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Results of the Steller Sea Lion (*Eumetopias jubatus*) Surveys in Alaska, June–July 2022

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Results of the Steller Sea Lion Surveys in Alaska, June–July 2022

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ABSTRACT

The Alaska Fisheries Science Center's Marine Mammal Laboratory (MML) conducts annual aerial-, boat-, and land-based surveys at known terrestrial rookery and haulout sites in Alaska to collect visual counts and high-resolution imagery from which Steller sea lions are counted. In 2022, MML survey teams collected counts from 97 sites in the Aleutian Islands regions and one site in the western Gulf of Alaska region. We used a newly updated agTrend model that is more precise to model all raw count data through 2022 to estimate counts (as an index of abundance) and annual rates of change. Non-pups and pups in the western DPS of Alaska increased 1.05 and 0.50% y^{-1}, respectively, between 2007 and 2022; however, there was high variability among regions. Non-pups and pups in the western Aleutian Islands region continued to decline, along with pups in the neighboring central Aleutian Islands region. Non-pups in the central Aleutian Islands region plateaued, however more data is needed from the eastern portion of this region. Regions east of Samalga Pass (western DPS) began to increase in the early 2000s; however, pup production slowed or plateaued in the early 2010s, with subsequent non-pup plateauing or declines starting in the late 2010s for all regions. Southeast Alaska (eastern DPS) non-pups and pups increased 2.08 and 2.51% y^{-1}, respectively, between 1992 and 2022. Declines in non-pup counts since 2019 were preceded by plateaued pup counts in the late 2000s. As signs of recovery have slowed or ceased altogether in the western DPS, and Southeast Alaska appears to be declining in recent years, it is evident Steller sea lion populations in Alaska remain sensitive and regular surveys are critically important to monitoring regional variability, especially as environmental anomalies (i.e., heatwaves in the North Pacific Ocean) occur with greater frequency and magnitude.

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INTRODUCTION

NOAA Fisheries is charged with monitoring and managing the two distinct population segments (DPS) of Steller sea lions (*Eumetopias jubatus*) under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (Muto et al. 2019, 2020). Steller sea lions' range extends throughout the North Pacific Ocean. The western DPS extends west from Cape Suckling (144° W) in the Gulf of Alaska through the western Aleutian Islands. The eastern DPS extends east of Cape Suckling (144° W) and south through California (United States).

In 1990, the species was listed as threatened under the ESA and in 1997, the western DPS listing status was elevated to endangered, while the eastern DPS remained listed as threatened. After over 30 years of showing signs of recovery, the eastern DPS was delisted under the ESA in 2013 (NMFS 2013b).

The Marine Mammal Laboratory (MML) conducts annual aerial-, boat-, and land-based surveys of Steller sea lions at known terrestrial rookery and haulout sites in Alaska (AFSC 2016) to collect visual counts and high-resolution imagery to count Steller sea lions. Due to the COVID-19 pandemic, there was no aerial- or ship-based survey effort in 2020 and only the occupied aircraft survey was conducted in 2021 in the Gulf of Alaska.

Generally, MML uses an occupied aircraft to survey the Gulf of Alaska (Southeast Alaska to the western Gulf of Alaska regions) in odd-numbered years and the Aleutian Islands (eastern to western Aleutian Islands regions) in even-numbered years. Challenges associated with operating an occupied aircraft in the western and central Aleutian Islands (e.g., inclement weather and remote airfields) led to the implementation of vessel-based surveys to collect visual counts and survey images using uncrewed aircraft systems (UAS) in these regions since 2014. There are several research priorities on these vessel-based trips and collecting counts is the highest priority in years when the occupied aircraft team is also surveying the Aleutian Islands regions.

Objectives for 2022 were to survey all known terrestrial sites in the Aleutian Islands, which had not been surveyed since 2018 or earlier, and use an updated agTrend model (Johnson and Fritz 2014, Gaos et al. 2021) to estimate Steller sea lion non-pup (juveniles ≥ 1 year old and adults) and pup (up to about 1 month old) counts (as an index of population abundance) and annual rates of change throughout Alaska.

METHODS

MML conducts count surveys of Steller sea lions in late June through mid-July during the peak of the breeding season when Steller sea lions aggregate onshore to pup and breed. Surveys begin about 10 days after the mean pup birth dates in the survey area (4–14 June) by which time about 95% of all pups are born (Pitcher et al. 2001; Kuhn et al. 2017). Surveys are targeted to occur between 1000–1800 Alaska time when Steller sea lions are more likely to have returned from foraging. Non-pup counts do not account for Steller sea lions at sea during the survey. Pup counts are considered a census count because pups tend to not leave the rookery until they are older than one month old; however, pup counts are not corrected for those that are born or die after the survey.

Steller Sea Lion Surveys and Raw Counts

The occupied aircraft survey team operated from a NOAA Twin Otter fixed-wing aircraft mounted with a vertically oriented camera mount from 23 June to 11 July, 2022 (as used since 2009; see Fritz et al. 2016). The team captured imagery or visual counts (when less than 10 sea lions were present) at sites from Unimak Island (163° W) in the eastern Aleutian Islands region to the Delarof Islands (179° W) in the central Aleutian Islands region (Fig. 1).

The ship-based survey team was aboard the U.S. Fish and Wildlife Service research vessel *Tiĝlâx* from 22 June to 8 July 2022. The team conducted visual counts from land, ship, and skiff and captured UAS imagery at sites from Oglodak Island (175° W) in the central Aleutian Islands region to Attu Island (172° E) in the western Aleutian Islands region.

MML biologists processed and counted imagery as in previous years (see Fritz et al. 2016). Steller sea lion raw counts were summarized for Alaska by DPS and smaller geographic areas: the western, central, and eastern Aleutian Islands (ALEU) regions; the central ALEU region further broken up into rookery cluster areas (RCA) 2 through 5; the western, central, and eastern Gulf of Alaska (GULF) regions; and Southeast Alaska region (eastern DPS; Fig. 1).

The Alaska Department of Fish and Game (ADFG) provided raw counts from Round (Walrus) Island (skiff-based count on 8 July; eastern ALEU) and White Sisters (UAS image count from 30 June; Southeast Alaska).

Because there were sites that were not surveyed in each region, we were unable to compare 2022 raw counts with those from previous survey years.

AgTrend Modeled Steller Sea Lion Counts and Trends

Our method for modeling raw count data produces estimated counts and annual rates of change (i.e., trends) for regional and temporal aggregations, which NOAA Fisheries uses for monitoring the Steller sea lion population. The agTrend model (R package; Johnson and Fritz 2014, Gaos et al. 2021) augments missing counts from raw data collected at all sites with at least two non-zero counts, rather than relying solely on counts at "trend" sites (see Fritz et al. 2013, 2016). In our 2022 analyses, we used an updated agTrend model which uses the penalized spline model to reduce variance for years where missing data is interpolated and provides more precise estimates than the previous model, which used a random walk-time series model (Johnson and Fritz 2014).

AgTrend employs a logarithmic linear regression model to fit the data and is not informed by population dynamics or biological constraints, which means the estimates derived for the most recent year in the data series (i.e., 2022) could change with the addition of new information collected in subsequent survey years.

The agTrend model produces two types of count estimates:

- **Realized counts** use the standardized variance of raw counts at each site throughout the time series to estimate survey counts we would expect to collect if we had completely surveyed all sites. Therefore, the more complete the survey, the more similar raw counts are to the realized counts, which is evident by smaller credible intervals; and
- **Predicted counts** are smoothed and used to estimate annual rates of change, and account for both observation and process errors.

We modeled data for the entire Alaska range, rather than just the 2022 Aleutian Islands survey area since we used the new agTrend model: total western DPS; west and east of Samalga Pass (western DPS only); the western, central, and eastern ALEU regions; RCA 2 through 5 in the central ALEU region; the combined ALEU regions; the western, central, and eastern GULF regions; eastern and central GULF regions combined (E+C GULF); the combined GULF regions; and the Southeast Alaska region (eastern DPS; Fig. 1). We used predicted count estimates to summarize total counts for geographic areas. To highlight fine-scale changes, we used realized counts for temporal comparisons within the new agTrend model outputs.

In the western DPS in Alaska, we modeled raw counts since 1978 for non-pups (NMFS 2015; Sweeney et al. 2016–2019, 2022) and 1973 for pups (NMFS 2019; Sweeney et al. 2022) to estimate counts. In order to be consistent with the Steller sea lion Recovery Plan (NMFS 2008), we reported

trends over a 15-year period (2007–2022) for the western DPS. We generated figures of modeled counts beginning in 2002, the year with the lowest (i.e., nadir) non-pup and pup counts for the total western DPS.

We modeled Southeast Alaska (eastern DPS) non-pup and pup raw counts since 1971, and reported trends for a 30-year period (1992–2022).

RESULTS

Steller Sea Lion Surveys

Between 23 June–11 July 2022, MML teams surveyed 98 sites: 34 in the eastern ALEU (missed 26 sites), 56 in the central ALEU (missed 37 sites), seven in the western ALEU (missed 6 sites), and one in the western GULF (Table 1 and Fig. 1). We were unable to survey sites because of inclement weather or logistical challenges (e.g., pilot duty days, COVID-19, etc.).

The Twin Otter crew surveyed 68 sites: 34 in the eastern ALEU, 33 in the central ALEU, and one in the western GULF (Table 1). Atka/Cape Korovin (central ALEU) was surveyed, however the majority of the Steller sea lions were in the water and could not be accurately counted so it was not included in the modeling analysis.

The RV *Tiĝlâx* crew surveyed 30 sites: 23 in the central ALEU and seven in the western ALEU (Table 1). Observers conducted visual counts from the research vessel offshore at 26 sites and UAS surveys at four sites.

Survey teams discovered two 'new' (to MML) locations where Steller sea lions were hauled out. The Twin Otter crew observed a subsite (i.e., within one mile) of Skagul/S. Point (central ALEU; 51.59 N, 178.57 W) and the RV *Tiĝlâx* crew observed a site at Adak/Cape Adagdak (central ALEU; 52.00 N, 176.59 W). We added these locations to the Steller sea lion site list to include in future surveys.

Steller Sea Lion Raw Counts

Non-Pups

In the western DPS, we counted 9,284 live non-pups on 67 sites that had at least one non-pup present (Table 1). Raw non-pup counts totaled 5,424 in the eastern ALEU, 3,403 in the central ALEU, 345 in the western ALEU, and 112 in the western GULF.

ADFG counted 153 non-pups at Walrus (Round) Island (eastern ALEU; J. A. Stephens, ADFG, pers. comm., 18 July 2022) and 818 non-pups at White Sisters (Southeast Alaska, eastern DPS, J. Jenniges, ADFG, pers. comm., 10 November 2022).

Pups

In the western DPS, we counted 1,439 live pups at 18 sites that had at least one pup present (Table 1). We counted 1,273 pups in the eastern ALEU, 99 pups in the central ALEU, 65 pups in the western ALEU, and two pups in the western GULF. ADFG counted 873 pups at White Sisters (Southeast Alaska, eastern DPS, J. Jenniges, ADFG, pers. comm., 10 November 2022).

AgTrend Modeled Steller Sea Lion Counts and Trends

Non-Pups

Steller sea lion non-pups in the western DPS increased 1.05% y^{-1} (95% credible interval or CI 0.46–1.69% y^{-1}; Table 2 and Fig. 2) between 2007 and 2022, and the predicted count estimate for 2022 was 37,333 (95% CI 34,274–40,245).

In the western ALEU, Steller sea lions significantly declined from 2007 to 2022 (-5.78% y^{-1}, 95% CI -8.02– -3.44% y^{-1}; Table 2 and Fig. 3). The central ALEU region was stable (-0.20% y^{-1}); however, RCA 2 and 3 were in significant decline (-2.85 and -2.86% y^{-1}, respectively) while RCA 4 and 5 were stable (Fig. 4). Only two rookeries were surveyed in RCA 5 (missed 1 rookery and 16 haulout sites) resulting in high credible intervals and higher uncertainty in RCA 5 and central ALEU estimates. West of Samalga Pass and the eastern ALEU regions were both stable, lending to the relative stability of the combined ALEU regions (Figs. 5 and 6). The eastern ALEU survey was relatively incomplete (missed more than 40% of sites including two major rookeries, Ugamak and Akutan/Cape Morgan), so this region had high credible intervals.

Non-pups in the western and central GULF regions significantly increased (1.22 and 3.74% y^{-1}, respectively) between 2007 and 2022, although the relatively steady growth ceased in 2017 (Fig. 3). The combined eastern and central GULF regions increased 2.05% y^{-1} from 2007 to 2022 (Fig. 7). This trend was driven by significant growth from the early to late 2010s in the central GULF, as non-pup counts plateaued in the eastern GULF from 2007 to 2022 (-0.21% y^{-1}, 95% CI -2.25–1.81% y^{-1}; Fig. 3).

Non-pups in Southeast Alaska (eastern DPS) increased 2.08% y^{-1} (95% CI 1.56–2.60% y^{-1}) between 1992 and 2022 and the predicted non-pup count was estimated to be 17,106 (95% CI

14,186–20,275; Fig. 8). This region steadily increased over most of the 30-year period, but realized counts of non-pups between 2019 and 2021 declined approximately 23%.

Pups

Steller sea lion pups in the western DPS increased 0.50% y^{-1} (95% CI 0.04–0.96% y^{-1}) between 2007 and 2022, and the predicted count estimated for 2022 was 11,987 (95% CI 11,291–12,703; Table 2 and Fig. 9). Western DPS pups increased starting in 2002; however, growth slowed and appeared to plateau since 2010.

The western ALEU region pups significantly declined from 2007 to 2022 (-4.10% y^{-1}, 95% CI -5.09– -3.7; Fig. 10). The central ALEU also declined, especially in RCA 2 and 3, and only RCA 5 was stable (Fig. 11). As with non-pup counts, RCA 5 estimates had high credible intervals lending to uncertainty in estimates for this RCA and region. Aggregated pup counts and trends west of Samalga Pass and for the ALEU regions combined significantly declined (Figs. 12 and 13, respectively). The eastern ALEU region trend was stable, but like non-pup counts for this region, had high credible intervals.

The western GULF and combined GULF regions increased over the 15-year period (1.36 and 1.64% y^{-1}, respectively). Pups in the combined eastern and central GULF regions (E+C GULF) increased 1.86% y^{-1} (Fig. 14), though the eastern GULF region was stable (0.81% y^{-1}, 95% CI -0.53–2.13% y^{-1}) and was largely offset by increases in the central GULF.

Pup counts in Southeast Alaska (eastern DPS) increased 2.51% y^{-1} (95% CI 2.27–2.76% y^{-1}) from 1992 to 2022 (Table 2 and Fig. 15). The predicted pup count was estimated to be 6,945 (95% CI 6,385–7,470).

DISCUSSION

The MML's main objective for the 2022 Steller sea lion count surveys was to collect counts in the Aleutian Islands regions. These regions had not been surveyed since 2018 or earlier, with some sites not surveyed since 2014. Although survey coverage was low in some regions, MML collected counts at nearly 100 sites. The second objective was to report count and trend estimates from the updated agTrend model for the Alaska range. Overall, the new model produces counts and annual rates of change that are similar to the previous version, but with narrower credible intervals and more precise estimates (a detailed comparison of agTrend versions is forthcoming).

The National Marine Fisheries Service first observed declines in Steller sea lions in Alaska in the 1950s, with the most significant declines occurring in the western DPS in the 1970s and 1980s (Muto 2020, 2021). The lowest non-pup count for the total western DPS was recorded in 2002, after which the population began to show signs of recovery in the regions east of Samalga Pass. We reported a significant increase for the total western DPS from 2007 to 2022, but it is important to note that, while the overall population trend is positive, abundance (i.e., modeled count estimates) and trends are highly variable across regions and age classes. The western DPS pup production slowed (nearly plateaued) in the early 2010s with a subsequent plateau in non-pups around 2015. Non-pups in the western DPS declined approximately 6% between 2019 and 2022.

The western ALEU region has continued to decline since 2002. In the last 15 years, non-pups and pups have declined by more than 50%, and in 2022, there were an estimated 442 non-pups and 144 pups in the western ALEU region. This represents a 96% decline in non-pups and 98% decline in pups since 1978. These declines are considerably higher than other western DPS regions and, as such, this continues to be an area of heightened concern for MML.

We observed a high variability in trends in the central ALEU region, depending on the temporal and geographic (i.e., RCA) scale. Non-pup counts were stable over the last 15 years, but there were contrasting trends among the RCAs, with significant declines in RCA 2 and 3 being offset by plateaued counts in the more populous RCAs 4 and 5. The continued significant decline in pup counts in the central ALEU could mean impacts on future non-pup counts. Since several sites were missed in RCA 5 in 2022, resulting in greater uncertainty in model estimates, more complete survey coverage is needed in RCA 5 to better understand what is happening with pups and non-pups in this RCA and the central ALEU region as a whole.

East of Samalga Pass (western DPS) began to show signs of recovery since the early 2000s and the population continued to increase through 2022; however, the magnitude of growth has been decreasing since approximately 2017. This is likely the result of slowed pup growth in the early 2010s and a subsequent non-pup decline in the late 2010s. We saw these same non-pup and pup trends in the eastern ALEU region. Even though 43% of sites were missed and model uncertainly was high for the eastern ALEU region in 2022, these results are consistent with the western DPS overall and, therefore, could indicate a true decline in non-pups.

Separate from modeled count trends, we observed anomalously high Steller sea lion non-pup counts at two haulout sites in the eastern ALEU region: Unimak/Cape Sarichef (high count also observed in 2018) and Unimak/Oksenof Point (Fritz et al. 2016, Sweeney et al. 2018). Within the

10-year period prior to these anomalously high counts, Cape Sarichef had an average count of 39 non-pups (n = 5, range: 0-167), and in 2018 and 2022, we observed 565 and 440 non-pups, respectively. Oksenof Point had an average non-pup count of 393 sea lions (n = 4, range: 188-594), and in 2022, we observed 848 non-pups. While counts often fluctuate temporally at haulout sites -- they are attended by mostly juveniles and sub-adult males with lower site fidelity during the breeding season (Fritz et al. 2013) -- this large fluctuation could indicate that the area around the northwest side of Unimak Island was of some particular importance (e.g., better prey availability) to Steller sea lions in 2022.

Steller sea lion count trends in the combined GULF regions were similar to what we observed east of Samalga Pass: pup counts began increasing in the early 2000s to 2010, then slowed through 2022, and non-pups declined after 2017. The individual GULF regions largely followed these trends, though pup counts appeared to be more influenced by the western GULF region, as the central started to plateau closer to 2015, and the eastern GULF region declined. It is not clear if non-pups in the western GULF are stable or declining (more information is needed, only one count recorded for this region in 2022 lending to uncertainty), and the eastern GULF region non-pups began to decline earlier, in 2015.

We observed similar trends in Southeast Alaska (eastern DPS) as we did in the western DPS and east of Samalga Pass (western DPS). After decades of increasing and even reaching recovery status in 2013 (NMFS 2013b), pup counts began to plateau around 2009, followed by a 23% decline in non-pups between 2019 and 2021 (Sweeney et al. 2022). This downturn is troubling given that the eastern DPS was delisted from the ESA in November 2013, and we are approaching the end of the 10-year post-delisting monitoring period (NMFS 2013a).

Several mechanisms could be driving population trends in the western DPS, including low pup production and subsequent low juvenile recruitment, reduced juvenile and/or adult survival, and movement in or out of a region. Declines in pup production alone cannot explain the observed declines in non-pup counts, and aside from an atypical movement of non-pups out of the GULF region in 2017 (Sweeney et al. 2017), we did not observe other evidence of significant movements in the count data in other years or areas.

All of the regions west of Samalga Pass (western DPS) have shown little to no signs of recovery since NOAA Fisheries observed declines in the 1950s. All areas east of Samalga Pass have either experienced a plateau or decline in pup counts and a subsequent plateau or decline (or both) in non-pups in the last fifteen years. Given these trends, the recent change in steady increase in

Southeast Alaska, and the greater frequency and magnitude of environmental anomalies in the North Pacific Ocean (and concomitant trophic impacts; Litzow et al. 2020, Suryan et al. 2021), it is imperative to continue to monitor these sensitive Steller sea lion populations.

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TABLES and FIGURES

Table 1. -- Raw counts of live Steller sea lion non-pups and pups from sites surveyed in the western (W), central (C), and eastern (E) Aleutian Islands (ALEU; including BERING sites) regions, and western (W) Gulf of Alaska region (GULF) in 2022. RCA is the rookery cluster area 2–5 within the C ALEU. ROOK indicates whether the site was a rookery (1; ≥ 50 pups) or haulout (0) site. SURVEY indicates the data were a Twin Otter visual (TO-V) or image (TO-I) count, or R/V *Tiĝlâx* visual (RV-V), or UAS image (RV-I) count. Asterisks (*) denote new sites.

SITE	REGION	RCA	ROOK	DATE	NON-PUP	PUP	SURVEY
AGATTU/CAPE SABAK	W ALEU		1	27-Jun	88	41	RV-I
AGATTU/GILLON POINT	W ALEU		1	26-Jun	88	63	RV-V
ALAID	W ALEU		0	24-Jun	36	2	RV-V
ATTU/CAPE WRANGELL	W ALEU		1	25-Jun	62	34	RV-I
ATTU/CHICHAGOF POINT	W ALEU		0	24-Jun	51	0	RV-I
ATTU/CHIRIKOF POINT	W ALEU		0	24-Jun	19	0	RV-V
BULDIR/NW ROCKS	W ALEU		0	28-Jun	1		RV-V
AMCHITKA/COLUMN ROCK	C ALEU	2	1	2-Jul	50	12	RV-V
AMCHITKA/EAST CAPE	C ALEU	2	0	1-Jul	64	15	RV-V
AYUGADAK	C ALEU	2	0	30-Jun	132	46	RV-I
KISKA/CAPE ST STEPHEN	C ALEU	2	1	29-Jun	97	49	RV-V
KISKA/GERTRUDE-BUKHTI	C ALEU	2	0	30-Jun	16	2	RV-V
KISKA/LIEF COVE	C ALEU	2	1	29-Jun	48	13	RV-V
KISKA/SIRIUS POINT	C ALEU	2	0	23-Jun	17		RV-V
KISKA/SOBAKA-VEGA	C ALEU	2	0	29-Jun	0	0	RV-V
LITTLE SITKIN	C ALEU	2	0	30-Jun	1	0	RV-V
SEGULA/CHUGUL POINT	C ALEU	2	0	6-Jul	2	0	RV-V
SEGULA/GULA POINT	C ALEU	2	0	30-Jun	0	0	RV-V
SEMISOPOCHNOI/PETREL	C ALEU	2	0	1-Jul	7	0	RV-V
SEMISOPOCHNOI/SUGARLOAF HEAD	C ALEU	2	0	1-Jul	0	0	RV-V
SEMISOPOCHNOI/SW KNOB	C ALEU	2	0	1-Jul	0	0	RV-V
SEMISOPOCHNOI/TUMAN POINT	C ALEU	2	0	1-Jul	0		RV-V
TANADAK (KISKA)	C ALEU	2	0	30-Jun	0	0	RV-V
BOBROF	C ALEU	3	0	9-Jul	14	0	TO-I
GARELOI	C ALEU	3	0	9-Jul	0		TO-V
GRAMP ROCK	C ALEU	3	1	9-Jul	292	105	TO-I
ILAK	C ALEU	3	0	9-Jul	42	0	TO-I
KANAGA/CAPE MIGA	C ALEU	3	0	9-Jul	0		TO-V
KANAGA/SHIP ROCK	C ALEU	3	1	9-Jul	342	208	TO-I
KAVALGA	C ALEU	3	0	9-Jul	0		TO-V
OGLIUGA	C ALEU	3	0	9-Jul	0		TO-V

SITE	REGION	RCA	ROOK	DATE	NON-PUP	PUP	SURVEY
SKAGUL/S. POINT*	C ALEU	3	0	9-Jul	113	8	TO-I
TAG	C ALEU	3	1	9-Jul	155	62	TO-I
TANAGA/BUMPY POINT	C ALEU	3	0	9-Jul	0		TO-V
TANAGA/CAPE SASMIK	C ALEU	3	0	5-Jul	22	0	RV-V
TANAGA/CAPE SUDAK	C ALEU	3	0	9-Jul	0		TO-V
UGIDAK	C ALEU	3	0	9-Jul	24	0	TO-I
ULAK/HASGOX POINT	C ALEU	3	1	9-Jul	228	86	TO-I
UNALGA+DINKUM ROCKS	C ALEU	3	0	9-Jul	0		TO-V
ADAK/ARGONNE POINT	C ALEU	4	0	9-Jul	2		TO-V
ADAK/CAPE ADAGDAK*	C ALEU	4	0	8-Jul	6	0	RV-V
ADAK/CAPE KAGIGIKAK	C ALEU	4	0	9-Jul	4	0	TO-I
ADAK/CAPE MOFFET	C ALEU	4	0	9-Jul	0		TO-V
ADAK/CAPE YAKAK	C ALEU	4	0	9-Jul	54	0	TO-I
ADAK/CRONE ISLAND	C ALEU	4	0	9-Jul	2	0	TO-I
ADAK/HEAD ROCK	C ALEU	4	0	9-Jul	0		TO-V
ADAK/LAKE POINT	C ALEU	4	1	9-Jul	332	185	TO-I
ANAGAKSIK	C ALEU	4	0	6-Jul	23	0	RV-V
ATKA/NORTH CAPE	C ALEU	4	0	10-Jul	45	0	TO-V
FENIMORE	C ALEU	4	0	6-Jul	55	0	RV-V
GREAT SITKIN	C ALEU	4	0	9-Jul	67	0	TO-I
IGITKIN/SW POINT	C ALEU	4	0	9-Jul	0		TO-V
IKIGINAK	C ALEU	4	0	6-Jul	16	0	RV-V
KAGALASKA	C ALEU	4	0	9-Jul	0		TO-V
KAGALASKA/RAGGED POINT	C ALEU	4	0	9-Jul	42	0	TO-I
KONIUJI/NORTH POINT	C ALEU	4	0	10-Jul	0		TO-V
LITTLE TANAGA STRAIT	C ALEU	4	0	9-Jul	0		TO-V
OGLODAK	C ALEU	4	0	6-Jul	67	0	RV-V
SALT	C ALEU	4	0	10-Jul	0		TO-V
SILAK	C ALEU	4	0	9-Jul	49	0	TO-I
TAGALAK	C ALEU	4	0	6-Jul	26	0	RV-V
SEGUAM/SADDLERIDGE	C ALEU	5	1	10-Jul	654	557	TO-I
YUNASKA	C ALEU	5	1	10-Jul	293	213	TO-I
ADUGAK	E ALEU		1	10-Jul	606	374	TO-I
AKUN/AKUN BAY	E ALEU		0	23-Jun	0		TO-V
AKUN/AKUN HEAD	E ALEU		0	23-Jun	0		TO-V
AKUN/BILLINGS HEAD	E ALEU		1	23-Jun	840	162	TO-I
AKUTAN/NORTH HEAD	E ALEU		0	23-Jun	0		TO-V
AKUTAN/REEF-LAVA	E ALEU		0	23-Jun	98	8	TO-I
AMAK+ROCKS	E ALEU		0	27-Jun	644	7	TO-I
BOGOSLOF/FIRE ISLAND	E ALEU		1	27-Jun	323	294	TO-I
OGCHUL	E ALEU		1	10-Jul	158	85	TO-I
SEA LION ROCK (AMAK)	E ALEU		1	27-Jun	556	281	TO-I

SITE	REGION	RCA	ROOK	DATE	NON-PUP	PUP	SURVEY
SUMMIT	E ALEU (BERING)		0	11-Jul	0		TO-V
THE TWINS	E ALEU (BERING)		0	11-Jul	0		TO-V
UMNAK/AGULIUK POINT	E ALEU		0	27-Jun	0		TO-V
UMNAK/CAPE ASLIK	E ALEU		0	27-Jun	216	0	TO-I
UMNAK/CAPE CHAGAK	E ALEU		0	27-Jun	0		TO-V
UMNAK/CAPE IDAK	E ALEU		0	27-Jun	0		TO-V
UMNAK/REINDEER POINT	E ALEU		0	27-Jun	0		TO-V
UNALASKA/BISHOP POINT	E ALEU		0	27-Jun	208	0	TO-I
UNALASKA/BRUNDAGE HEAD	E ALEU		0	23-Jun	0		TO-V
UNALASKA/CAPE IZIGAN	E ALEU		1	10-Jul	246	59	TO-I
UNALASKA/CAPE STARICHKOF	E ALEU		0	27-Jun	0		TO-V
UNALASKA/CAPE WISLOW	E ALEU		0	27-Jun	0		TO-V
UNALASKA/KOVRIZHKA	E ALEU		0	27-Jun	0		TO-V
UNALASKA/MAKUSHIN BAY	E ALEU		0	27-Jun	50	0	TO-I
UNALASKA/POINT KADIN	E ALEU		0	27-Jun	2		TO-V
UNALASKA/PRIEST ROCK	E ALEU		0	23-Jun	7	0	TO-I
UNALASKA/SPRAY CAPE	E ALEU		0	27-Jun	76	0	TO-I
UNIMAK/CAPE LUTKE	E ALEU		0	23-Jun	0		TO-V
UNIMAK/CAPE SARICHEF	E ALEU		0	23-Jun	440	1	TO-I
UNIMAK/CAVE POINT	E ALEU		0	23-Jun	1		TO-V
UNIMAK/OKSENOF POINT	E ALEU		0	23-Jun	848	0	TO-I
UNIMAK/SCOTCH CAP	E ALEU		0	23-Jun	0		TO-V
UNIMAK/SENNETT POINT	E ALEU		0	23-Jun	0		TO-V
VSEVIDOF	E ALEU		0	10-Jul	105	2	TO-I
BIRD	W GULF		0	23-Jun	112	2	TO-I

Table 2. -- Annual rates of change (% y^{-1} with ± 95% credible intervals, CI) in counts of Steller sea lion non-pups and pups modeled with agTrend. We modeled the total western DPS in Alaska and spatial areas therein for the 15-year period, 2007–2022: west of Samalga Pass; Aleutian Islands (ALEU) regions combined; western (W), central (C), and eastern (E) ALEU regions individually; rookery cluster areas (RCA) 2–5 within the C ALEU region; east of Samalga Pass; Gulf of Alaska (GULF) regions combined; western (W), central (C), and eastern (E) GULF regions individually; and eastern and central (E+C) GULF regions combined. Southeast Alaska (eastern DPS) is modeled for the 30-year period, 1992–2022.

	NON-PUP			PUP		
AREA/REGION	RATE	-95% CI	+95% CI	RATE	-95% CI	+95% CI
West of Samalga Pass	-0.70	-2.04	0.72	-2.17	-2.94	-1.41
Aleutian Islands	0.26	-0.75	1.23	-0.73	-1.41	-0.05
W ALEU	-5.78	-8.02	-3.44	-4.10	-5.09	-3.07
C ALEU	-0.20	-1.56	1.36	-2.01	-2.85	-1.21
RCA 2	-2.85	-5.02	-0.40	-4.86	-6.70	-3.11
RCA 3	-2.86	-4.26	-1.38	-5.52	-6.21	-4.87
RCA 4	-0.81	-2.70	0.98	-1.31	-2.54	-0.04
RCA 5	2.83	-0.18	6.28	0.95	-1.17	2.89
East of Samalga Pass	1.52	0.82	2.20	1.35	0.84	1.91
E ALEU	1.09	-0.27	2.46	0.73	-0.31	1.75
Gulf of Alaska	1.71	0.91	2.50	1.64	0.99	2.26
W GULF	1.22	0.08	2.45	1.36	0.46	2.28
C GULF	3.74	2.80	4.73	2.32	1.18	3.43
E GULF	-0.21	-2.25	1.81	0.81	-0.53	2.13
E+C GULF	2.05	0.90	3.03	1.86	0.99	2.74
Total Western DPS (US)	1.05	0.46	1.69	0.50	0.04	0.96
Western DPS annual rates of change, 2007–2022						
Southeast Alaska (eastern DPS)	2.08	1.56	2.60	2.51	2.27	2.76
Southeast Alaska (eastern DPS) annual rates of change, 1992–2022						

Figure 1. -- Steller sea lion terrestrial haulout and rookery sites surveyed in June–July 2022. Steller sea lion management regions and areas are shown: eastern, central, and western Aleutian Islands and Gulf of Alaska regions; rookery cluster areas (RCA) 2–5 within the central Aleutian Islands region, Samalga Pass, and the boundary between the eastern and western distinct population segments (DPS).

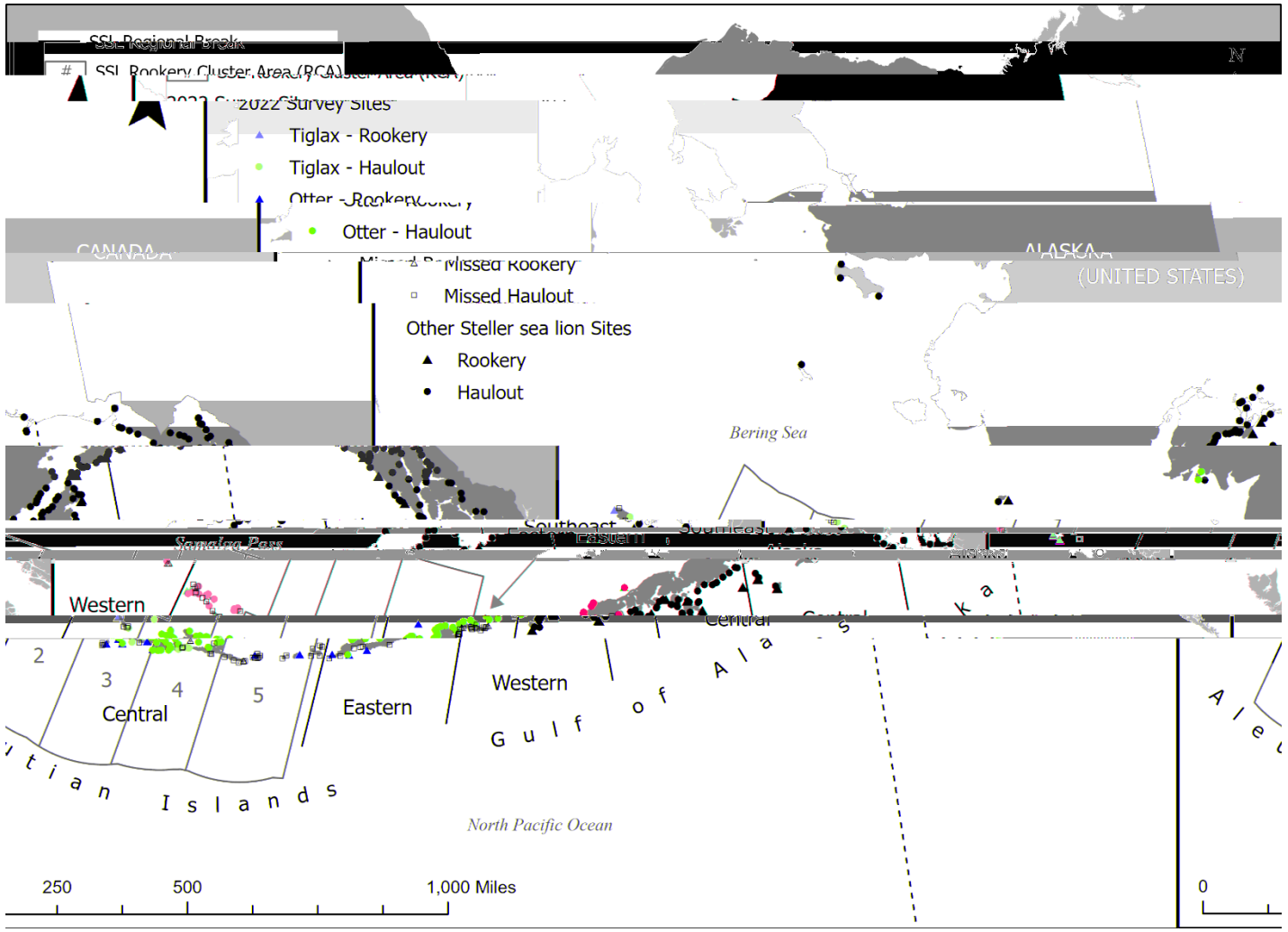


Figure 2. -- Realized and predicted Steller sea lion non-pup counts in the total western distinct population segment in Alaska, 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

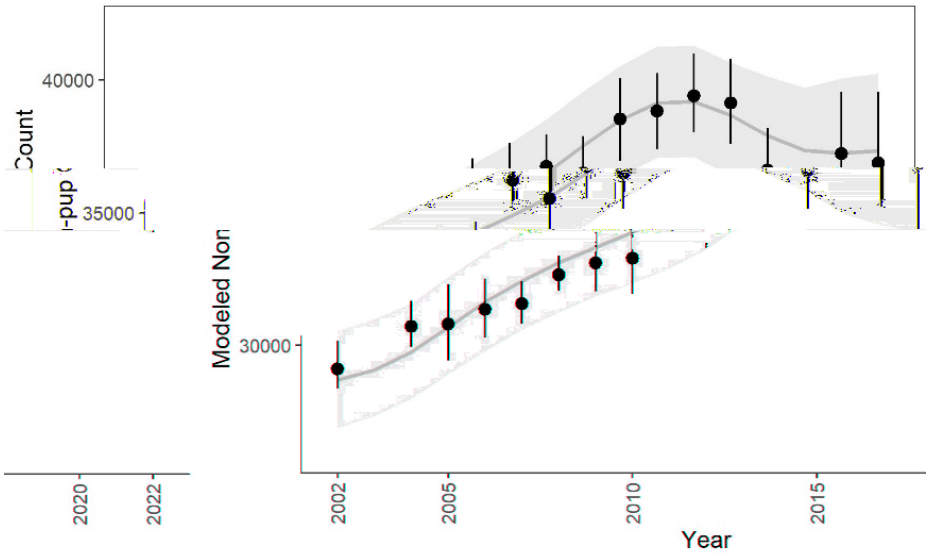


Figure 3. -- Realized and predicted Steller sea lion non-pup counts in the western (W), central (C), and eastern (E) Aleutian Island (ALEU) and Gulf of Alaska (GULF), regions, 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

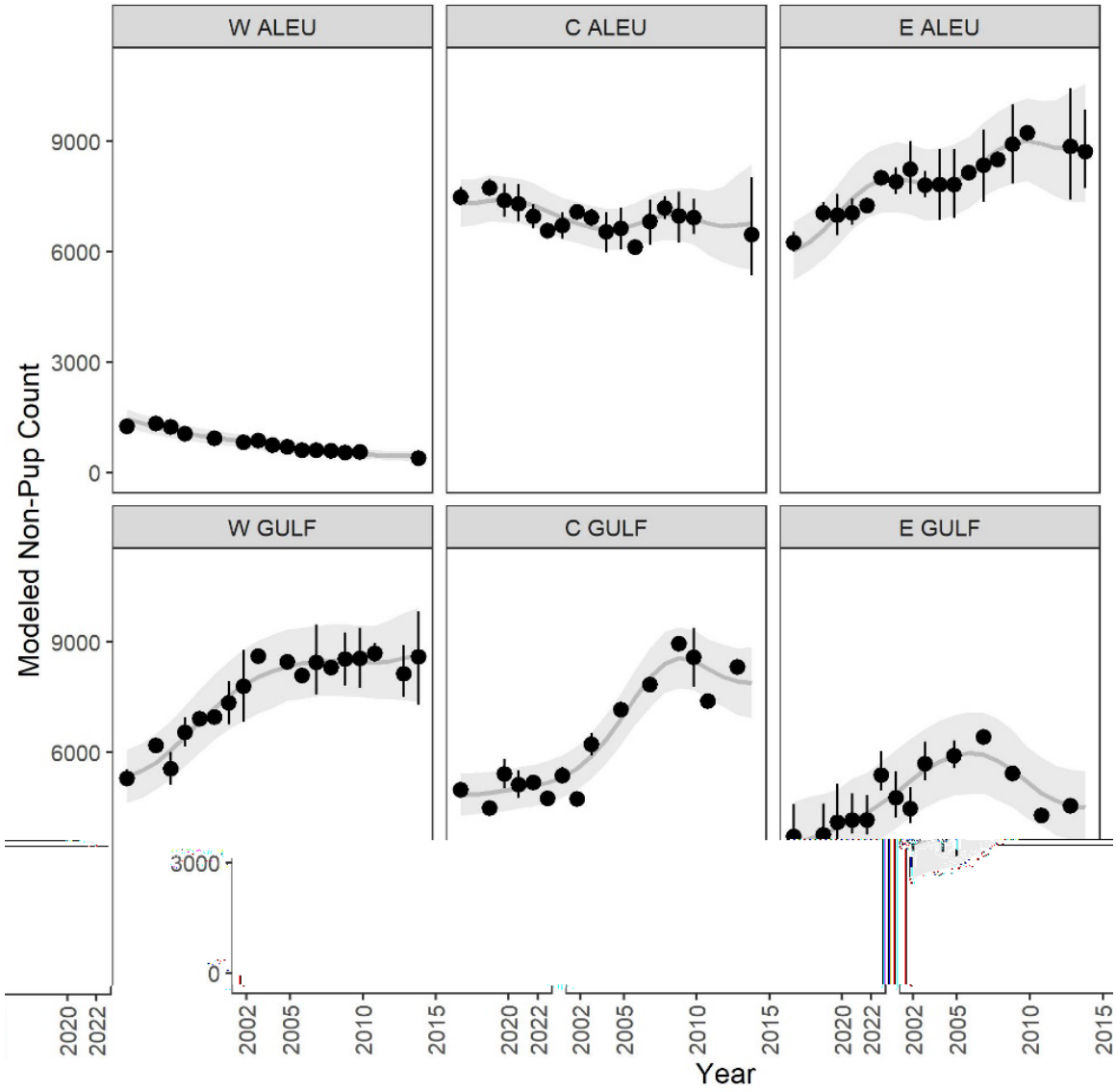


Figure 4. -- Realized and predicted Steller sea lion non-pup counts in rookery cluster areas (Fig. 1) within the central Aleutian Islands region, 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

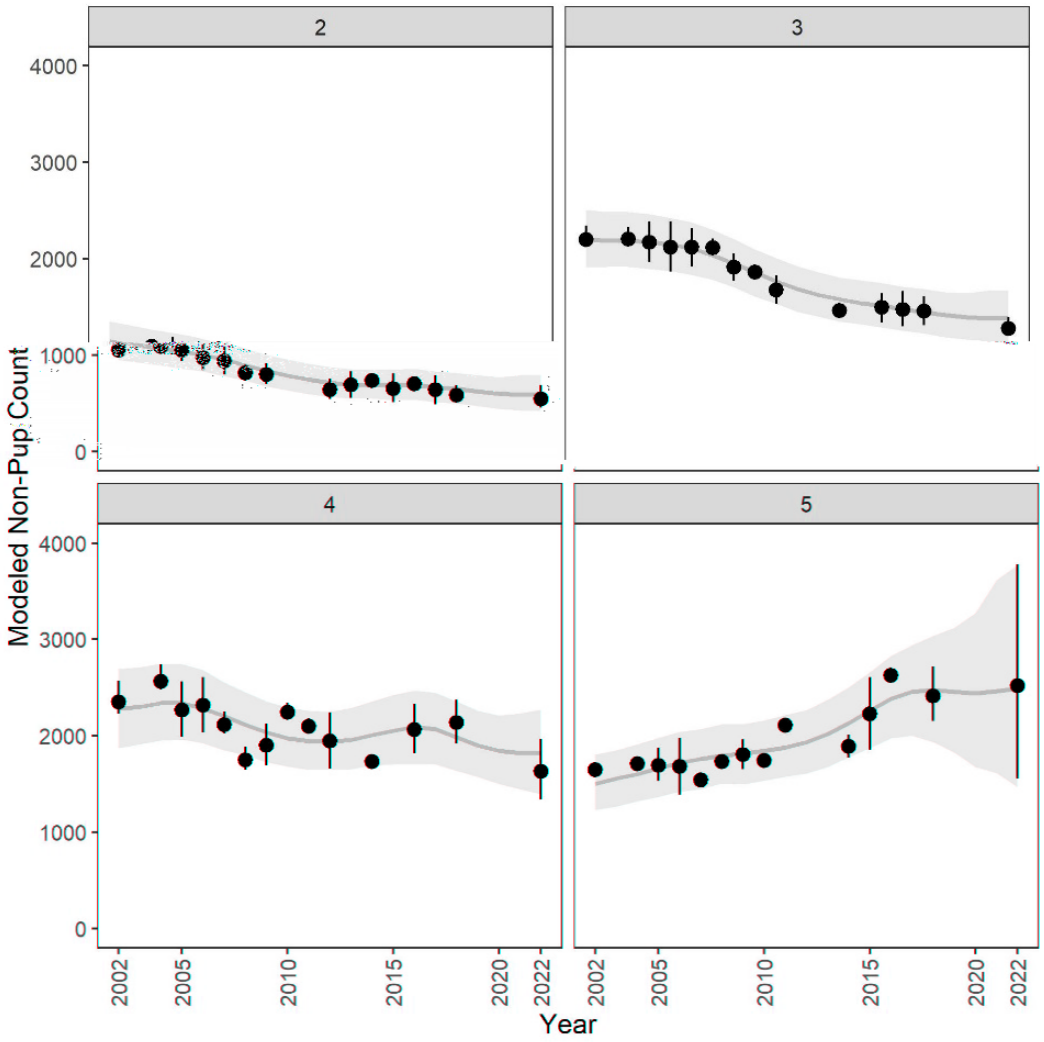


Figure 5. -- Realized and predicted Steller sea lion non-pup counts west (W) and east (E) of Samalga Pass, 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

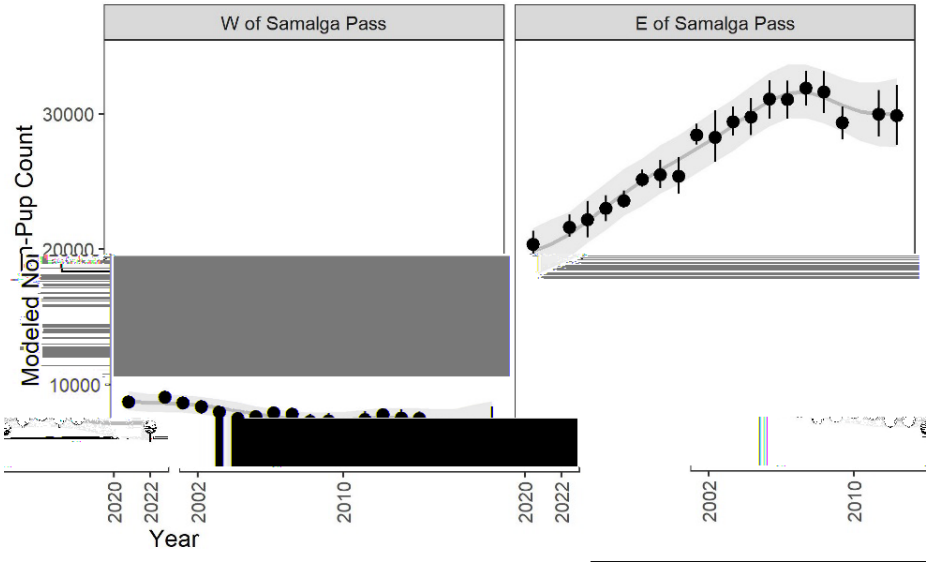


Figure 6. -- Realized and predicted Steller sea lion non-pup counts of the combined regions within the Gulf of Alaska (GULF) and Aleutian Islands (ALEU), 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

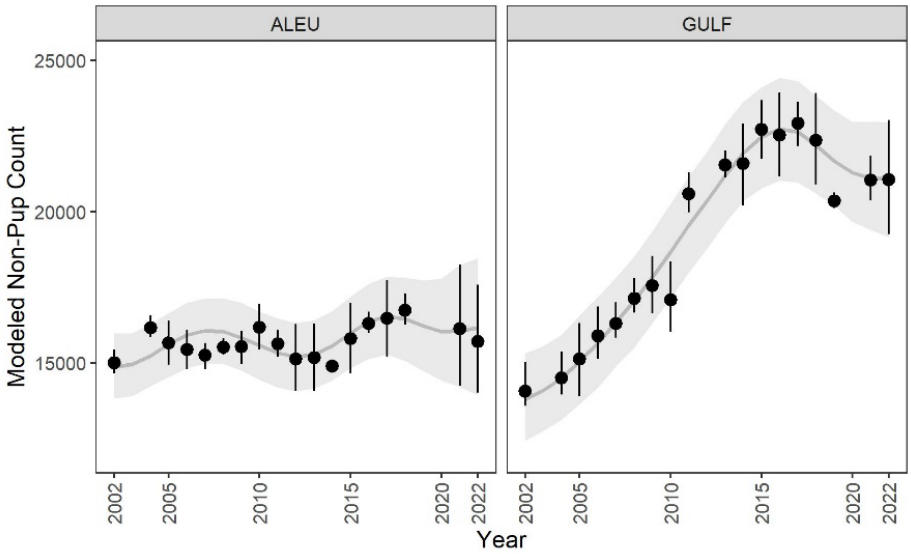


Figure 7. -- Realized and predicted Steller sea lion non-pup counts in the eastern and central Gulf of Alaska regions combined, 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

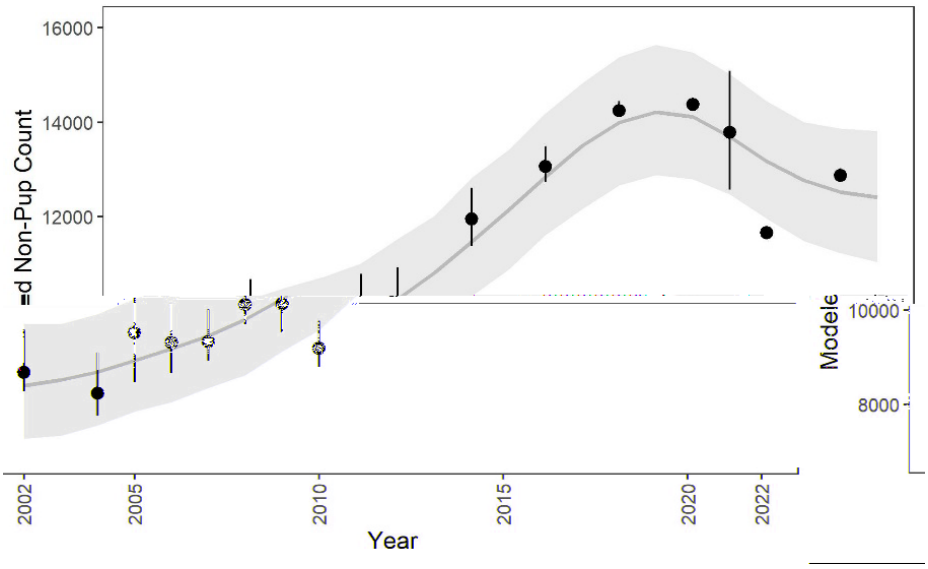


Figure 8. -- Realized and predicted Steller sea lion non-pup counts in Southeast Alaska region (eastern distinct population segment), 1992–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

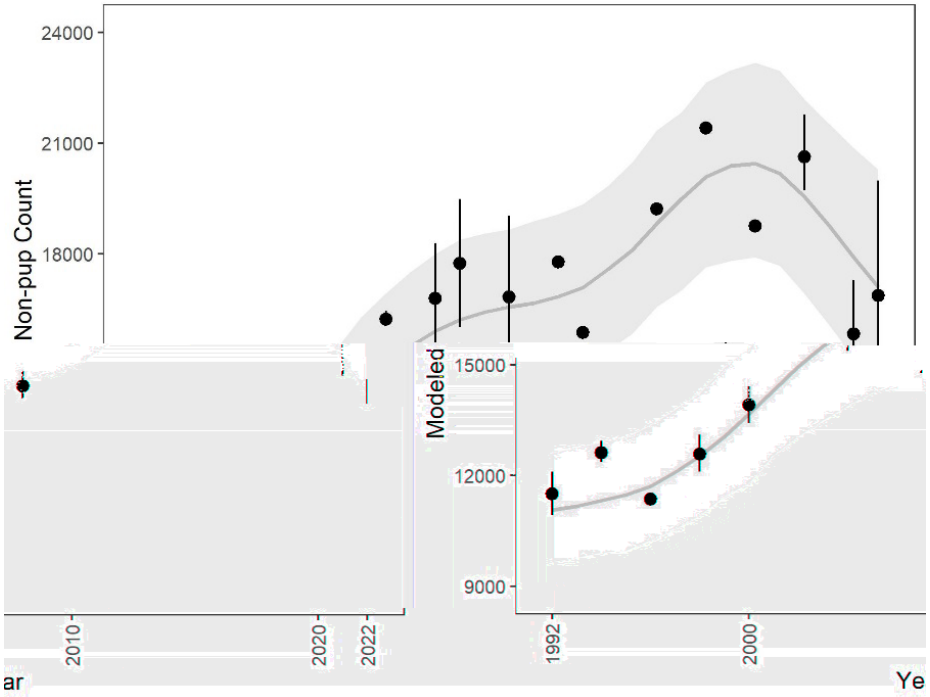


Figure 9. -- Realized and predicted Steller sea lion pup counts in the total western distinct population segment in Alaska, 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

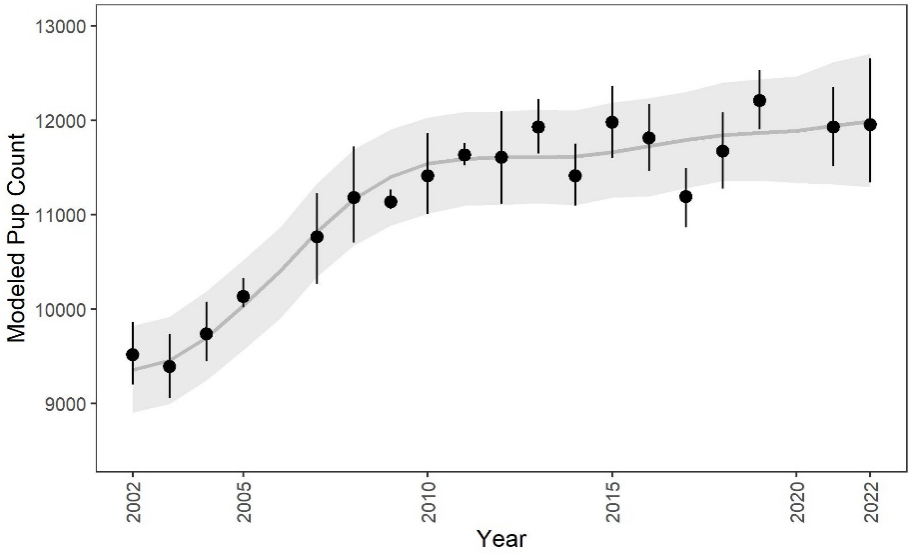


Figure 10. -- Realized and predicted Steller sea lion pup counts in the western (W), central (C), and eastern (E) Aleutian Island (ALEU) and Gulf of Alaska (GULF), regions, 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

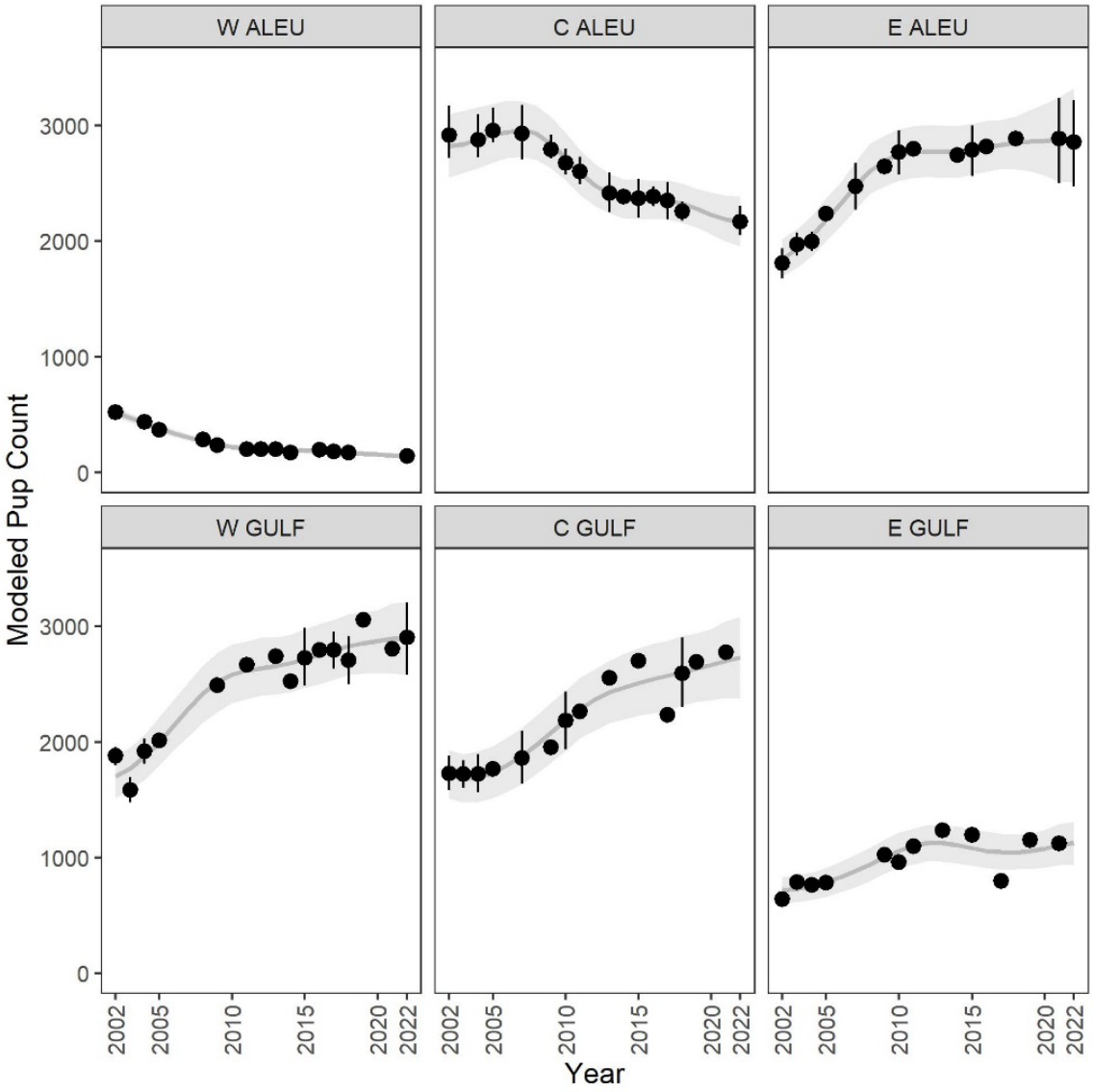


Figure 11. -- Realized and predicted Steller sea lion pup counts in rookery cluster areas (Fig. 1) within the central Aleutian Islands region, 2002-2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

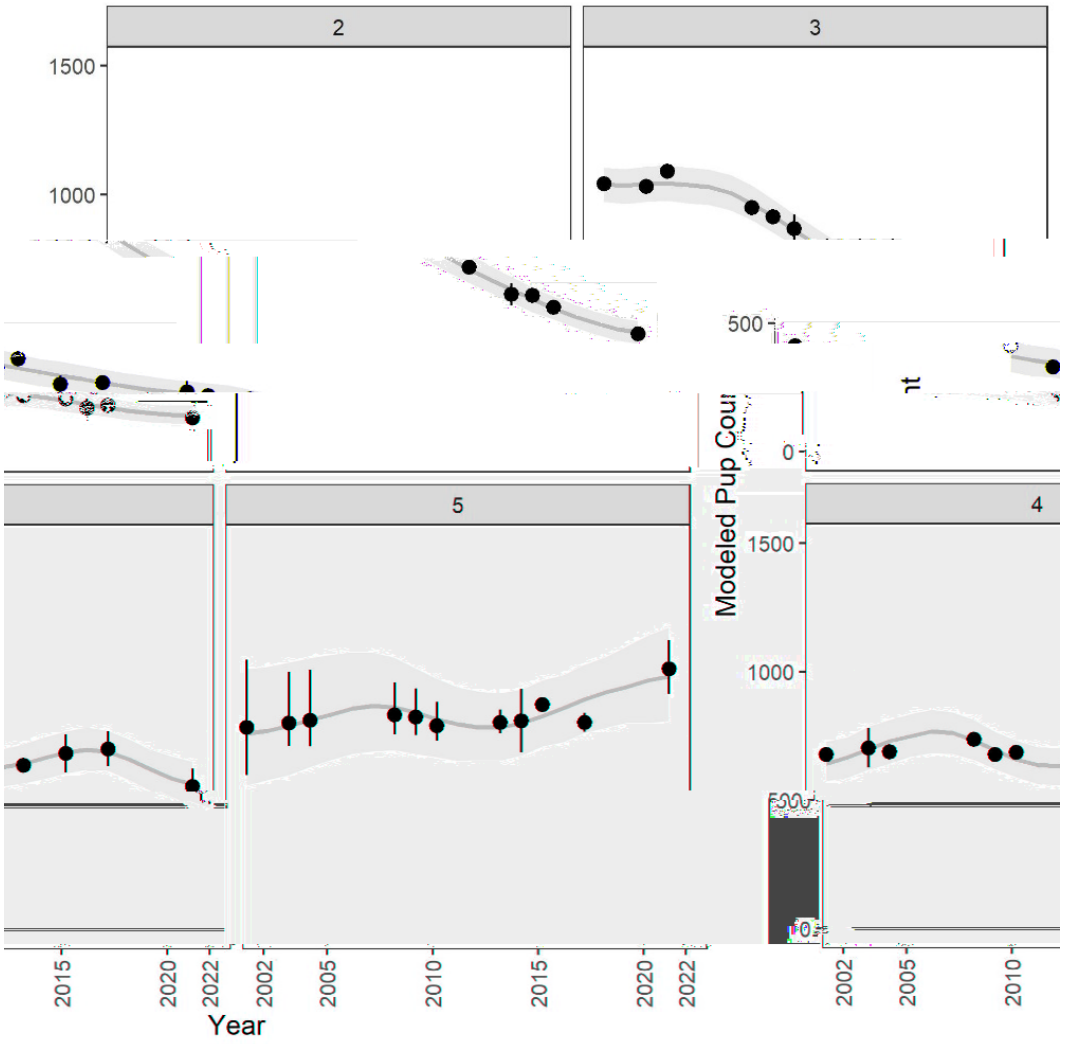


Figure 12. -- Realized and predicted Steller sea lion pup counts west and east of Samalga Pass, 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

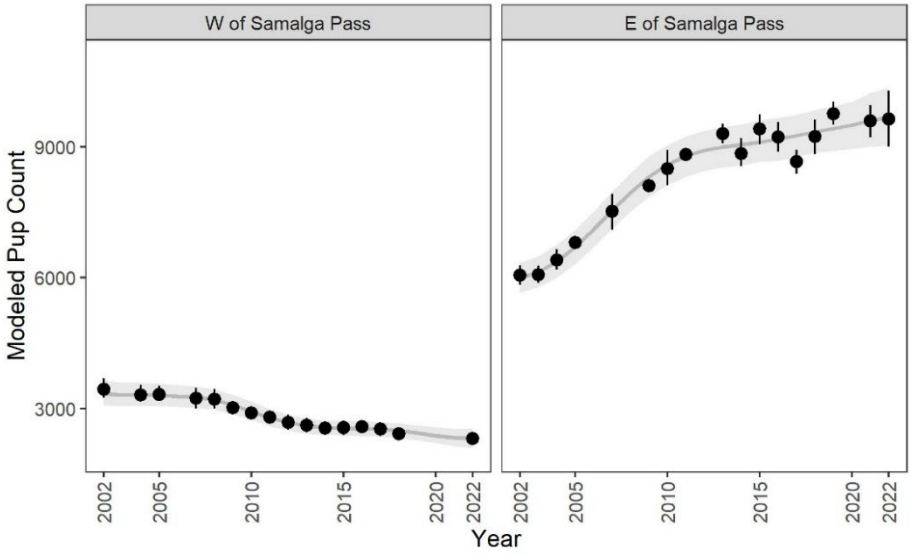


Figure 13. -- Realized and predicted Steller sea lion pup counts of the combined regions within the Aleutian Islands (ALEU) and Gulf of Alaska (GULF), 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

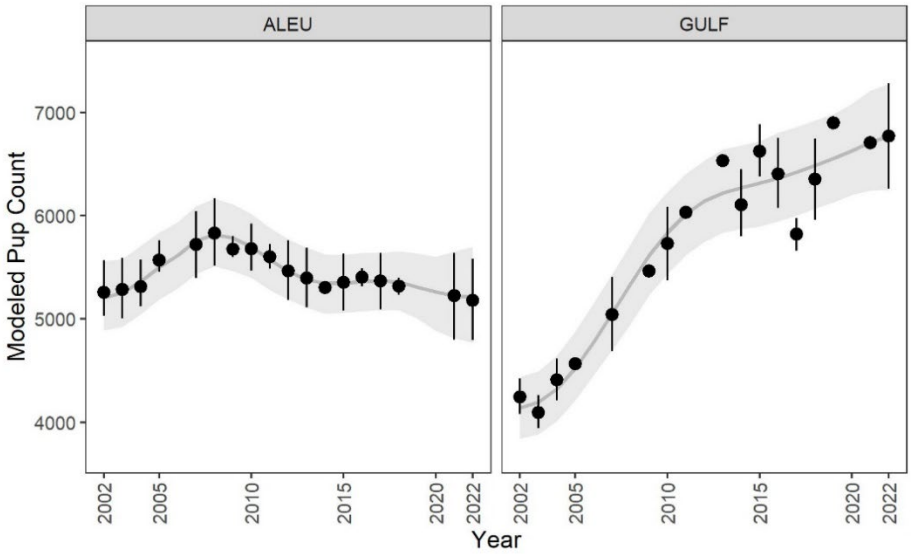


Figure 14. -- Realized and predicted Steller sea lion pup counts in the eastern and central Gulf of Alaska regions combined, 2002–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).

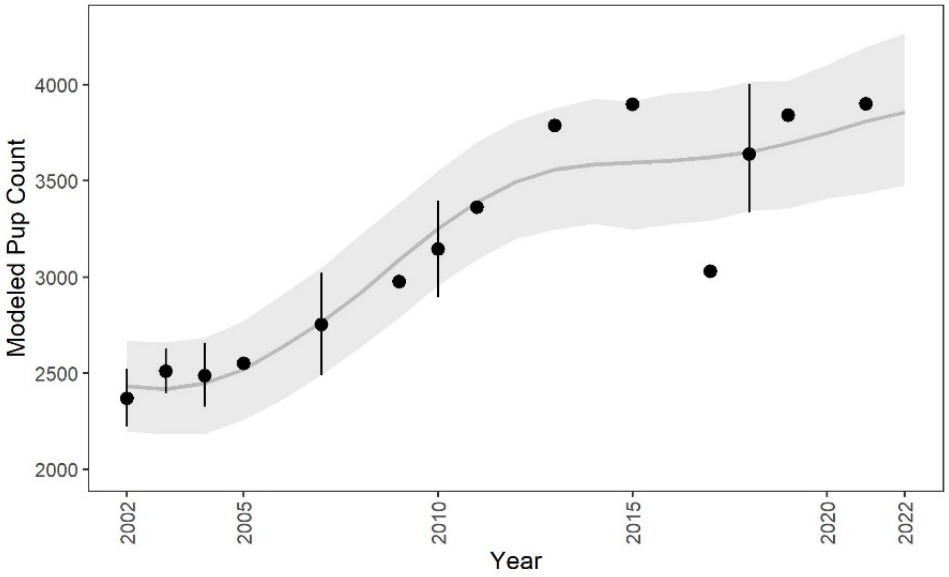
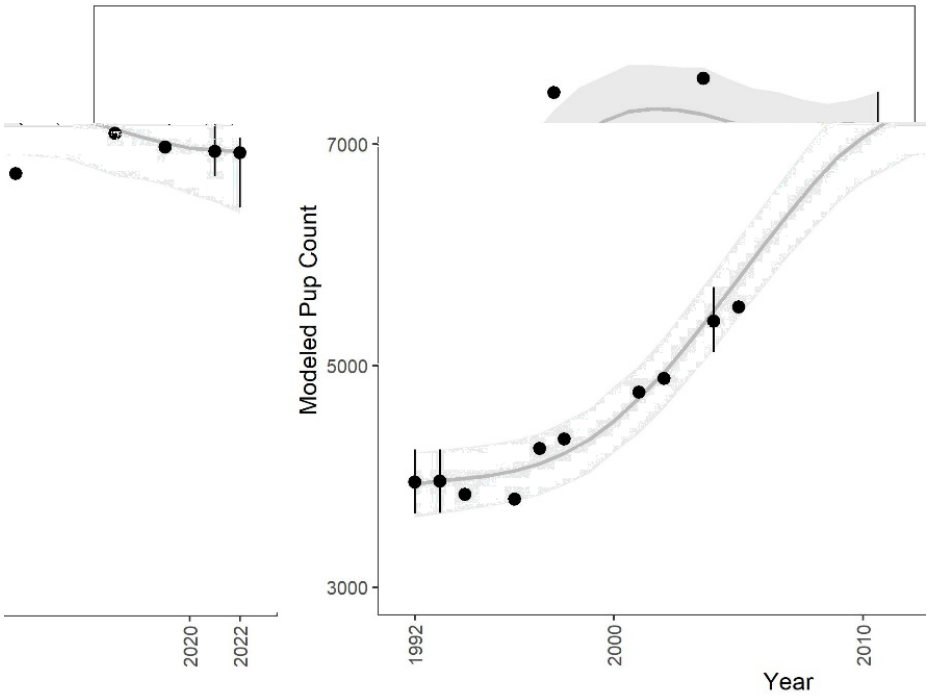


Figure 15. -- Realized and predicted Steller sea lion pup counts in Southeast Alaska region (eastern DPS), 1992–2022. Realized counts are represented by points and vertical lines (±95% credible intervals). Predicted counts are represented by the black line and gray shaded area (±95% credible intervals).



U.S. Secretary of Commerce
Gina M. Raimondo

Under Secretary of Commerce for
Oceans and Atmosphere
Dr. Richard W. Spinrad

Assistant Administrator,
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