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Memorandum To: The Record

From: Kathryn Sweeney, Lowell Fritz, Rod Towell, and Thomas Gelatt
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Subject: Results of Steller Sea Lion Surveys in Alaska, June-July 2017

The Marine Mammal Laboratory (MML) conducted aerial-, ship-, and land-based surveys to count Steller sea lion (*Eumetopias jubatus*) pups (~1 mo old) and non-pups (adults and juveniles ≥ 1 year old) on terrestrial rookery and haulout sites in Alaska in June-July 2017. The occupied aircraft survey team conducted their survey from 27 June to 5 July from southeast Alaska (Dixon Entrance, 132°W) to the Shumagin Islands in the western Gulf of Alaska (161°W). The ship-based survey team, which included the use of an unoccupied aircraft system (UAS), conducted their survey from 22 June to 7 July in the Aleutian Islands between 172°E and 166°W. In addition, the Alaska Department of Fish and Game (ADFG) counted Steller sea lions from land on Round Island in Bristol Bay (eastern Bering Sea).

The stock boundary between the eastern and western DPSs of the Steller sea lion is 144˚W longitude. The MML's survey in southeast Alaska was part of a range-wide survey of the eastern distinct population segment (DPS) of Steller sea lions (California through southeast Alaska) conducted in 2017 by Department of Fisheries and Oceans Canada, Washington and Oregon Departments of Fish and Wildlife, and NOAA Fisheries (including the SW Fisheries Science Center).

Methods

Abundance surveys to count Steller sea lions are conducted in late June through mid-July starting ~10 days after the mean pup birth dates in the survey area (4-14 June) after ~95% of all pups are born (Pitcher et al. 2001; Kuhn et al. 2017). MML's objectives for the 2017 were to survey all terrestrial rookery and haulout sites in southeast Alaska and through the Gulf of Alaska, as well as opportunistically in the 2016 Aleutians Islands, especially those sites missed (n=24) in the central Aleutian Islands during the occupied aircraft survey.

The occupied aircraft survey team operated from a NOAA twin Otter fixed-wing aircraft equipped with three high-resolution digital cameras (as in 2009-2016; see Fritz et al. 2016), and surveyed sites from southeast Alaska (eastern DPS) and into the western DPS from the eastern to the western Gulf of Alaska (Figure 1). The ship-based survey team worked off the US Fish and Wildlife Service (USFWS) *R/V Tiĝlâx* to survey the Aleutian Islands. Ground

observers conducted sea lion counts from a skiff offshore, research vessel, or land-based overlook (mean counts of 2-3 observers are reported); or from aerial images captured using the UAS (i.e., APH-22 hexacopter).

Field camp observers counted Steller sea lions hauled out on Round (Walrus Is.) from an overlook the same day the twin Otter team surveyed northern Bristol Bay in the eastern Bering Sea (personal communication from E. Weiss, Lands and Refuge Manager, Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, AK 99518). MML analyzed aerial images captured with the UAS and twin Otter camera array as in previous years (see Fritz et al. 2016).

agTrend modeling—We estimated pup and non-pup count data using agTrend (Johnson and Fritz 2014) by region and for the western DPS overall in Alaska. Using raw count data from 1978 to 2017, we estimated that the year with the lowest non-pup and pup counts in the western DPS (in Alaska) was 2002. We estimated abundance trends from 2002 to 2017 for the western DPS in Alaska (Johnson and Fritz 2014). We calculated trends in southeast Alaska from 1987 to 2017 (30-year period).

Our method for modeling raw counts (agTrend) produces trend estimates and two types of counts: predicted and realized counts. Predicted counts are used to estimate trends, and account for both observation and process errors. Realized counts use the standardized variance at each site throughout the 1978-2017 time series to estimate survey counts we could expect to collect if we had completely surveyed all sites. Therefore, the more complete the survey, the more similar raw counts are to realized counts.

Results

The twin Otter-based crew surveyed 195 sites in southeast Alaska, the eastern and central Gulf of Alaska, northern Bristol Bay in the eastern Bering Sea, and the Shumagin Islands in the western Gulf of Alaska (Table 1 and Table 2). Five sites were missed in this survey area due to fog or survey logistics. To avoid disturbance of Pacific walrus (*Odobenus rosmarus*), Round (Walrus Is) in northern Bristol Bay was not surveyed. ADFG provided a ground count of Steller sea lions at Round (Walrus Is) for the same day the Otter team surveyed the other sites in the area (Table 3).

The *R/V Tiĝlâx* crew counted sea lions or conducted UAS surveys at 17 sites in the Aleutian Islands: 11 were counted by observers from either land-based overlooks, inflatable skiffs offshore, or from the research vessel (all labelled as “ground”; Table 2), while the UAS operators piloted the hexacopter at 6 sites to capture aerial imagery. The *R/V Tiĝlâx* team surveyed 11 of the 24 sites missed by the occupied aircraft team in 2016, mostly in the Delarof Islands (10 sites in RCA 3, Figure 1).

Steller sea lion non-pup counts

In the western DPS, we counted a total of 19,988 live non-pups on 83 sites that had at least one non-pup (Tables 1 and 2). The eastern and central GULF regions were surveyed almost completely with the exception of two missed sites that historically had zero or very few sea lions present. In the eastern GULF region we counted 970 fewer non-pups in 2017 (N=5,264) than in 2015 (N=6,234), the most recent year we surveyed the Gulf of Alaska. Central GULF non-pup counts were 1,117 higher in 2017 (N=8,953 non-pups) than in 2015 (N=7,836).

Actual non-pup counts in the two regions combined remained relatively stable from 2015 to 2017 (147 more non-pups in 2017).

We counted a total of 18,763 live non-pups on 40 sites with at least one non-pup in the eastern DPS in Alaska (southeast Alaska; Table 3), which is 2,505 fewer than in 2015. The three sites missed during the 2017 survey historically had very few or no sea lions present.

agTrend modeling—Non-pup counts increased at a rate of 2.14% y^{-1} between 2002 and 2017 in the western DPS in Alaska (95% credible interval of 1.49-2.78% y^{-1}; Table 4 and Figure 2). This is a slightly lower rate of increase than what we reported last year for the 2003-2016 period (2.24% y^{-1}; Sweeney et al. 2016; this citation and time period applies to all 2016 results referenced). The total model-predicted non-pup count in the western DPS in Alaska in 2017 is 42,315 (38,039-47,377), ~1,600 more than the 2016 estimate.

Non-pups increased at 3.09% y^{-1} east of Samalga Pass from 2002 to 2017 (Table 4), down slightly from rates reported 2016 (3.40% $y^{-1)}$) due to 2017 results in the eastern and central GULF regions. Rates of increase in eastern GULF non-pup counts decreased from 5.55% y^{-1} through the 2015 estimate for the 2003-2015 period (Fritz et al 2016; this citation and time period applies to all 2015 results referenced) to 4.21% y^{-1} between 2002 and 2017 (Figure 3). This was due solely to the lower 2017 non-pup count. In the same time period, the central GULF increased 3.90% y^{-1}, nearly identical to the 2015 estimate. Non-pup counts increased in the western GULF at 3.01% y^{-1}, slightly lower than the rates reported through 2015 and 2016 (3.84% y^{-1} and 3.28% y^{-1}, respectively). In 2017, however, only the eastern half of the western GULF was surveyed. Since there was only limited new data for the eastern Aleutian Islands/eastern Bering Sea region (only for northern Bristol Bay), there was little change in the rate of change of non-pup counts for this region from the previous two years.

West of Samalga Pass, modeled non-pup trends and counts were similar to what we reported in 2016 however, the 2017 realized counts have wider confidence intervals since we surveyed only 17 sites in this area. Non-pup counts in the central Aleutian Islands region remained statistically stable at a rate of -0.07% y^{-1} (-1.26 to 1.15% y^{-1}). We surveyed in RCAs 2 and 3, within the central ALEU, which both declined from 2002 to 2017 at -4.00% y^{-1} and -2.91% y^{-1}, respectively (Figure 4). These are slightly steeper rates of decline than what we reported in 2016. Western Aleutian Islands region non-pups declined -6.71% y^{-1} through 2017, similar the 2016 estimate.

Non-pup counts in southeast Alaska (eastern DPS) increased at 2.14% y^{-1} (1.49-2.78 y^{-1}) from 1987 to 2017 (Figure 5).

Steller sea lion pup counts

In the western DPS we counted a total of 4,641 live pups from aerial images of 32 sites that had at least one pup present (Tables 1 and 2). In the eastern and central GULF regions, we counted 33% and 17% fewer pups, respectively, than in 2015 (2,707 and 1,194 pups, respectively).

We counted a total 7,110 live pups from aerial images on 20 sites in the eastern DPS in Alaska (southeast Alaska) that had at least one pup present (Table 3). This year's pup count is 6% lower than in 2015.

agTrend modeling—Pups in the western DPS in Alaska increased at 1.78% y^{-1} (1.19-2.34 y^{-1}) between 2002 and 2017 (Table 4 and Figure 6), down from the 2.19% y^{-1} estimated in 2016. The total estimated pup count for the western DPS in Alaska in 2017 is 11,953 (10,879-13,195), which is 678 fewer than the 2016 estimate.

Pup counts east of Samalga Pass increased at 3.18% y^{-1}, lower than the 2016 estimate (3.71% y^{-1}). The lower rate through 2017 was mostly due to the steep decline in pups in 2017 in the eastern and central GULF. Pup counts in the eastern GULF increased 2.65% y^{-1} from 2002 to 2017, which is considerably lower than the 4.54% y^{-1} estimated through 2015 (Figure 7). Central GULF pup counts increased 3.28% y^{-1} through 2017, also a lower rate than estimated through 2015 (4.17% y^{-1}). Rates of increase in pup counts in the western GULF and in the eastern ALEU were similar through 2016 and 2017.

West of Samalga Pass, pup counts decreased at a rate of -1.90% y^{-1} between 2002 and 2017, almost identical to the 2016 estimate. Though non-pup counts in the central Aleutian Islands remain relatively stable, pup counts significantly declined in this region (-1.33% y^{-1}), and in RCAs 2 and 3 (-4.15% y^{-1} and -3.20% y^{-1}, respectively; Figure 8). The rate of decline in pup counts in the central Aleutians Islands as a whole was the same in both 2016 and 2017. With the addition of the 2017 data, that rate is now significantly less than 0 (-1.33% y^{-1}, 95% CI -2.43 – -0.18% y^{-1}). Pup trend in this region went from being statistically stable to declining. Pup counts remained relatively stable in RCAs 4 and 5, but continued to decrease in the western ALEU (-6.38% y^{-1} through 2017, similar to the 2016 estimate).

Pup counts in southeast Alaska (eastern DPS) increased >3% y^{-1} from 1987 to 2017, but counts between 2009 and 2017 are relatively stable (Figure 9).

Discussion

Overall counts of Steller sea lions within the range of the western DPS in Alaska increased between 2002 and 2017 but at lower trend rates than estimated in both 2015 and 2016, especially for pups. Declines in rates of increase in pup counts were mainly due to lower counts in the eastern and central GULF and parts of the central Aleutian Islands in 2017 relative to the previous two years.

Given the similarity in total non-pup counts for the combined eastern and central GULF regions in 2015 and 2017, the continued increase in the central GULF may have been due to movement of non-pups from the eastern GULF. Movement of non-pups from the eastern to the central GULF in the breeding season is opposite the general pattern described from the distribution of juvenile and adult sea lions branded as pups in 2000-2014 (Fritz et al. 2016), and may have been due to changes in availability of prey associated with warm ocean temperatures that occurred in the northern Gulf of Alaska in 2014-2016 (Bond et al. 2015; Peterson et al. 2016). While adult females and juveniles were largely responsible for the greater non-pup count in the central Gulf of Alaska in 2017 than 2015 (MML, unpublished) and these animals may have moved from the eastern GULF, this did not result in greater pup counts in the central GULF (18% lower in 2017 than in 2015).

Trends in pup and non-pup counts east (increasing) and west (generally decreasing) of Samalga Pass in the Aleutian Islands were similar through 2017 to rates we have reported in previous years. The agTrend model produced fairly large estimates for 2017 for the central Aleutian region as a whole with very large confidence bounds. This was due to the fact that

we had no new data for RCAs 4 and 5 and agTrend estimated that counts in 2017 would be greater than in 2016 for these two areas that have both generally increasing counts and the largest rookeries in the central Aleutian Islands region. Data collected during the 2018 survey, which will be focused in the Aleutian Islands, should yield more precise and accurate estimates of counts and trends west of Samalga Pass, and for the western DPS overall in Alaska.

Acknowledgments

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Literature Cited

Bond, N. A., M. F. Cronin, H. Freeland, and N. Mantua. 2015. Causes and impacts of the 2014 warm anomaly in the NE Pacific. Geophys. Res. Lett., 42, 3414–3420. doi: 10.1002/2015GL063306.

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

Johnson, D. S., and L. W. Fritz. 2014. agTrend: A Bayesian approach for estimating trends of aggregated abundance. Methods in Ecology and Evolution 5(10): 1110-1115.

Kuhn C. E., K. Chumbley, D. Johnson, and L. Fritz. 2017. A re-examination of the timing of pupping for Steller sea lions *Eumetopias jubatus* breeding on two islands in Alaska. Endang Species Res 32:213-222. https://doi.org/10.3354/esr00796

Peterson, W., N. Bond, and M. Robert. 2016. The blob (part three): Going, going, gone? PICES Press, 24(1), 46-48. Retrieved from https://search.proquest.com/docview/1785278412?accountid=28257

Pitcher, K. W., V. N. Burkanov, D. G. Calkins, B. J. LeBoeuf, E. G. Mamaev, R. L. Merrick, and G. W. Pendleton. 2001. Spatial and temporal variation in the timing of births of Steller sea lions. J. Mammalogy 82(4): 1047-1053.

Sweeney, K. L., L. Fritz, R. Towell, and T. Gelatt. 2016. Results of Steller sea lion surveys in Alaska, June-July 2016. Memorandum to D. DeMaster, J. Bengtson, J. Balsiger, J. Kurland, and L. Rotterman, December 5, 2016. https://www.afsc.noaa.gov/NMML/PDF/SSL_Aerial_Survey_2016.pdf.

Table 1—Counts of live Steller sea lion non-pups and pups (mean of 2 independent counters) on sites surveyed in in the western DPS in 2017 by the occupied aircraft survey team. "Rookery" sites are noted with a '1' (≥ 50 pups in any year since 1970).

Site	Region	Rookery	Date	Non-Pup	Pup
AIALIK CAPE	E GULF		2-Jul	0	
CAPE FAIRFIELD	E GULF		2-Jul	26	0
CAPE HINCHINBROOK	E GULF		29-Jun	1	
CAPE JUNKEN	E GULF		2-Jul	0	
CAPE PUGET	E GULF		2-Jul	11	0
CAPE RESURRECTION	E GULF		2-Jul	108	0
CAPE ST. ELIAS	E GULF		29-Jun	1258	20
CHISWELL ISLANDS	E GULF	1	2-Jul	160	79
DANGER	E GULF		2-Jul	7	
DUTCH GROUP	E GULF		2-Jul	124	0
FOX	E GULF		29-Jun	1	
GLACIER	E GULF		2-Jul	1228	5
GRANITE CAPE	E GULF		2-Jul	0	
HOOK POINT	E GULF		29-Jun	0	
NATOA (GROTTO)	E GULF		2-Jul	46	0
NO NAME	E GULF		2-Jul	128	0
PERRY	E GULF		2-Jul	0	
PILOT ROCK	E GULF		2-Jul	84	0
PLEIADES	E GULF		2-Jul	0	
POINT ELEANOR	E GULF		2-Jul	0	
POINT ELRINGTON	E GULF		2-Jul	138	0
POINT LaTOUCHE	E GULF		2-Jul	0	
PROCESSION ROCKS	E GULF		2-Jul	148	4
RABBIT	E GULF		2-Jul	0	
RAGGED/HOOF POINT	E GULF		2-Jul	148	0
RUGGED	E GULF		2-Jul	34	0
SEAL ROCKS	E GULF	1	29-Jun	747	504
SEAL ROCKS (KENAI)	E GULF		2-Jul	110	0
STEEP POINT	E GULF		2-Jul	0	
THE NEEDLE	E GULF		2-Jul	289	5
WOODED (FISH)	E GULF	1	29-Jun	468	178
AFOGNAK/TONKI CAPE	C GULF		4-Jul	0	
AGHIYUK	C GULF		5-Jul	100	0
AIUGNAK COLUMNS	C GULF		5-Jul	6	
CAPE DOUGLAS	C GULF		3-Jul	0	
CAPE GULL	C GULF		3-Jul	152	0
CAPE KULIAK	C GULF		3-Jul	36	0
CAPE NUKSHAK	C GULF		3-Jul	0	
CAPE UGYAK	C GULF		3-Jul	0	
CHIRIKOF	C GULF	1	5-Jul	594	193
CHOWIET	C GULF	1	5-Jul	1154	562
EAST CHUGACH	C GULF		2-Jul	0	
ELIZABETH/CAPE ELIZABETH	C GULF		2-Jul	0	
FLAT	C GULF		2-Jul	0	

Site	Region	Rookery	Date	Non-Pup	Pup
GORE POINT	C GULF		2-Jul	0	
KILOKAK ROCKS	C GULF		5-Jul	299	0
KODIAK/CAPE ALITAK	C GULF		4-Jul	0	
KODIAK/CAPE BARNABAS	C GULF		4-Jul	152	0
KODIAK/CAPE CHINIAK	C GULF		4-Jul	194	0
KODIAK/CAPE IKOLIK	C GULF		4-Jul	47	0
KODIAK/CAPE KULIUK	C GULF		4-Jul	0	
KODIAK/CAPE PARAMANOF	C GULF		4-Jul	0	
KODIAK/CAPE UGAT	C GULF		4-Jul	392	0
KODIAK/CAPE UYAK	C GULF		4-Jul	0	
KODIAK/GULL POINT	C GULF		4-Jul	50	0
KODIAK/MALINA POINT	C GULF		4-Jul	0	
KODIAK/STEEP CAPE	C GULF		4-Jul	57	0
KODIAK/STURGEON HEAD	C GULF		4-Jul	0	
KODIAK/SUNDSTROM	C GULF		4-Jul	0	
KODIAK/TOMBSTONE ROCKS	C GULF		4-Jul	0	
LATAX ROCKS	C GULF		4-Jul	366	12
LONG ISLAND	C GULF		4-Jul	24	0
MARMOT	C GULF	1	4-Jul	1319	500
NAGAHUT ROCKS	C GULF		2-Jul	17	0
NAGAI ROCKS	C GULF		5-Jul	226	6
NOISY	C GULF		4-Jul	0	
NUKA POINT	C GULF		2-Jul	0	
OUTER (PYE)	C GULF	1	2-Jul	346	100
PERL	C GULF		2-Jul	140	0
PERL ROCKS	C GULF		2-Jul	0	
PUALE BAY	C GULF		3-Jul	292	0
SEA LION ROCKS (MARMOT)	C GULF		4-Jul	50	0
SEA OTTER	C GULF		4-Jul	204	1
SEA OTTER/RK NEAR	C GULF		4-Jul	0	
SHAKUN ROCKS	C GULF		3-Jul	214	3
SHAW	C GULF		3-Jul	0	
SITKINAK/CAPE SITKINAK	C GULF		4-Jul	244	0
SUD	C GULF		3-Jul	0	
SUGARLOAF	C GULF	1	3-Jul	980	682
SUTWIK	C GULF		5-Jul	262	25
TAKLI	C GULF		3-Jul	1	0
TWOHEADED	C GULF	1	4-Jul	562	54
UGAIUSHAK	C GULF		5-Jul	0	
UGAK	C GULF		4-Jul	0	
USHAGAT/NW	C GULF		3-Jul	0	
USHAGAT/ROCKS SOUTH	C GULF		3-Jul	56	0
USHAGAT/SW	C GULF	1	3-Jul	417	97
WEST AMATULI	C GULF		3-Jul	0	
ATKINS	W GULF	1	5-Jul	791	333
ATKULIK	W GULF		5-Jul	0	
BIG KONIUJI	W GULF		5-Jul	0	

Site	Region	Rookery	Date	Non-Pup	Pup
BIRD (SHUMAGINS)	W GULF		5-Jul	40	0
CHANKLIUT	W GULF		5-Jul	0	
CHERNABURA	W GULF	1	5-Jul	1188	348
EGG (SAND POINT)	W GULF		5-Jul	6	
JUDE	W GULF	1	5-Jul	681	358
KAK	W GULF		5-Jul	236	0
KUPREANOF POINT	W GULF		5-Jul	162	0
LIGHTHOUSE ROCKS	W GULF	1	5-Jul	236	15
MITROFANIA	W GULF		5-Jul	172	0
NAGAI/MOUNTAIN POINT	W GULF		5-Jul	229	0
NAGAI/RK W OF CAPE WEDGE	W GULF		5-Jul	0	
PAUL	W GULF		5-Jul	0	
SEA LION ROCKS (SHUMAGINS)	W GULF		5-Jul	68	0
SEAL CAPE	W GULF		5-Jul	0	
SIMEONOF	W GULF		5-Jul	9	0
SPITZ	W GULF		5-Jul	4	0
THE HAYSTACKS	W GULF		5-Jul	30	1
THE WHALEBACK	W GULF	1	5-Jul	122	68
TWINS	W GULF		5-Jul	0	
UNGA/ACHEREDIN POINT	W GULF		5-Jul	146	0
UNGA/CAPE UNGA	W GULF		5-Jul	0	
CAPE NEWENHAM	E ALEU (BERING)		3-Jul	115	0
SUMMIT	E ALEU (BERING)		3-Jul	0	
THE TWINS	E ALEU (BERING)		3-Jul	0	

Table 2—Counts of live Steller sea lion non-pups and pups on sites surveyed during 2017 ship- and ground-based efforts in the western DPS. Counts conducted from cliff tops, inflatable skiffs offshore, or from the research vessel are indicated as a "ground" mode and sites surveyed with the unmanned aircraft are labeled "UAS", Rookeries are noted with a '1' (≥ 50 pups in any year since 1970).

Site	Region	Rookery	Date	Non-Pup	Pup	Mode
ROUND (WALRUS IS)	E ALEU (BERING)		3-Jul	180		Ground
AMATIGNAK/KNOB POINT	C ALEU		29-Jun	0		Ground
AMATIGNAK/NITROF POINT	C ALEU		29-Jun	14		Ground
AMATIGNAK/WEST	C ALEU		29-Jun	0		Ground
GRAMP ROCK	C ALEU	1	1-Jul	371	176	UAS
ILAK	C ALEU		30-Jun	24		Ground
KAVALGA	C ALEU		1-Jul	5		Ground
KISKA/CAPE ST STEPHEN	C ALEU	1	28-Jun	75	26	UAS
OGLIUGA	C ALEU		1-Jul	0	0	Ground
SKAGUL/S. POINT	C ALEU		1-Jul	53	1	Ground
TAG	C ALEU	1	1-Jul	176	73	UAS
UGIDAK	C ALEU		1-Jul	10		Ground
ULAK/HASGOX POINT	C ALEU	1	29-Jun	380	150	UAS
AGATTU/CAPE SABAK	W ALEU	1	26-Jun	141	54	UAS
ALAID	W ALEU		25-Jun	78	8	UAS
ATTU/CHICHAGOF POINT	W ALEU		25-Jun	15		Ground
BULDIR/NW ROCKS	W ALEU		24-Jun	14		Ground
SHEMYA	W ALEU		25-Jun	0		Ground

Table 3— Counts of live Steller sea lion non-pups and pups (mean of 2 independent counters) on sites surveyed in in the eastern DPS in Alaska (southeast Alaska) in 2017 by the occupied aircraft survey team. “Rookery” sites are noted with a ‘1’ (≥ 50 pups in any year since 1973).

Site	Rookery	Date	Non-Pup	Pup
AKWE		29-Jun	0	
ALSEK		29-Jun	0	
BENJAMIN		28-Jun	331	0
BERNERS BAY		28-Jun	0	
BIALI ROCK	1	27-Jun	934	202
BLACK ROCK		28-Jun	0	
CAPE ADDINGTON		27-Jun	778	1
CAPE BARTOLOME		27-Jun	1	
CAPE BINGHAM		28-Jun	46	0
CAPE CROSS		28-Jun	172	0
CAPE FAIRWEATHER		29-Jun	0	
CAPE OMMANEY		27-Jun	215	0
CAPE OMMANEY/S		27-Jun	74	0
CASE (TLINGIT) POINT		28-Jun	0	
CIRCLE POINT		28-Jun	0	
CORONATION		27-Jun	92	1
DOROTHY		28-Jun	0	
EASTERLY		27-Jun	160	1
ELDRED ROCK		28-Jun	0	
EMMONS		28-Jun	0	
ETOLIN		27-Jun	0	
FALSE POINT PYBUS		28-Jun	0	
FORRESTER/C HORN RK	1	27-Jun	413	378
FORRESTER/EAST RK	1	27-Jun	200	136
FORRESTER/FORRESTER ISLAND		27-Jun	45	0
FORRESTER/LOWRIE	1	27-Jun	1636	1492
FORRESTER/NORTH RK	1	27-Jun	974	1101
FORRESTER/SEA LION RK	1	27-Jun	604	556
FUNTER BAY		28-Jun	0	
GAFF ROCK		28-Jun	0	
GLOOMY KNOB		28-Jun	0	
GRAN (LEDGE) POINT		28-Jun	381	1
GRAVES ROCK	1	28-Jun	1844	474
GRINDALL		27-Jun	190	0
HAENKE		29-Jun	0	
HARBOR POINT		29-Jun	218	0
HAZY	1	27-Jun	2033	1750
INIAN		28-Jun	214	0
JACOB ROCK		27-Jun	333	2
KAIUCHALI (BIORKA)		27-Jun	10	0
LARCH BAY		27-Jun	0	
LISENOI		27-Jun	0	

Site	Rookery	Date	Non-Pup	Pup
LITTLE ISLAND		28-Jun	2	
MET POINT		28-Jun	1	
MIDDLE PASS ROCK		28-Jun	29	0
MIST		28-Jun	0	
NOSE POINT		27-Jun	0	
PINTA ROCKS		28-Jun	0	
POINT CAROLUS		28-Jun	0	
POINT ISLET (POINT ROCK)		27-Jun	0	
POINT LEAGUE (STEVENS PASSAGE)		28-Jun	0	
POINT LULL		28-Jun	0	
POINT MARSDEN		28-Jun	0	
POINT MARSH		27-Jun	4	0
ROCKY ISLAND		28-Jun	125	0
ROUND ROCK		28-Jun	0	
SAIL		28-Jun	4	0
SAKIE POINT		27-Jun	0	
SEA LION ISLANDS		28-Jun	524	2
SEA LION ROCK (PUFFIN BAY)		27-Jun	108	0
SITKAGI BLUFFS		29-Jun	0	
SITUK		29-Jun	0	
SOUTH MARBLE		28-Jun	910	6
ST. LAZARIA		28-Jun	0	
SUNSET		28-Jun	1140	5
SUNSET POINT		28-Jun	0	
TARR INLET		28-Jun	0	
TENAKEE CANNERY POINT		28-Jun	0	
THE BROTHERS/SW		28-Jun	258	0
THE BROTHERS/W+E		28-Jun	0	
THE SISTERS		28-Jun	0	
TIMBERED		27-Jun	516	9
TURNABOUT		28-Jun	0	
VENISA		28-Jun	0	
WALTER (PORT HOUGHTON)		28-Jun	0	
WEST ROCK		27-Jun	702	1
WHITE SISTERS	1	28-Jun	1678	981
WOLF ROCK		27-Jun	422	0
YASHA		28-Jun	442	11

Table 4—Annual rates of change (% y^{-1} with ± 95% credible intervals) in counts of Steller sea lion pups and non-pups from west to east in the western DPS (U.S.), for the period 2002-2017 modeled using agTrend. Growth for southeast Alaska (eDPS) pup and non-pup counts for the last thirty years (1987-2017) is also shown at the bottom.

	Non-Pup			Pup		
	Rate	-95% CI	+95% CI	Rate	-95% CI	+95% CI
W ALEU	-6.73	-8.34	-5.20	-6.83	-7.93	-5.71
C ALEU	-0.07	-1.26	1.15	-1.33	-2.43	-0.18
RCA 2	-4.00	-6.15	-1.51	-4.15	-6.62	-1.87
RCA 3	-2.91	-4.17	-1.49	-3.20	-4.67	-1.87
RCA 4	-0.48	-2.73	1.82	-0.27	-1.98	1.67
RCA 5	3.81	1.15	6.29	0.83	-2.16	3.79
W of Samalga Pass	-0.84	-1.94	0.26	-1.90	-2.88	-0.82
E ALEU	1.85	0.42	3.27	2.79	1.80	3.83
W GULF	3.01	1.50	4.56	3.65	2.31	5.12
Eastern & Central GULF	4.03	2.95	5.14	3.10	1.93	4.37
C GULF	3.90	2.88	4.98	3.28	1.73	4.84
E GULF	4.21	2.04	6.26	2.65	0.99	4.63
E of Samalga Pass	3.09	2.35	3.90	3.18	2.48	3.87
All western DPS (US)	**2.14**	**1.49**	**2.78**	**1.78**	**1.19**	**2.34**
Southeast Alaska (eastern DPS)	2.47	1.89	3.11	3.05	2.53	3.59

Figure 1—Steller sea lion terrestrial rookeries and haulouts surveyed in June-July 2017. Survey regions, rookery cluster areas (RCAs) and boundary of the eastern and western distinct population segments (DPSs) in Alaska are also shown.

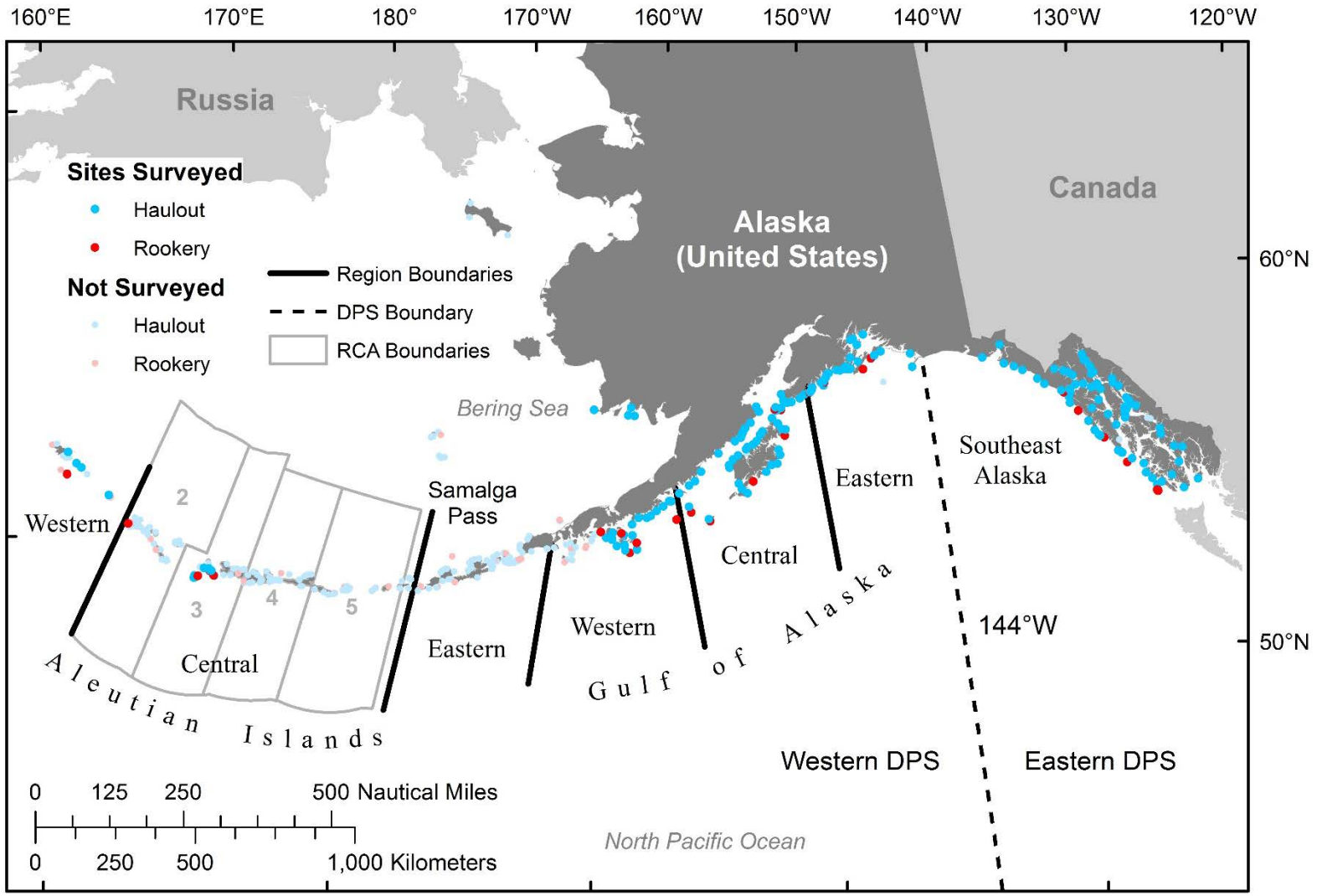

Figure 2—Realized and predicted counts of western Steller sea lion non-pups in Alaska, 2002-2017. Realized counts are represented by points and vertical lines (95% credible intervals). Predicted counts are represented by the black line surrounded by the gray 95% credible interval.

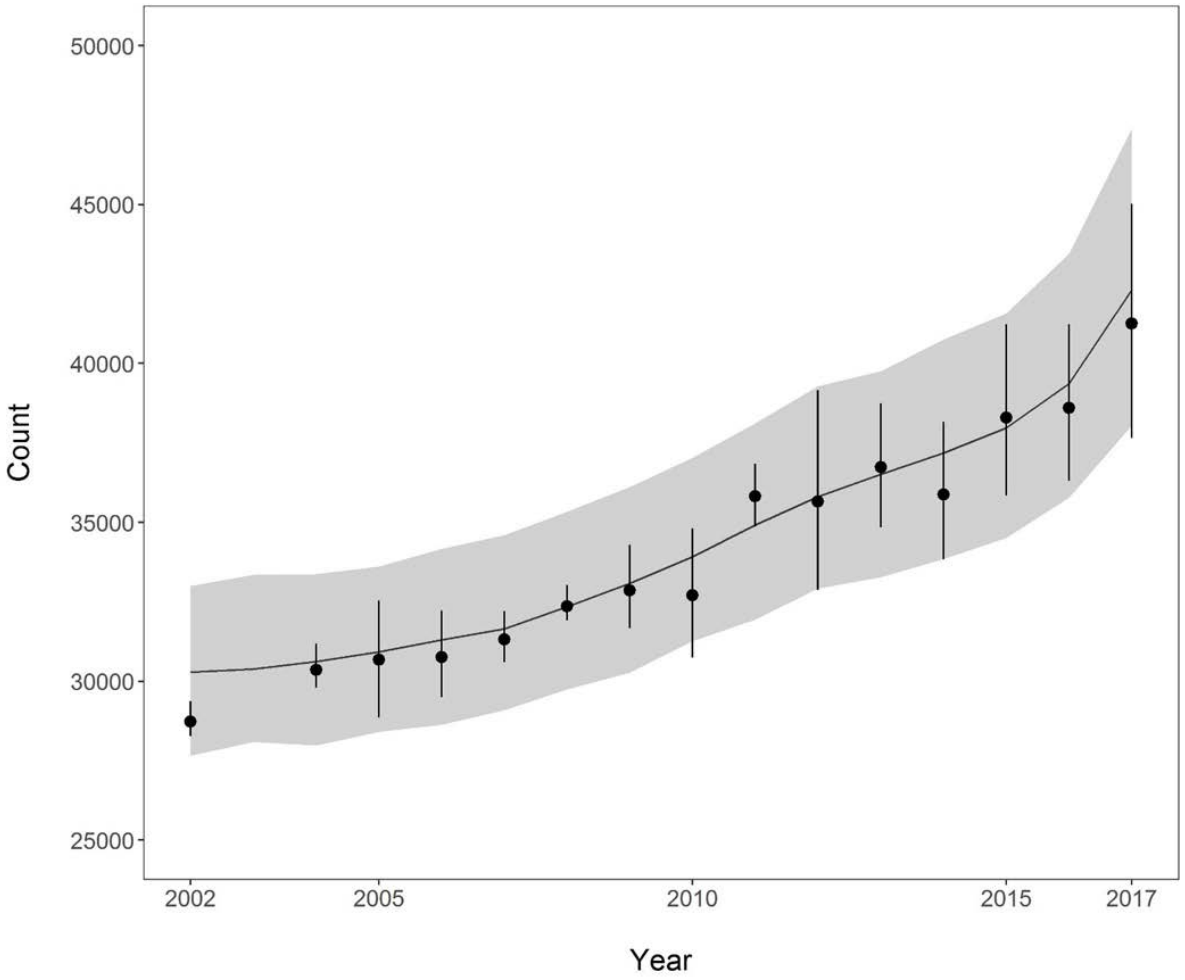

Figure 3—Realized and predicted counts of western Steller sea lion non-pups in the central (C GULF) and eastern Gulf of Alaska (E GULF) regions, 2002-2017. Realized counts are represented by points and vertical lines (95% credible intervals). Predicted counts are represented by the black line surrounded by the gray 95% credible interval.

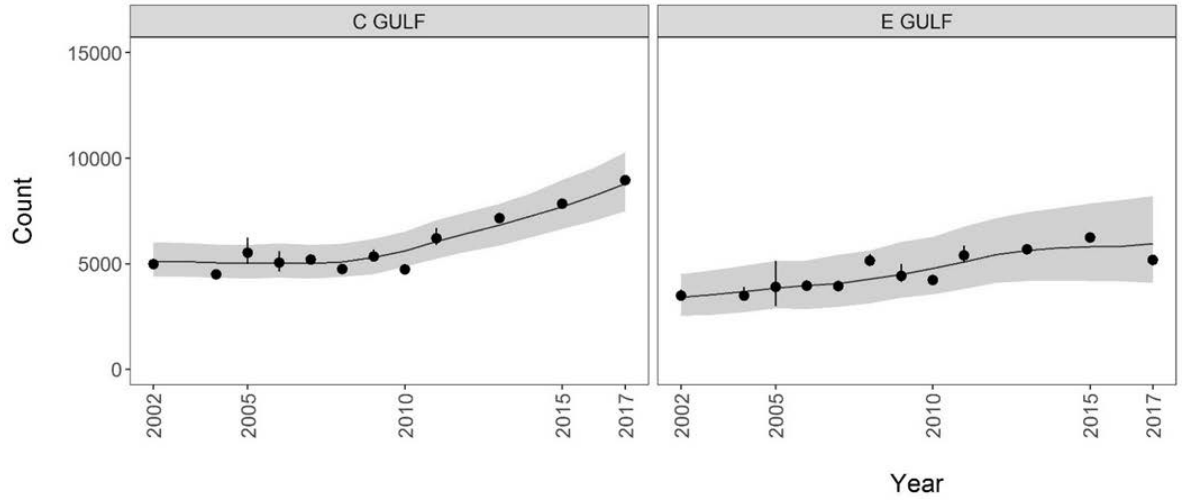

Figure 4— Realized and predicted counts of western Steller sea lion non-pups in the western Aleutian Islands (W ALEU) and Rookery Cluster Areas (RCAs) 2 and 3 (in the C ALEU, Figure 1); 2002-2017. Realized counts are represented by points and vertical lines (95% credible intervals). Predicted counts are represented by the black line surrounded by the gray 95% credible interval.

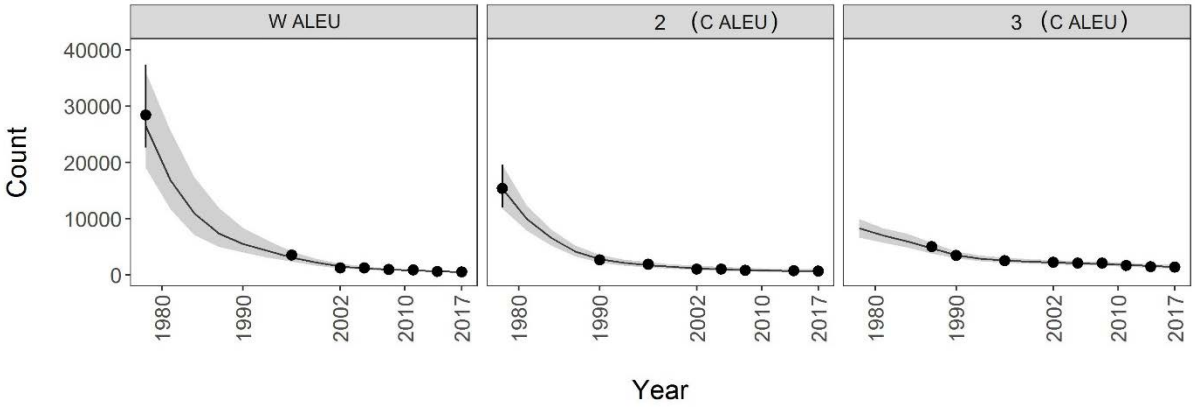

Figure 5—Realized and predicted counts of eastern DPS Steller sea lion non-pups in the southeast Alaska region, 1987-2017. Realized counts are represented by points and vertical lines (95% credible intervals). Predicted counts are represented by the black line surrounded by the gray 95% credible interval.

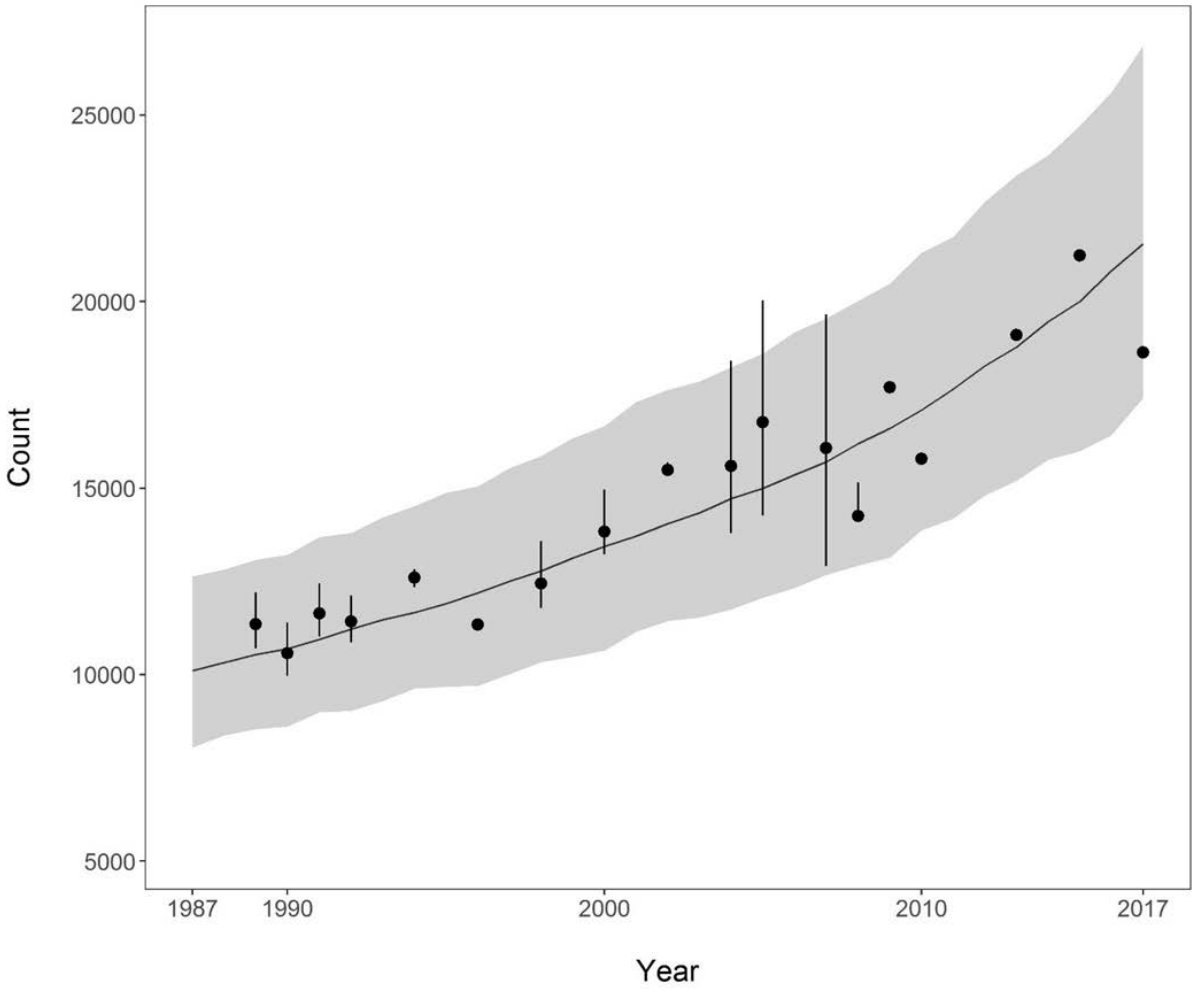

Figure 6—Realized and predicted counts of western Steller sea lion pups in Alaska, 2002-2017. Realized counts are represented by points and vertical lines (95% credible intervals). Predicted counts are represented by the black line surrounded by the gray 95% credible interval.

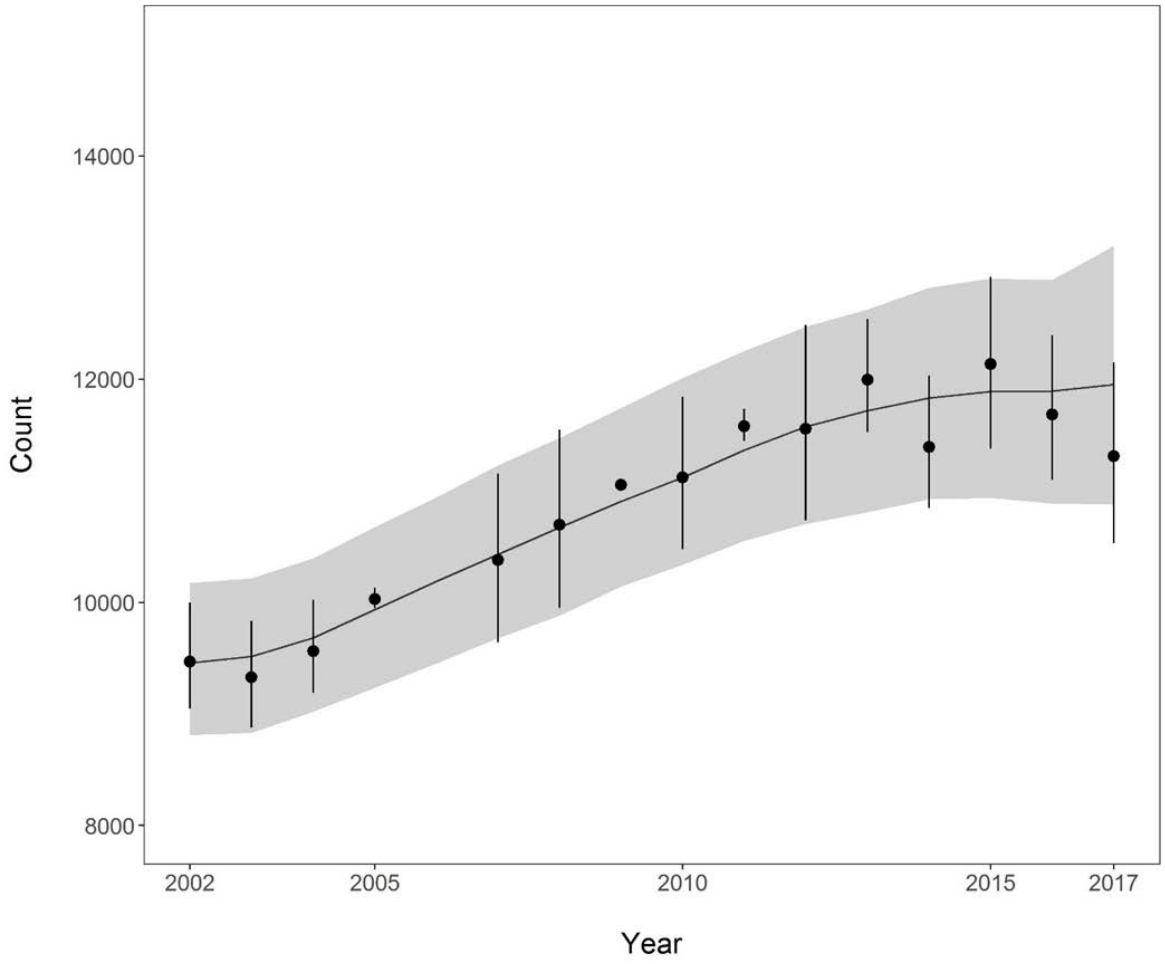

Figure 7—Realized and predicted counts of western Steller sea lion pups in the central (C GULF) and eastern Gulf of Alaska (E GULF) regions, 2002-2017. Realized counts are represented by points and vertical lines (95% credible intervals). Predicted counts are represented by the black line surrounded by the gray 95% credible interval.

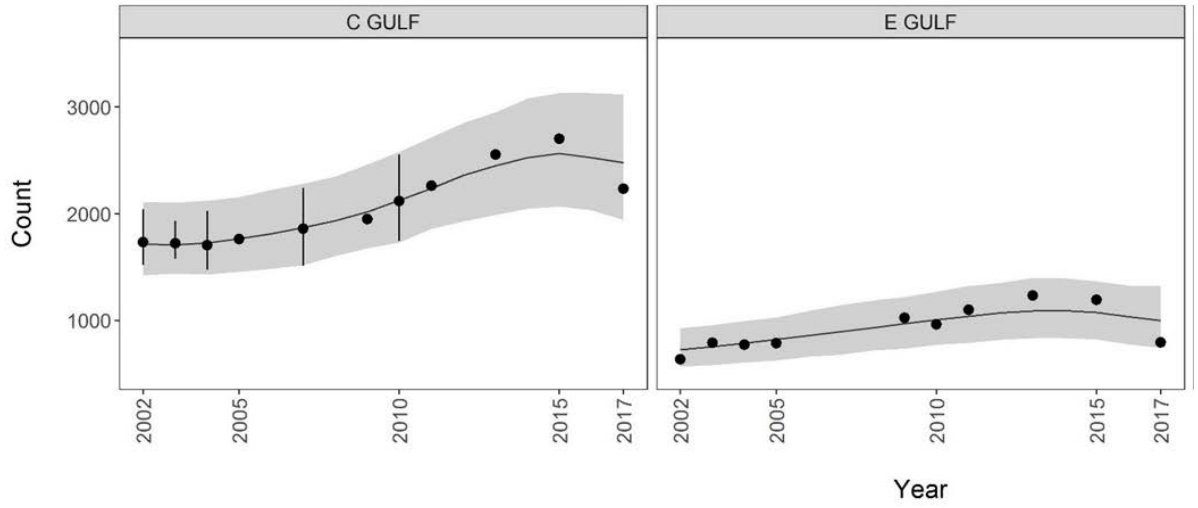

Figure 8— Realized and predicted counts of western Steller sea lion pups in the western Aleutian Islands (W ALEU) and Rookery Cluster Areas (RCAs) 2 and 3 (in the C ALEU, Figure 1); 2002-2017. Realized counts are represented by points and vertical lines (95% credible intervals). Predicted counts are represented by the black line surrounded by the gray 95% credible interval.

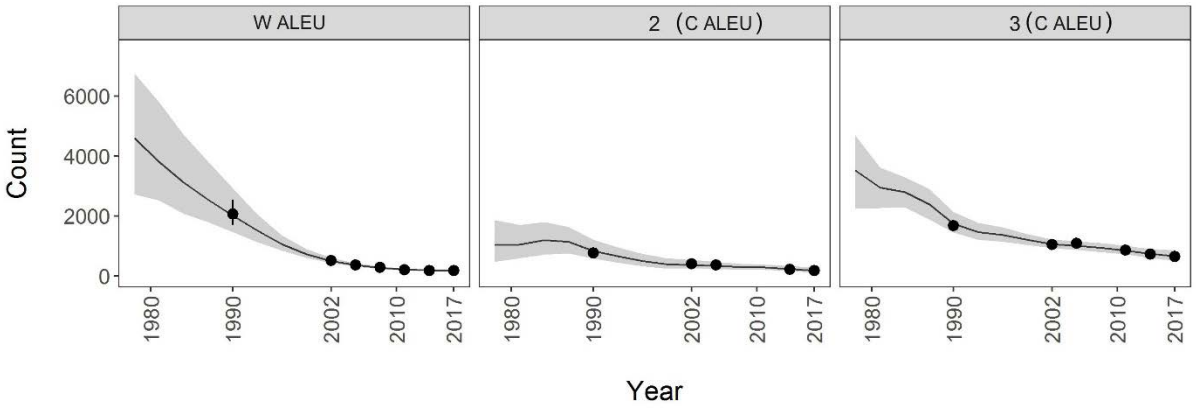

Figure 9— Realized and predicted counts of eastern DPS Steller sea lion pups in the southeast Alaska region, 1987-2017. Realized counts are represented by points and vertical lines (95% credible intervals). Predicted counts are represented by the black line surrounded by the gray 95% credible interval.