two Steller sea lions with gunshot wounds were reported to the NMFS Alaska Region stranding network between 2013 and 2017 (one each in 2016 and 2017). Although it is likely that illegal shooting does occur in Alaska, these events are not included in the estimate of the average annual mortality and serious injury rate because it could not be confirmed that the deaths were due to illegal shooting and were not already accounted for in the estimate of animals struck and lost in the Alaska Native subsistence harvest. Other non-fishery human-caused mortality and serious injury of Steller sea lions reported to the NMFS Alaska Region stranding network between 2013 and 2017 (and the resulting minimum mean annual mortality and serious injury rates) were due to entanglement in marine debris (29), dependent pups of animals seriously injured by marine debris (1.8), explosives (0.2), ship strikes (0.2), and incidental mortality (0.2) during direct removals of California sea lions under authorization of MMPA Section 120 in response to their predation on endangered salmon and steelhead stocks in the Columbia River (Table 3; Delean et al. 2020). 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.

STATUS OF STOCK

Based on currently available data, the minimum estimated mean annual U.S. commercial fishery-related mortality and serious injury rate for this stock (24 sea lions) is less than 10% of the calculated PBR (10% of PBR = 259) and, therefore, can be considered to be insignificant and approaching a zero mortality and serious injury rate. The minimum estimated mean annual level of human-caused mortality and serious injury (112 sea lions) does not exceed the PBR (2,592) for this stock. The Eastern U.S. stock of Steller sea lions is not listed under the ESA and is not considered depleted under the MMPA. This stock is classified as a non-strategic stock. Because the counts of eastern 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 U.S. stock of Steller sea lions. There is some overlap in range between animals in the western and eastern stocks in northern Southeast Alaska. The population is based on counts of visible animals; the calculated N_{MIN} and PBR levels are conservative because there are no data available to correct for animals not visible during the visual surveys. There are multiple nearshore commercial fisheries which are not observed; thus, there is likely to be unreported fishery-related mortality and serious injury of Steller sea lions. Estimates of human-caused mortality and serious injury from stranding data are underestimates because not all animals strand nor are all stranded animals found, reported, or have the cause of death determined.

HABITAT CONCERNS

Unlike the Western U.S. stock of Steller sea lions, there has been a sustained and robust increase in abundance of the Eastern U.S. stock throughout its breeding range. In the southern end of its range (Channel Islands in southern California), it has declined considerably since the late 1930s and several rookeries and haulouts south of Año Nuevo Island have been abandoned. Changes in the ocean environment, particularly warmer temperatures, may be factors that have favored California sea lions over Steller sea lions in the southern portion of the Steller sea lion's range (NMFS 2008). The risk of oil spills to this stock may increase in the next several decades due to increased shipping, including tanker traffic, from ports in British Columbia and possibly Washington State (COSEWIC 2013, NMFS 2013, Wiles 2014) and LNG facility and pipeline construction (COSEWIC 2013).

CITATIONS

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

Berta, A., and M. Churchill. 2012. Pinniped taxonomy: review of currently recognized species and subspecies, and evidence used for their description. Mammal Rev. 42(2):207-234.

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

Breiwick, J. M. 2013. North Pacific marine mammal bycatch estimation methodology and results, 2007-2011. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-260, 40 p.

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

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2013. COSEWIC assessment and status report on the Steller sea lion *Eumetopias jubatus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Canada. xi + 54 p. Available online: https://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Steller%20Sea%20Lion_2013_e.pdf . Accessed December 2019.

Delean, B. J., V. T. Helker, M. M. Muto, K. Savage, S. Teerlink, L. A. Jemison, K. Wilkinson, J. Jannot, and N. C. Young. 2020. Human-caused mortality and injury of NMFS-managed Alaska marine mammal stocks, 2013-2017. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-401, 86 p.

DeMaster, D. 2014. Results of Steller sea lion surveys in Alaska, June-July 2013. Memorandum to J. Balsiger, J. Kurland, B. Gerke, and L. Rotterman, January 27, 2014, NMFS Alaska Regional Office, Juneau AK. Available from Alaska Fisheries Science Center, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115.

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

Fisheries and Oceans Canada. 2010. Management Plan for the Steller Sea Lion (*Eumetopias jubatus*) in Canada [Final]. Species at Risk Act Management Plan Series. Fisheries and Oceans Canada, Ottawa. vi + 69 p.

Fritz, L., K. Sweeney, R. Towell, and T. Gelatt. 2016. Aerial and ship-based surveys of Steller sea lions (*Eumetopias jubatus*) conducted in Alaska in June-July 2013 through 2015, and an update on the status and trend of the western distinct population segment in Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-321, 72 p.

Gelatt, T., A. W. Trites, K. Hastings, L. Jemison, K. Pitcher, and G. O'Corry-Crowe. 2007. Population trends, diet, genetics, and observations of Steller sea lions in Glacier Bay National Park, p. 145-149. *In* J. F. Piatt and S. M. Gende (eds.), Proceedings of the Fourth Glacier Bay Science Symposium, October 26-28, 2004: U.S. Geological Survey Scientific Investigations Report 2007-5047.

Harlin-Cognato, A., J. W. Bickham, T. R. Loughlin, and R. L. Honeycutt. 2006. Glacial refugia and the phylogeography of Steller's sea lion (*Eumetopias jubatus*) in the North Pacific. J. Evol. Biol. 19:955-969. DOI: dx.doi.org/10.1111/j.1420-9101.2005.01052.x .

Hastings, K. K., L. A. Jemison, G. W. Pendleton, K. L. Raum-Suryan, and K. W. Pitcher. 2017. Natal and breeding philopatry of female Steller sea lions in southeastern Alaska. PLoS ONE 13(4):e0196412. DOI: dx.doi.org/10.1371/journal.pone.0176840 .

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

Hoffman, J. I., K. K. Dasmahapatra, W. Amos, C. D. Phillips, T. S. Gelatt, and J. W Bickham. 2009. Contrasting patterns of genetic diversity at three different genetic markers in a marine mammal metapopulation. Mol. Ecol. 18(14):2961-2978.

Jannot, J. E., K. A. Somers, V. Tuttle, J. McVeigh, J. V. Carretta, and V. Helker. 2018. Observed and estimated marine mammal bycatch in U.S. west coast groundfish fisheries, 2002–16. U.S. Dep. Commer., NWFSC Processed Report 2018-03, 36 p. DOI: dx.doi.org/10.25923/fkf8-0x49 .

Jemison, L. A., G. W. Pendleton, L. W. Fritz, K. K. Hastings, J. M. Maniscalco, A. W. Trites, and T. S. Gelatt. 2013. Inter-population movements of Steller sea lions in Alaska with implications for population separation. PLoS ONE 8(8):e70167.

Jemison, L. A., G. W. Pendleton, K. K. Hastings, J. M. Maniscalco, and L. W. Fritz. 2018. Spatial distribution, movements, and geographic range of Steller sea lions (*Eumetopias jubatus*) in Alaska. PLoS ONE 13:e0208093.

Johnson, D. S., and L. W. Fritz. 2014. agTrend: a Bayesian approach for estimating trends of aggregated abundance. Methods Ecol. Evol. 5:1110-1115. DOI: dx.doi.org/10.1111/2041-210X.12231 .

Le Boeuf, B. J., K. Ono, and J. Reiter. 1991. History of the Steller sea lion population at Año Nuevo Island, 1961-1991. Southwest Fisheries Science Center Admin. Rep. LJ-91-45C. 9 p. + tables + figs. Available from Southwest Fisheries Science Center, 8901 La Jolla Shores Drive, La Jolla, CA 92037.

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

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

Merrick, R. L., R. Brown, D. G. Calkins, and T. R. Loughlin. 1995. A comparison of Steller sea lion, *Eumetopias jubatus*, pup masses between rookeries with increasing and decreasing populations. Fish. Bull., U.S. 93:753-758.

National Marine Fisheries Service (NMFS). 2008. Recovery Plan for the Steller sea lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, MD. 325 p.

National Marine Fisheries Service (NMFS). 2013. Status review of the eastern Distinct Population Segment of Steller sea lion (*Eumetopias jubatus*). 144 p. + appendices. Protected Resources Division, Alaska Region, NMFS, 709 West 9th Street, Juneau, AK 99802.

National Marine Fisheries Service (NMFS). 2016. Guidelines for preparing stock assessment reports pursuant to the 1994 amendments to the Marine Mammal Protection Act. 23 p. Available online: https://www.fisheries.noaa.gov/national/marine-mammal-protection/guidelines-assessing-marine-mammal-stocks . Accessed December 2019.

O'Corry-Crowe, G., B. L. Taylor, and T. Gelatt. 2006. Demographic independence along ecosystem boundaries in Steller sea lions revealed by mtDNA analysis: implications for management of an endangered species. Can. J. Zool. 84(12):1796-1809.

O'Corry-Crowe, G., T. Gelatt, L. Rea, C. Bonin, and M. Rehberg. 2014. Crossing to safety: dispersal, colonization and mate choice in evolutionarily distinct populations of Steller sea lions, *Eumetopias jubatus*. Mol. Ecol. 23(22):5415-5434.

Olesiuk, P. F. 2004. Status of sea lions (*Eumetopias jubatus* and *Zalophus californianus*) wintering off southern Vancouver Island. NMMRC Working Paper No. 2004-03 (DRAFT).

Olesiuk, P. F. 2018. Recent trends in abundance of Steller sea lions (*Eumetopias jubatus*) in British Columbia. DFO Can. Sci. Advis. Sec. Res. Doc. 2018/006. v + 67 p.

Phillips, C. D., J. W. Bickham, J. C. Patton, and T. S. Gelatt. 2009. Systematics of Steller sea lions (*Eumetopias jubatus*): subspecies recognition based on concordance of genetics and morphometrics. Museum of Texas Tech University Occasional Papers 283:1-15.

Phillips, C. D., T. S. Gelatt, J. C. Patton, and J. W. Bickham. 2011. Phylogeography of Steller sea lions: relationships among climate change, effective population size, and genetic diversity. J. Mammal. 92(5):1091-1104.

Pitcher, K. W., P. F. Olesiuk, R. F. Brown, M. S. Lowry, S. J. Jeffries, J. L. Sease, W. L. Perryman, C. E. Stinchcomb, and L. F. Lowry. 2007. Abundance and distribution of the eastern North Pacific Steller sea lion (*Eumetopias jubatus*) population. Fish. Bull., U.S. 105(1):102-115.

Raum-Suryan, K. L., K. W. Pitcher, D. G. Calkins, J. L. Sease, and T. R. Loughlin. 2002. Dispersal, rookery fidelity, and metapopulation structure of Steller sea lions (*Eumetopias jubatus*) in an increasing and a decreasing population in Alaska. Mar. Mammal Sci. 18(3):746-764. DOI: dx.doi.org/10.1111/j.1748-7692.2002.tb01071.x .

Raum-Suryan, K. L., L. A. Jemison, and K. W. Pitcher. 2009. Entanglement of Steller sea lions (*Eumetopias jubatus*) in marine debris: identifying causes and finding solutions. Mar. Pollut. Bull. 58:1487-1495.

Rehberg, M., L. Jemison, J. N. Womble, and G. O'Corry-Crowe. 2018. Winter movements and long-term dispersal of Steller sea lions in the Glacier Bay region of Southeast Alaska. Endang. Species Res. 37:11-24. DOI: dx.doi.org/10.3354/esr00909 .

Sease, J. L., and A. E. York. 2003. Seasonal distribution of Steller's sea lions at rookeries and haul-out sites in Alaska. Mar. Mammal Sci. 19(4):745-763.

Sweeney, K., L. Fritz, R. Towell, and T. Gelatt. 2017. Results of Steller sea lion surveys in Alaska, June-July 2017. Memorandum to the Record, December 5, 2017. Available from Marine Mammal Laboratory, AFSC, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115.

Wiles, G. J. 2014. Draft Washington State periodic status review for the Steller sea lion. Washington Department of Fish and Wildlife, Olympia, WA. 35 p.

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

Wolfe, R. J., J. A. Fall, and M. Riedel. 2008. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 2006. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 339, Juneau, AK.

Wolfe, R. J., J. A. Fall, and M. Riedel. 2009a. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 2007. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 345, Juneau, AK.

Wolfe, R. J., J. A. Fall, and M. Riedel. 2009b. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 2008. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 347, Juneau, AK.

Wolfe, R. J., J. Bryant, L. Hutchinson-Scarbrough, M. Kookesh, and L. A. Sill. 2013. The subsistence harvest of harbor seals and sea lions in Southeast Alaska in 2012. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 383, Anchorage, AK.

York, A. E., R. L. Merrick, and T. R. Loughlin. 1996. An analysis of the Steller sea lion metapopulation in Alaska, p. 259-292. *In* D. R. McCullough (ed.), Metapopulations and Wildlife Conservation. Island Press, Covelo, CA.