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Memorandum For: The Record

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Subject: Survey of Adult and Juvenile Steller Sea Lions, June-July 2008

Summary: An aerial survey to assess trends in numbers of adult and juvenile (non-pup) Steller sea lions (*Eumetopias jubatus*) in Alaska was conducted by NMFS from 7 June to 6 July 2008. We used a Twin Otter aircraft (operated by NOAA, Aircraft Operations Center, Tampa FL) equipped with a vertically-oriented, high resolution digital camera (with forward motion compensation) mounted in the plane's belly port to survey Steller sea lions on terrestrial rookery and haul-out sites from southeast Alaska through the Aleutian Islands. This was the first complete survey of the endangered western distinct population segment (DPS) in Alaska since 2004 (Fritz et al. 2008), and the first complete survey of the threatened eastern DPS in southeast Alaska since 2002 (Pitcher et al. 2007; Figure 1).

The recent (2004-2008) overall trend in the population of adult and juvenile western Steller sea lions in Alaska is stable or declining slightly. This follows a 4-year period of population increase (at approximately 3% per year) between 2000 and 2004 which is the only increasing period observed since trend information began to be collected in the 1970s. There continues to be considerable regional variability in recent (2004-2008) trends (percentages listed below are % change between years):

- the eastern Aleutian Islands is the only consistently increasing region (+7%);
- the central and western Aleutian Islands declined at relatively high rates (-16% and -30%, respectively);
- the central and western Gulf of Alaska increased between 2004 and 2007, but declined slightly between 2007 and 2008; and
- the eastern Gulf of Alaska increased by 35%, but likely because of movement of eastern DPS animals from southeast Alaska .

Counts in the area from the central Gulf of Alaska through the western Aleutian Islands (85% of the 2008 population) declined slightly (-1%) between 2004 and 2008. Thus, the overall increase observed (3%) was due to increases in the eastern Gulf of Alaska population, which likely had some level of movement from the eastern DPS.

Methods

Aerial surveys for non-pups are conducted in June, when the greatest proportion of adults is onshore to give birth and breed. The primary objective in 2008 was to survey all terrestrial rookery and haul-out sites within the Alaskan Steller sea lion range from Dixon Entrance in southeast (SE) Alaska (134°W) to Attu Island (172°E) at the western end of the Aleutian Islands; the single rookery (Walrus Island) and 9 haul-outs in the eastern Bering Sea region north of the Alaska Peninsula were not surveyed. In 2008, we successfully assessed sea lion numbers at 339 of the 356 (95%) known terrestrial rookery and haul-out sites in the survey region (Tables 1-3). Of the 339 sites successfully surveyed, 169 were photographed, 30 had so few sea lions (< 15) that they were counted visually by observers on the plane, and 140 had no sea lions. Of the 17 'missed' sites, 15 could not be surveyed because of poor weather conditions, while 2 (rookeries on Chowiet and Chirikof Islands) were incompletely surveyed.

In 2008, we began the survey in SE Alaska, basing operations in Sitka, and surveyed the entire southeast area on 7-8 June. In the past, SE Alaska surveys were usually conducted after the western DPS survey was completed, and as a consequence, have generally been conducted in late June or early July. The last survey of SE Alaska sea lions was conducted on 4-5 July 2002, or approximately 1 month earlier in the year than in 2008. All other Steller sea lion surveys conducted in SE Alaska since 1996 were done on or after 20 June, or about 2 weeks later than the 2008 survey. Prior to 2008, the next earliest-in-the-year SE Alaska survey was conducted on 12-13 June 1994. In 2008, we began the western DPS survey in the Prince William Sound area on the same day (9 June) as in 2007.

NMML monitors the Steller sea lion population by surveying and counting animals at trend sites which have been consistently surveyed since the mid-1970s (N=85 1970s trend sites in the range of the western DPS in Alaska; N=19 in SE Alaska including each of the sites that comprise the Forrester complex) or 1991 (N=161 1990s trend sites in the range of the western DPS in Alaska). The vast majority (> 90%) of all sea lions counted during surveys conducted since 2004 have been counted at trend sites. All trend sites in SE Alaska (eastern DPS) and all but 5 of the 161 trend sites in the range of the western DPS were surveyed in 2008; of these, 3 could not be surveyed from the air because of bad weather (two rookeries on Ugamak Island and a haul-out located at East Cape on Amchitka Island), while 2 (rookeries on Chowiet and Chirikof Islands) were incompletely surveyed. For trend analyses, 2008 counts at these five sites were estimated using the following methods:

- At Chirikof, the most recent non-pup count, from the 2007 survey (N=300), was used in 2008. Counts at this rookery have been relatively stable since 1996 (range of 266-360).
- At Amchitka/East Cape, the most recent non-pup count, from the 2006 survey (N=103), was used in 2008. Trend counts within the western portion of the central Aleutian Islands region have been declining since the mid-1990s (Fritz et al. 2008), and the 2006 count is near the low end of the range counted since 1996 (101-186).

- Chowiet is a complex site composed of a strip of beach and several coves on the main island, along with an offshore islet where the primary breeding rookery is located. Only the islet and the strip of beach were photographed in the 2007 and 2008 surveys, while all areas were photographed in all previous surveys, including the one conducted in 2004. We used the ratio of all animals counted at Chowiet in 2004 (N=541) to those on the islet and beach (N=368; ratio=1.47) to estimate the total number at this rookery in both 2007 and 2008. In 2007 and 2008, 392 and 380 adult and juvenile sea lions were counted on the islet and beach. Multiplying these counts by 1.47 yielded estimates of 576 and 559 for all of Chowiet in 2007 and 2008, respectively. These estimates are within the range counted at Chowiet since 1996 (504-592).
- Ugamak Island has two main rookery beaches located at the eastern end of the island, one on the north and one on the south (Ugamak/Ugamak Bay). NMML scientists maintain a summer field camp between 1 June and 1 August each year and count animals, conduct behavior scans and record observations of permanently marked (hot-branded) sea lions on Ugamak Island as part of studies to estimate survival and reproductive rates. We compared aerial survey counts of adult and juvenile sea lions on the two rookery beaches in 2004 and 2005 with land-based counts made on the same day, and calculated the ratio of aerial:land counts (Table 4). To estimate aerial survey counts in 2008 at each rookery, we multiplied land-based counts made on or about 17 June (when the aerial survey was conducted in this area) by the average aerial:land ratio at each rookery. Counts at both rookeries have been increasing since 2004 (Figure 2).

Two researchers working independently counted all adult and juvenile Steller sea lions at each terrestrial site photographed during the 2008 survey. Sea lions were counted off digital photographs using high resolution monitors and Adobe Photoshop software (mention of specific products does not serve as an endorsement). A script within the software tallied the number of pups, juveniles, adult females, sub-adult males and adult males that were counted. Initial total counts of non-pups (juveniles, adult females, sub-adult males and adult males) at each site by each researcher were compared; if the difference in total non-pup counts at a site was greater than 10% or greater than 20, then the photographs (with counted animals) were compared to reconcile the discrepancies. This occurred at 28 sites, with the majority of cases involving animals in the water that were counted by one researcher but not the other. If sea lions were disturbed into the water by the survey aircraft, then every effort was made to count them, but animals that were in the water near undisturbed sites were not. After reconciliation of counts at the 28 sites, total counts of non-pups by the two researchers at all 162 sites photographed during the 2008 survey (~ 42,000) differed by less than 1%. All differences between the two researchers in non-pup sea lion counts at individual sites were less than 20 sea lions and 8%. Non-pup counts reported here are means of the replicate counts by each researcher for the 162 photographed sites, the visual count recorded by the observer for those sites with few sea lions, or the estimated non-pup population for the 5 sites either incompletely or not surveyed in 2008.

For western DPS trend analysis, the 2008 survey is directly comparable to that conducted in 2004 since both surveyed the vast majority of trend sites and both used vertical high

resolution photography. In 2006 and 2007, only 106 and 124, respectively, of the 161 western DPS 1990s trend sites were successfully surveyed (Table 5A). As such, data collected in 2006 and 2007 are useful for analysis of trends across one or more regions but not for the entire western DPS in Alaska. For 2007, a subset of 1990s trend sites was created that consisted of:

- All sites in the eastern Gulf of Alaska (E GULF: 145°-150°W; N=13)
- All but one site (Long Island) in the central Gulf of Alaska (C GULF: 150°-157°W; N=32 of 33)
- All but one site (Kak Island) in the western Gulf of Alaska (W GULF: 157°-163°W; N=19 of 20), and
- All but one site (Umnak/Cape Aslik) in the eastern Aleutian Islands (E ALEU: 163°-169°W; N=26 of 27).

In the eastern portion of the central Aleutian Islands (C ALEU-E) between the Islands of Four Mountains (169°W) and Tanaga Island (178°W), counts of non-pups at trend sites in 2006 and 2007 were pooled by averaging. In the western portion of the central Aleutian Islands (C ALEU-W), there were no surveys in 2006 and 2007 permitting only comparisons between 2004 and 2008. In the W ALEU, only the rookery on Buldir Island was missed in 2006 and there were no surveys in 2007 (Table 1).

Because the 2008 survey dates in SE Alaska were earlier than in other years, we analyzed the effect that day of the year may have had on counts in the SE Alaska and E GULF regions. We used generalized linear models and estimating equations (SAS procedure GENMOD; SAS 2002) to *a posteriori* analyze counts of adult and juvenile sea lions in 10 clusters of rookeries and haul-outs in both regions (Figure 3):

- E GULF Clusters
 - 1-Eastern haul-outs: CAPE HINCHINBROOK and CAPE ST. ELIAS
 - 2-Prince William Sound haul-outs: GLACIER, PERRY, and THE NEEDLE
 - 3-Central haul-outs: AIALIK CAPE, CAPE FAIRFIELD, POINT ELRINGTON, and RUGGED
 - 4-Western haul-outs: GRANITE CAPE, SEAL ROCKS (KENAI), and STEEP POINT
 - 5-Rookeries: CHISWELL ISLANDS, SEAL ROCKS, and WOODED (FISH)
- SE Alaska Clusters
 - 6-Southern, outside haul-outs: CORONATION and TIMBERED
 - 7-Central, outside haul-outs: CAPE OMMANEY, JACOB ROCK, and KAIUCHALI (BIORKA)
 - 8-Northern, outside haul-outs: CAPE CROSS, HARBOR POINT and INIAN
 - 9-Inside haul-outs: GRAN (LEDGE) POINT, SUNSET, and YASHA
 - 10-Rookeries: BIALI ROCK, FORRESTER COMPLEX, HAZY, and WHITE SISTERS

The response variable was the total non-pup count in the cluster, and the factors included in the model were:

- year (0=1990), year², day (1=1 June), region, cluster, year*region, year²*region, day*region, and cluster*day.

We assumed a negative binomial distribution and set the maximum iterations to 1000. We ran 3 different models that used different groups of clusters:

- 10 clusters (shown above with 5 in each region)
- 7 clusters
 - E GULF: 1, 2, 3-4, and 5
 - SE Alaska: 6-8, 9, and 10
- 5 clusters
 - E GULF: 1, 2-4, and 5
 - SE Alaska: 6-9 and 10

Model fits were compared with QAIC and the model with 5 clusters was superior to the other two; results from only the 5-cluster model will be discussed.

Surveys conducted prior to 2004 used oblique 35 mm photography. Differences in resolution between oblique 35 mm and vertical high resolution photographs requires an adjustment factor of -3.64% be applied to all counts from vertical photographs in order to properly analyze regional time series that include counts from years prior to 2004 (Fritz and Stinchcomb 2005).

Results and Discussion

Counts of adult and juvenile Steller sea lions at 1990s trend sites within the range of the western DPS in Alaska in 2004-2008 are listed in Table 1, while those at all other sites within the range of the western DPS in Alaska are listed in Table 2. Counts at all sites in SE AK within the range of the eastern DPS from surveys in 2002 and 2008 are shown in Table 3.

Counts of adult and juvenile Steller sea lions on all 1990s trend sites within the range of the western DPS in Alaska increased by 748, or 3%, between 2004 and 2008 (Table 5B; Figure 3). There was considerable variation, however, in the change in counts between 2004 and 2008 by region (Table 5B and C; Figure 4):

- In the C GULF, W GULF and E ALEU, counts increased between 337 and 430, or between 6 and 10%, while
- In the C ALEU and W ALEU, counts declined by 1,108 and 407, or -16% and -30%, respectively;
- In the E GULF, counts increased by 1,090, or 35%.

In the C GULF, what appears to be an increase of 10% between 2004 and 2008 is actually an increase of 17% ($\Delta=692$) between 2004 and 2007 followed by a decline of 6% ($\Delta=-312$) between 2007 and 2008 (Table 5C; Figure 4). Similarly, in the W GULF, counts increased 8% ($\Delta=431$) between 2004 and 2007 but then declined by 2% ($\Delta=-79$) between 2007 and 2008. Only in the E ALEU did counts continue to increase between 2004 and 2008, with increases of 3% ($\Delta=163$) between 2004 and 2007 and 5% ($\Delta=323$) between 2007 and 2008.

By contrast, counts in the C ALEU and W ALEU declined throughout the last 4 years (Tables 5B and C; Figures 4 and 5). In the C ALEU-E (Islands of Four Mountains-Tanaga), a 16% decline between 2004 and 2006/07 ($\Delta=-701$) was followed by an additional, though smaller 2% decline ($\Delta=-65$) between 2006/07 and 2008 (Table 5C;

Figure 5). Increases in non-pup counts in the C ALEU-E area between 1996 and 2004 were the reason why the C ALEU as whole was largely stable for most of the last decade. Surveys conducted in the C ALEU in 2008 preceded the 7 August eruption of the volcano on Kasotochi Island, which greatly altered the physical structure of the island and deposited a thick layer of gravel, boulders and ash on the rookery area and extended the beach hundreds of yards. The fate of the approximately 350 pups and 550 non-pups counted on the rookery on 21 June (approximately 6 weeks before the eruption) is not known. However, on 28 August, US Fish and Wildlife Service scientists observed approximately 250 non-pups and 2 pups on the southwest side of the island (J. Williams, USFWS, personal communication). To the west in the C ALEU-W (Delarofs-Kiska), counts dropped 13% ($\Delta=-342$) between 2004 and 2008 (there are no survey data for 2006 or 2007). In the W ALEU, there are no survey data for 2007 and limited data (missing Buldir) for 2006; it appears that most of the decline between 2004 and 2008 in the W ALEU occurred in the first 2 years (-19%; $\Delta=-230$) and was smaller in the last 2 years (-11%; $\Delta=-111$).

Total non-pup counts in the area from the C GULF through the W ALEU declined slightly (-1%; $\Delta=-342$) between 2004 and 2008 (Table 5B). This indicates that the increase in western DPS counts as a whole between 2004 and 2008 is largely due to the 35% increase in counts in the E GULF. Analysis of trends west of the E GULF in more detail reveals that total counts from the C GULF through C ALEU-E increased (3%; $\Delta=585$) between 2004 and 2007, but then declined slightly (-1%; -131) between 2007 and 2008 due to declines in the C GULF, W GULF and C ALEU-E; in the area west of the E GULF, only the E ALEU had a higher non-pup count in 2008 than in 2007. These trends suggest overall stability of the non-pup Steller sea lion population in the C GULF through C ALEU-E area, which is the core of the range of the western DPS in Alaska. Within this core, increases in the E ALEU are largely balanced by declines to the east and west. West of this core (C ALEU-W and W ALEU), non-pup counts have not stabilized and have continued to decline since the late 1970s (Fritz et al. 2008).

In the E GULF, total non-pup counts at trend sites varied considerably between 2004 and 2008. The increase in the E GULF alone was almost as great as the combined increases in the C GULF, W GULF, and E ALEU between 2004 and 2008, and this was despite a decline ($\Delta=-265$) in E GULF counts between 2004 and 2007. The 1,223 increase in animals counted between 2007 and 2008 in the E GULF to C ALEU-E area was due entirely to a jump of 1,355 in the E GULF alone (Table 5C). Looking at this increase in more detail we found that it was due to higher counts at the four easternmost sites in the E GULF outside of Prince William Sound (haul-outs on Cape St. Elias and Cape Hinchinbrook, and rookeries on Seal Rocks and Wooded (Fish) Island) and that more than half occurred on a single site (Cape St. Elias; Table 1; Figure 7). Since 2004, non-pup counts at these four sites have varied considerably:

- Increased over 4-fold (318 to 1400) at Cape St. Elias;
- Declined 400 between 2004 and 2007, then increased over 100 between 2007 and 2008 at Cape Hinchinbrook;
- Increased (+278) between 2004 and 2006, decreased (-316) between 2006 and 2007, and increased again (+221) in 2008 at Seal Rocks; and
- Ranged between 282 and 619 at Wooded (Fish).

It is unlikely that the large increase in non-pup counts observed in the E GULF between 2007 and 2008 (or even between 2004 and 2008) is a result of production at E GULF or neighboring C GULF rookeries. Total pup production at the two primary E GULF rookeries (Seal Rocks and Wooded-Fish) declined at the rate of -3.5% per year between 1992 and 2005, and at -8.9% per year at the three primary C GULF rookeries (Outer, Marmot and Sugarloaf Islands) between 1989 and 2005 (Fritz et al. 2008). By contrast, pup production increased at 2.2% per year between 1990 and 2005 at the three primary rookeries in SE AK (Forrester Complex, Hazy Island and White Sisters Island), and increased overall in the region at 3.1% per year (NMFS 2008).

Thus, these observations:

- an overall increase in non-pups in the E GULF,
- high variability in non-pup counts between sites and years in the E GULF,
- declining pup production in the E & C GULF, and
- increasing pup production in SE AK

are consistent with the hypothesis that some fraction of the non-pups counted in the E GULF region in the last several surveys (2006-2008) are eastern DPS animals that forage in the northern Gulf of Alaska in late spring (through early June) before moving back to SE AK in late June-early July. If this hypothesis is true, we should count more sea lions in early June in the E GULF, particularly at the easternmost sites, and count fewer in late June-early July; in SE AK, we should observe the opposite pattern: lower counts early and higher counts late. Total counts at SE AK trend sites in 2002 and 2008 generally support this hypothesis (Table 3). The survey in 2002 was conducted ‘late’ (in early July), and resulted in a total count of 15,284 non-pups with 9,989 on trend sites. By contrast, the survey in 2008 was conducted ‘early’ (in early June), and 939 fewer non-pups were counted on all sites and 1,201 fewer on trend sites. The Steller sea lion population in SE AK was increasing in the three decades prior to 2002 (Pitcher et al. 2007; NMFS 2008) and there is no evidence to suggest that it declined between 2002 and 2008. Instead, it may be the timing of the surveys in these two regions in 2008 compared to previous years that gives the appearance of a decline in SE AK and contributes to the apparent increase in the E GULF.

Results of analyses of E GULF and SE AK non-pup counts from 1990-2008 using generalized linear models, though not statistically significant, generally support the proposed hypothesis of regional movement between the E GULF and SE AK in June (Figure 8). Only at the easternmost E GULF haul-outs (cluster 1) does the model estimate higher counts early in the survey period (early June) than later (late June or early July; Figure 8C). At the western E GULF haul-outs (clusters 2-4), estimated counts late in the survey period were slightly higher than those early (Figure 8A), but the slope here was much smaller than that estimated for the SE AK haul-outs (clusters 6-9; Figure 8D). Slightly increasing estimated counts at rookeries (clusters 5 and 10) during the survey period are not unexpected since adult females would be arriving at these locations to give birth and breed. These patterns of non-pup counts at haul-outs in the E GULF and SE AK in June through early July are consistent with, but do not prove, the regional movement hypothesis. In 2008, then, we may have counted animals on the four easternmost sites in the E GULF (surveyed ‘early’) that ‘should’ have been counted as

part of the eastern DPS. Over 85% of the non-pups counted on Cape St. Elias and Cape Hinchinbrook during the 2006-2008 surveys (all of which were conducted 'early' prior to 14 June) were juveniles or adult females, the most likely age-sex classes to make such movements at this time. If we had surveyed SE AK 'late' instead of 'early', we could have counted some of these animals in both the E GULF and SE AK. Based on the magnitude of the 'decline' in SE AK between 2002 and 2008, and the 'increase' in the E GULF between 2004 and 2008, the number of non-pups moving from the E GULF back to SE AK by late in the survey period may be as high as 1,000, with most being juveniles and adult females. At this time, however, we have no quantitative estimate of the number of eastern DPS animals from SE AK that could be counted on haul-outs or rookeries early in the survey period in the E GULF.

Summary

We conclude that the recent (2004-2008) overall trend in the population of adult and juvenile Steller sea lions in the range of the western DPS in Alaska is stable or declining slightly. This follows a 4-year period of population increase (at approximately 3% per year) between 2000 and 2004 which is the only increasing period observed since trend information began to be collected in the 1970s. There continues to be considerable regional variability in recent (2004-2008) trends (percentages listed below are % change between years):

- the E ALEU is the only consistently increasing region (+7%);
- the C ALEU and W ALEU, which comprised over 30% of the population in 2004 but less than 25% in 2008, declined at relatively high rates (-16% and -30%, respectively);
- the C GULF and W GULF increased between 2004 and 2007, but declined slightly between 2007 and 2008; and
- the E GULF increased by 35%, but likely because of immigration from SE AK.

Counts in the area from the C GULF through the W ALEU (85% of the 2008 population) declined slightly (-1%) between 2004 and 2008, indicating that the overall increase observed (3%) was entirely in the E GULF, which likely had some level of immigration from the eastern DPS.

Acknowledgments

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Table 1. Counts of adult and juvenile (non-pup) Steller sea lions at TREND ROOKERIES AND HAUL-OUTS in the range of the western distinct population segment (DPS) in Alaska from high resolution aerial photographs taken in June-July 2004, 2006, 2007 and 2008. These are trend sites that have been surveyed regularly since 1991. Rookeries labeled Y* are 'new' rookeries, which were not included as rookeries in the designation of critical habitat (CH) in 1993 but have produced at least 50 pups since 1975. Rookeries labeled N* are listed CH rookeries, but have no record of at least 50 pups since 1975. Counts are unadjusted.

SITENAME	REGION	ROOKERY	2004	2006	2007	2008
CAPE ST. ELIAS	E GULF		318	414	728	1,400
CAPE HINCHINBROOK	E GULF		496	237	95	229
SEAL ROCKS	E GULF	Y	841	1,119	803	1,024
WOODED (FISH)	E GULF	Y	523	619	282	603
GLACIER	E GULF		620	466	531	509
THE NEEDLE	E GULF		123	127	145	88
POINT ELRINGTON	E GULF		132	58	37	169
CAPE PUGET	E GULF		0	0	0	0
CAPE FAIRFIELD	E GULF		0	0	10	47
RUGGED	E GULF		0	0	0	8
AIALIK CAPE	E GULF		1	103	161	77
CHISWELL ISLANDS	E GULF	Y*	72	71	74	68
SEAL ROCKS (KENAI)	E GULF		3	4	2	0
OUTER (PYE)	C GULF	Y	222	251	268	249
GORE POINT	C GULF		0	0	0	0
EAST CHUGACH	C GULF		0		0	0
PERL	C GULF		49		241	144
NAGAHUT ROCKS	C GULF		1		2	21
ELIZABETH/CAPE ELIZABETH	C GULF		28		0	0
SUGARLOAF	C GULF	Y	667	733	662	849
USHAGAT/NW	C GULF		3	0	0	0
USHAGAT/SW	C GULF	Y*	101	141	74	96
USHAGAT/ROCKS SOUTH	C GULF		8	9	0	45
LATAK ROCKS	C GULF		56		115	108
SEA OTTER	C GULF		127		100	1
RK NEAR SEA OTTER	C GULF		10		0	47
AFOGNAK/TONKI CAPE	C GULF		0		0	16
SEA LION ROCKS (MARMOT)	C GULF		2		1	13
MARMOT	C GULF	Y	703	686	551	644
LONG ISLAND	C GULF		32			59
KODIAK/CAPE CHINIAK	C GULF		87		241	130
UGAK	C GULF		0		0	0
KODIAK/GULL POINT	C GULF		109		148	109
KODIAK/CAPE BARNABAS	C GULF		0		140	84
TWOHEADED	C GULF		266		228	204
SITKINAK/CAPE SITKINAK	C GULF		80		104	115
KODIAK/CAPE UGAT	C GULF		2	167	248	285
KODIAK/STEEP CAPE	C GULF		0	14	61	38
SHAKUN ROCKS	C GULF		104	67	113	81

Table 1 (continued)

SITENAME	REGION	ROOKERY	2004	2006	2007	2008
TAKLI	C GULF		85	157	92	67
PUALE BAY	C GULF		58	2	1	2
UGAIUSHAK	C GULF		0	0	2	0
SUTWIK	C GULF		206	114	127	93
CHOWIET	C GULF	Y	541		424	559
CHIRIKOF	C GULF	Y	303		300	300
NAGAI ROCKS	C GULF		330		449	234
CHERNABURA	W GULF	Y	828		1,228	1281
LIGHTHOUSE ROCKS	W GULF	Y*	111	153	152	164
KAK	W GULF		17	24		1
MITROFANIA	W GULF		182	103	116	129
SPITZ	W GULF		1	0	11	1
KUPREANOF POINT	W GULF		53	116	53	72
CASTLE ROCK	W GULF		70	15	38	28
ATKINS	W GULF	Y	651	663	585	558
THE HAYSTACKS	W GULF		38	1	41	3
THE WHALEBACK	W GULF		102	99	83	102
NAGAI/MOUNTAIN POINT	W GULF		80	56	148	60
SEA LION ROCKS (SHUMAGINS)	W GULF		36	142	44	54
UNGA/ACHEREDIN POINT	W GULF		264	152	229	202
JUDE	W GULF	Y*	474	338	445	465
PINNACLE ROCK	W GULF	Y	1,011	1,167	1,057	1,094
CLUBBING ROCKS	W GULF	Y	911	1,037	1,063	952
CHERNI	W GULF		0	0	0	0
SOUTH ROCKS	W GULF		528	320	457	451
BIRD ROCK	W GULF		57	62	97	155
UNIMAK/CAPE SARICHEF	E ALEU		250	6	0	167
AMAK+ROCKS	E ALEU		733	410	220	265
SEA LION ROCK (AMAK)	E ALEU	Y	456	447	385	360
UGAMAK COMPLEX	E ALEU	Y	1,304	1,319	1,493	1,619
AIKTAK	E ALEU		101	111	43	42
TIGALDA/ROCKS NE	E ALEU		141	202	236	359
TIGALDA/SOUTH SIDE	E ALEU		46	83	105	91
ROOTOK	E ALEU		96	96	141	60
TANGINAK	E ALEU		4	6	4	1
AKUN/BILLINGS HEAD	E ALEU	Y	307	338	523	386
AKUTAN/REEF-LAVA	E ALEU		119	103	57	128
AKUTAN/CAPE MORGAN	E ALEU	Y	1,021	1,249	1,172	1,135
OLD MAN ROCKS	E ALEU		71	112	81	89
EGG	E ALEU		5	0	0	0
OUTER SIGNAL	E ALEU		0	0	0	10
UNALASKA/CAPE SEDANKA	E ALEU		0	0	0	0
UNALASKA/BISHOP POINT	E ALEU		265	285	196	204
UNALASKA/MAKUSHIN BAY	E ALEU		20	88	154	115
UNALASKA/SPRAY CAPE	E ALEU		0	0	0	0
UNALASKA/CAPE IZIGAN	E ALEU		238	329	304	188

Table 1 (continued)

SITENAME	REGION	ROOKERY	2004	2006	2007	2008
BOGOSLOF/FIRE ISLAND	E ALEU	Y	380	358	405	390
UMNAK/CAPE ASLIK	E ALEU		119	73		63
POLIVNOI ROCK	E ALEU		91	42	96	93
THE PILLARS	E ALEU		4	0	0	0
OGCHUL	E ALEU	Y	139	132	152	200
VSEVIDOF	E ALEU		48	41	35	50
ADUGAK	E ALEU	Y	259	429	473	636
ULIAGA	C ALEU		0	99		66
KAGAMIL	C ALEU		1	0		0
CHUGINADAK	C ALEU		129	79		53
CARLISLE	C ALEU		0	0		27
HERBERT	C ALEU		38	66		105
YUNASKA	C ALEU	Y	260	255	279	282
CHAGULAK	C ALEU		0	13		59
AMUKTA+ROCKS	C ALEU		2	18	56	35
SEGUAM/FINCH POINT	C ALEU		2		0	0
SEGUAM/SW RIP	C ALEU		40		31	39
SEGUAM/SADDLERIDGE	C ALEU	Y	923		668	835
SEGUAM/TURF POINT	C ALEU		58		8	3
SEGUAM/LAVA COVE	C ALEU		0		0	0
SEGUAM/LAVA POINT	C ALEU		5		0	0
SEGUAM/WHARF POINT	C ALEU		90		121	49
AGLIGADAK	C ALEU	N*	61		15	14
AMLIA/EAST CAPE	C ALEU		34		55	117
AMLIA/SVIECH. HARBOR	C ALEU		144		113	100
TANADAK (AMLIA)	C ALEU		1		0	30
SAGIGIK	C ALEU		30		10	14
ATKA/NORTH CAPE	C ALEU		383	279	140	32
ATKA/CAPE KOROVIN	C ALEU		4	0	30	39
SALT	C ALEU		0		0	4
KASATOCHI/NORTH POINT	C ALEU	Y	667	610	613	550
OGLODAK	C ALEU		86	111	58	99
IKIGINAK	C ALEU		0	8	16	0
FENIMORE	C ALEU		30	10	9	4
ANAGAKSIK	C ALEU		2	52	14	20
GREAT SITKIN	C ALEU		0	0	0	0
LITTLE TANAGA STRAIT	C ALEU		49		15	36
KAGALASKA	C ALEU		48	0	3	42
ADAK	C ALEU	Y	1,008		779	621
KANAGA/N CAPE	C ALEU		7	13	2	14
KANAGA/CAPE MIGA	C ALEU		0	0	0	0
KANAGA/SHIP ROCK	C ALEU	Y*	229		331	322
TANAGA/BUMPY POINT	C ALEU		33		33	22
TANAGA/CAPE SASMIK	C ALEU		122		63	95
GRAMP ROCK	C ALEU	Y	679			593
UGIDAK	C ALEU		25			16
TAG	C ALEU	Y	242			255
KAVALGA	C ALEU		56			63

Table 1 (continued)

SITENAME	REGION	ROOKERY	2004	2006	2007	2008
UNALGA+DINKUM ROCKS	C ALEU		19			0
ULAK/HASGOX POINT	C ALEU	Y	531			537
AMATIGNAK/KNOB POINT	C ALEU		1		0	3
AMATIGNAK/NITROF POINT	C ALEU		76	38		49
SEMISOPOCHNOI/POCHNOI	C ALEU	N*	55	41		32
AMCHITKA/CAPE IVAKIN	C ALEU		0	0	0	0
AMCHITKA/EAST CAPE	C ALEU	N*	178	103		103
AMCHITKA/ST. MAKARIUS	C ALEU		0	0	0	0
AMCHITKA/COLUMN ROCK	C ALEU	Y	85			71
AYUGADAK	C ALEU	Y	152			152
RAT	C ALEU		45			0
SEA LION ROCK (KISKA)	C ALEU		0			0
TANADAK (KISKA)	C ALEU		34			1
KISKA/SOBAKA-VEGA	C ALEU		101			52
KISKA/CAPE ST STEPHEN	C ALEU	Y	210			229
KISKA/LIEF COVE	C ALEU	Y	170			162
KISKA/PILLAR ROCK	C ALEU		0			0
BULDIR	W ALEU	Y	108			43
SHEMYA	W ALEU		17	18		4
AL Aid	W ALEU		125	86		86
AGATTU/CAPE SABAK	W ALEU	Y	325	282		202
AGATTU/GILLON POINT	W ALEU	Y	374	308		281
ATTU/MASSACRE BAY	W ALEU		0	0		0
ATTU/CHIRIKOF POINT	W ALEU		75	30		42
ATTU/CHICHAGOF POINT	W ALEU		54	13		25
ATTU/KRESTA POINT	W ALEU		0	0		0
ATTU/CAPE WRANGELL	W ALEU	Y	257	260		247
Western DPS Trend Site Counts			27,437	19,058	23,144	28,185
Other Site Counts (Table 2)			1,600	2,231	3,012	3,060
Total Count			29,037	21,289	26,156	31,245

Table 2. Counts of adult and juvenile (non-pup) Steller sea lions at NON-TREND HAUL-OUTS in the range of the western stock in Alaska from high resolution aerial photographs taken in June-July 2004, 2006, 2007 and 2008. Counts are unadjusted.

SITENAME	REGION	2004	2006	2007	2008	COMMENT
HOOK POINT	E GULF	96	101	132	261	
STEEP POINT	E GULF	1	11	90	92	
MIDDLETON	E GULF	4	0	0	0	
POINT ELEANOR	E GULF		0	0	0	
PERRY	E GULF		218	437	227	
PLEIADES	E GULF		0	0	0	
POINT LaTOUCHE	E GULF	0	0	0	0	
DANGER	E GULF	12	10	119	2	
PROCESSION ROCKS	E GULF	36	67	77	102	
CAPE JUNKEN	E GULF	0	0	0	0	
CAPE RESURRECTION	E GULF	3	0	12	0	
GRANITE CAPE	E GULF	1	89	25	4	
Rocks b/n Steep and Rabbit	E GULF					2007 count of 90 and 2008 count of 92 applied to Steep Point
RABBIT	E GULF	0	0	0	0	
NEAR AIALIK CAPE	E GULF					2006 count of 103, 2007 count of 161, and 2008 count of 77 applied to Aialik Cape
HOOF POINT	E GULF		52		0	
FLAT	C GULF	4		44	0	
SHAW	C GULF	81	162	1	0	
NUKA POINT	C GULF	0	0	0	0	
PERL ROCKS	C GULF	0		0	0	
WEST AMATULI	C GULF	0	0	0	0	
SUD	C GULF	0	0	0	0	
KODIAK/CAPE						
PARAMANOF	C GULF	0	0	0	0	
CAPE DOUGLAS	C GULF	0	0	0	0	
KODIAK/MALINA POINT	C GULF	0	0	0	0	
NOISY	C GULF	0	0	0	0	
KODIAK/CAPE KULIUK	C GULF	0	0	0	0	
CAPE NUKSHAK	C GULF	0	0	0	0	
CAPE UGYAK	C GULF	0	0	0	0	
KODIAK/SUNDSTROM	C GULF	0		0	0	
CAPE GULL	C GULF	0	0	0	0	
CAPE KULIAK	C GULF		0	4	0	
KODIAK/CAPE ALITAK	C GULF	0		0	0	
KODIAK/CAPE UYAK	C GULF		0	0	0	
KODIAK/STURGEON						
HEAD	C GULF		0	0	0	
KODIAK/CAPE IKOLIK	C GULF	108	52	33	57	
KODIAK/TOMBSTONE						
ROCKS	C GULF	0	0	0	0	

Table 2 (continued)

SITENAME	REGION	2004	2006	2007	2008	COMMENT
KILOKAK ROCKS	C GULF	85	144	198	101	
AIUGNAK COLUMNS	C GULF	1	24	7	3	
AGHIYUK	C GULF	27	5	9	0	
OLGA ROCKS NE	W GULF	11	28	36	48	
OLGA ROCKS SW	W GULF	117	102	95	128	
SUSHILNOI ROCKS	W GULF	290	327	289	286	
CATON	W GULF	109	368	416	542	
ATKULIK	W GULF	0	0		0	
CHANKLIUT	W GULF	0	0		0	
SEAL CAPE	W GULF	0	0		0	
BIG KONIUJI	W GULF	0	0	0	0	
TWINS	W GULF	0	0	0	0	
NAGAI/RK W OF CAPE WEDGE	W GULF	0	0	0	0	
EGG (SAND POINT)	W GULF	0	0	0	0	
UNGA/CAPE UNGA	W GULF	0	0	0	0	
OMEGA	W GULF	0	1	0	0	
WOSNESENSKI	W GULF	166	113	110	98	
HUNT	W GULF	0	0	0	0	
HAGUE ROCK	W GULF	0	0	0	1	
SOZAVARIKA	W GULF	0	0		0	
SANAK	W GULF	0	0	0	0	
UMGA	W GULF	0	0	0	0	
UNIMAK/CAPE LAZAREF	E ALEU	0		0	0	
UNIMAK/OKSENOF POINT	E ALEU			269	762	
UNIMAK/CAPE LUTKE	E ALEU	0	0	0	0	
UNIMAK/SCOTCH CAP Rock b/n Unimak/Sennett Point and Unimak/Cape Sarichef	E ALEU		19	6	0	
KALIGAGAN	E ALEU	1	0	6	1	
UNIMAK/SENNETT POINT	E ALEU	0	1	0	0	
BASALT ROCK	E ALEU	1	4	0	0	
AKUN/AKUN BAY	E ALEU	0	0	18	8	
AKUN/JACKASS POINT	E ALEU	0	0	0	0	
AKUN/AKUN HEAD	E ALEU	0	0	0	0	
AKUTAN/BATTERY POINT	E ALEU	0	0	0	0	
AVATANAK	E ALEU		15	42	0	
BABY	E ALEU	0	4	0	0	
INNER SIGNAL	E ALEU	38	0	47	54	
UNALASKA/PRIEST ROCK	E ALEU	0	1	3	2	
UNALASKA/WHALEBONE CAPE	E ALEU	0	0	0	0	
UNALASKA/CAPE WISLOW	E ALEU	0	0	0	0	

Table 2 (continued)

SITENAME	REGION	2004	2006	2007	2008	COMMENT
UNALASKA/CAPE STARICHKOF	E ALEU	0	0	0	0	
Unlisted Rock b/n Rootok and Tigalda	E ALEU		15	42		
Unlisted Rock b/n Bishop and Kovrizhka	E ALEU				0	2007 count of 10 applied to Unalaska/Bishop Point
UNALASKA/KOVRIZHKA	E ALEU	0	0	0	0	
UNALASKA/RK NEAR MAKUSHIN	E ALEU				0	2006 count of 60 applied to Unalaska/Makushin Bay
UMNAK/CAPE IDAK	E ALEU		0	0	0	
EMERALD	E ALEU	0		0	0	
UMNAK/REINDEER POINT	E ALEU		0		0	
UMNAK/CAPE CHAGAK	E ALEU		0		0	
UMNAK/AGULIUK POINT	E ALEU		0		0	
SAMALGA	E ALEU	1	0	0	0	
TAGALAK	C ALEU	91	134	162	86	
SILAK	C ALEU	38	32	88	32	
ADAK/CAPE MOFFET	C ALEU	0	0	0	0	
ADAK/ARGONNE POINT	C ALEU	35	12	10	0	
BOBROF	C ALEU	49	21		0	
SEMISOPOCHNOI/PETREL	C ALEU	0	43		0	
SEMISOPOCHNOI/SW KNOB	C ALEU	17	0		0	
SEMISOPOCHNOI/TUMAN POINT	C ALEU	0	0		0	
SEGULA/GULA POINT	C ALEU		1		0	
AMLIA/CAPE MISTY	C ALEU	21		72	0	
KONIUJI/NORTH POINT	C ALEU	0	0	0	0	
CHUGUL	C ALEU	39	69	73	12	
IGITKIN/SW POINT	C ALEU	0	0	0	0	
ADAK/CRONE ISLAND	C ALEU	0			60	
KANAGA/CAPE CHUNU	C ALEU	9		82	69	
ILAK	C ALEU	45			18	
SKAGUL/S. POINT	C ALEU	1			1	
OGLIUGA	C ALEU	49			0	
AMCHITKA/OMEGA POINT	C ALEU	0	0	0	0	
AMCHITKA/CHITKA POINT	C ALEU	0		0	0	
AMCHITKA/BIRD	C ALEU	0		0	0	
TWIN ROCKS (KISKA)	C ALEU	13			1	
KISKA/SOUTH HEAD	C ALEU	0	0		0	
KISKA/WITCHCRAFT POINT	C ALEU	0			7	
KISKA/GERTRUDE-BUKHTI	C ALEU	0	0		0	
INGENSTREM ROCKS	W ALEU	0	1		0	
NIZKI	W ALEU	0	0		0	
DAN'S ROCKS	W ALEU	0	0		0	
Total Other Sites		1,600	2,231	3,012	3,060	

Table 3. Counts of adult and juvenile (non-pup) Steller sea lions at TREND (1) and NON-TREND (0) HAUL-OUTS and ROOKERIES (Y) from high resolution aerial photographs taken in July 2002 and June 2008. Counts from trend sites labeled 1* were omitted from the Total Southeast Alaska Trend-Site since there are no counts of these sites from 2002. The Brothers count is the sum of counts from The Brothers/SW and The Brothers/NW. For 2002, Forrester Complex count includes Forrester/Horn Rk, Forrester/East Rk, Forrester/West Rock, Forrester/Lowrie, Forrester North Rk, and Forrester/Sea Lion Rk. The Forrester Complex count for 2008 includes Forrester/Horn Rk, Forrester/Forrester Island, Forrester/Lowrie, Forrester North Rk, and Forrester/Sea Lion Rk.

SITENAME	REGION	TREND	ROOKERY	2002	2008
LITTLE ISLAND	SE AK	0			0
POINT MARSH	SE AK	0		104	4
WEST ROCK	SE AK	0		640	841
WOLF ROCK	SE AK	0		207	300
SAKIE POINT	SE AK	0			0
CAPE BARTOLOME	SE AK	0		41	0
CAPE ADDINGTON	SE AK	0		1074	718
GRINDALL	SE AK	0		130	374
TIMBERED	SE AK	0		442	288
HAZY	SE AK	1	Y	2,050	1,686
EASTERLY	SE AK	0			255
CORONATION	SE AK	1		46	279
South of Cape Ommaney	SE AK	0			102
CAPE OMMANEY	SE AK	0		344	117
LARCH BAY	SE AK	0			28
SEA LION ROCK (PUFFIN BAY)	SE AK	0		264	0
ETOLIN	SE AK	0			0
PATTERSON POINT	SE AK	0			0
BIALI ROCK	SE AK	1	Y	626	408
FORRESTER COMPLEX	SE AK	1	Y	3,699	2,894
JACOB ROCK	SE AK	1		203	101
KAIUCHALI (BIORKA)	SE AK	0		46	31
HORN CLIFF	SE AK	0			0
YASHA	SE AK	0		920	379
ST. LAZARIA	SE AK	0			0
PINTA ROCKS	SE AK	0			0
TURNABOUT	SE AK	1*			0
ROUND ROCK	SE AK	0			0
THE BROTHERS	SE AK	1		981	765
SEA LION ISLANDS	SE AK	1*			137
POINT LULL	SE AK	0			153
SAIL	SE AK	0		0	3
FALSE POINT PYBUS	SE AK	0		0	0
SUNSET	SE AK	0		348	384
POINT LEAGUE (STEVENS PASSAGE)	SE AK	0		0	1
WHITE SISTERS	SE AK	1	Y	1,156	1,132
TENAKEE CANNERY POINT	SE AK	0			0

Table 3 (Continued)

SITENAME	REGION	TREND	ROOKERY	2002	2008
CAPE CROSS	SE AK	1		1	1
MIST	SE AK	0			0
POINT MARSDEN	SE AK	0			0
CAPE BINGHAM	SE AK	0		0	0
CIRCLE POINT	SE AK	0			0
THE SISTERS	SE AK	0			0
DOROTHY	SE AK	0			0
GRAVES ROCK	SE AK	1	Y	1,001	1,305
INIAN	SE AK	0		206	116
VENISA	SE AK	0		0	0
POINT CAROLUS	SE AK	0		0	0
BENJAMIN	SE AK	0		0	0
HARBOR POINT	SE AK	1		186	178
SOUTH MARBLE	SE AK	0		238	786
CASE (TLINGIT) POINT	SE AK	0			0
CAPE FAIRWEATHER	SE AK	1*			0
MET POINT	SE AK	0			0
ELDRED ROCK	SE AK	0			0
GRAN (LEDGE) POINT	SE AK	0		331	583
Total Trend Sites				9,949	8,748
Total Other Sites				5,335	5,597

Table 4. Counts of adult and juvenile Steller sea lions at rookeries on Ugamak Island in June 2004-2008 by land-based observers and from aerial survey photographs. Land-based counts are lower than aerial survey counts because the entire beach cannot be seen from the cliff-side observation points. The average ratio of aerial:land counts from each rookery was multiplied by the 2008 land-based count to estimate the 2008 adult and juvenile aerial survey count (bold and italics).
 Ugamak/South = Ugamak/Ugamak Bay.

Rookery	Year	Land-Based		Aerial Survey		Ratio	Average Ratio
		Date	Count	Date	Count		
Ugamak/North	2004	14-Jun	419	14-Jun	644	1.54	1.49
	2005	25-Jun	453	25-Jun	650	1.43	
	2007			25-Jun	669		
	2008	~ 17-Jun	476		707		
Ugamak/South	2004	14-Jun	398	14-Jun	575	1.44	1.26
	2005	25-Jun	478	25-Jun	518	1.08	
	2007				654		
	2008	~ 17-Jun	608		769		

Table 5. Summary of 1990s trend sites surveyed (A) and counts of adult and juvenile (non-pup) Steller sea lions at 1990s Trend Sites (B & C) within the range of the western stock from vertical high resolution aerial photographs taken in June 2004-2008. Counts are unadjusted.

A. Number of 1990s Trend Sites Surveyed

Region	2004	2006	2007	2008
E GULF	13	13	13	13
C GULF	33	14	32	33
W GULF	20	19	19	20
E ALEU	27	27	26	27
C ALEU	58	24	34	58
W ALEU	10	9	0	10
Total	161	106	124	161

B. Counts of Non-Pup Steller Sea Lions at 1990s Trend Sites

Only Completely Surveyed Regions						
Region	2004	2006	2007	2008	$\Delta(08-04)$	% diff
E GULF	3,129	3,218	2,865	4,219	1,090	35%
C GULF	4,180			4,587	407	10%
W GULF	5,431			5,768	337	6%
E ALEU	6,217	6,259		6,647	430	7%
C ALEU	7,145			6,037	-1,108	-16%
W ALEU	1,335			928	-407	-30%
Total	27,437			28,185	748	3%
C GULF-W ALEU	24,308			23,966	-342	-1%

C. Counts of Non-Pup Steller Sea Lions at the Subset of 1990s Trend Sites

Includes regions missing 1 trend site (removed from all years)						
Region	2004	2006	2007	2008	$\Delta(07-04)$	$\Delta(08-07)$
E GULF ¹	3,129	3,218	2,865	4,219	-265	1,355
C GULF ²	4,148		4,840	4,528	692	-312
W GULF ³	5,414		5,845	5,767	431	-79
E ALEU ⁴	6,098	6,186	6,261	6,584	163	323
C ALEU-E ⁵	4,486	3,785		3,721	-701	-65
C ALEU-W ⁶	2,659			2,317		
W ALEU ⁷	1,227	997		886		
Total	27,161			28,020		
E GULF-C ALEU-E	23,275		23,595	24,818	320	1,223
C GULF-C ALEU-E	20,146		20,731	20,599	585	-131

¹ Complete

² Missing Long

³ Missing Kak

⁴ Missing Umnak/Cape Aslik

⁵ Is. 4 Mtns to Tanaga; pooled 2006-07

⁶ Delarofs to Kiska

⁷ Missing Buldir

Figure 1. Terrestrial rookery and haulout sites in the range of eastern and western stocks of Steller sea lions in Alaska surveyed in 2008 and used in the analysis of population trends. Boundaries of the eastern, central, and western regions of the Gulf of Alaska (GOA) and Aleutian Islands (AI) are shown. The eastern and western stocks breed on rookeries east and west of 144°W, respectively.

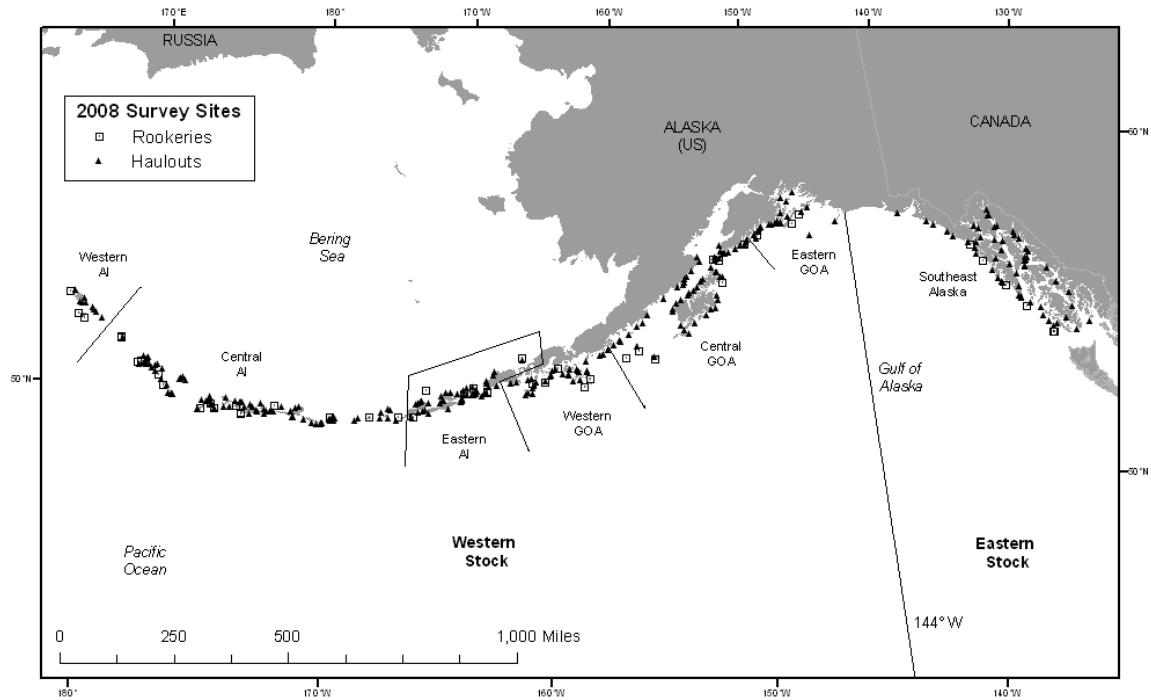


Figure 2. Field camp (land-based) and aerial survey counts of adult and juvenile Steller sea lions in June 2004-2008 at Ugamak/North (A) and Ugamak/South (also called Ugamak/Ugamak Bay; B) rookeries. Aerial survey data for 2008 (open squares) were estimated from ratio of aerial to land-based counts in 2004 and 2005; data in Table 4.

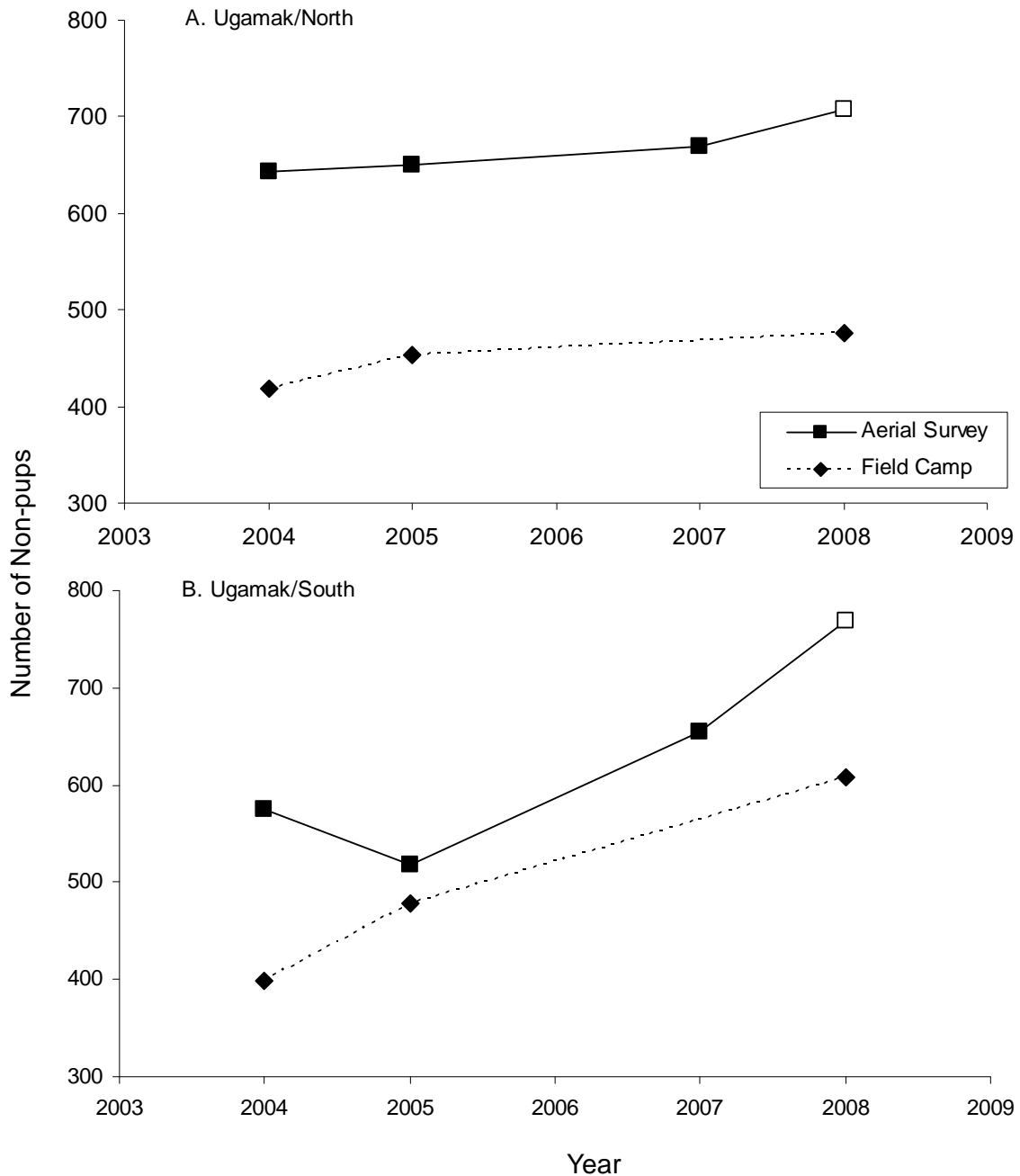


Figure 3. Clusters of haul-out and rookery sites used in analysis of non-pup Steller sea lion counts in the SE Alaska and E GULF regions.

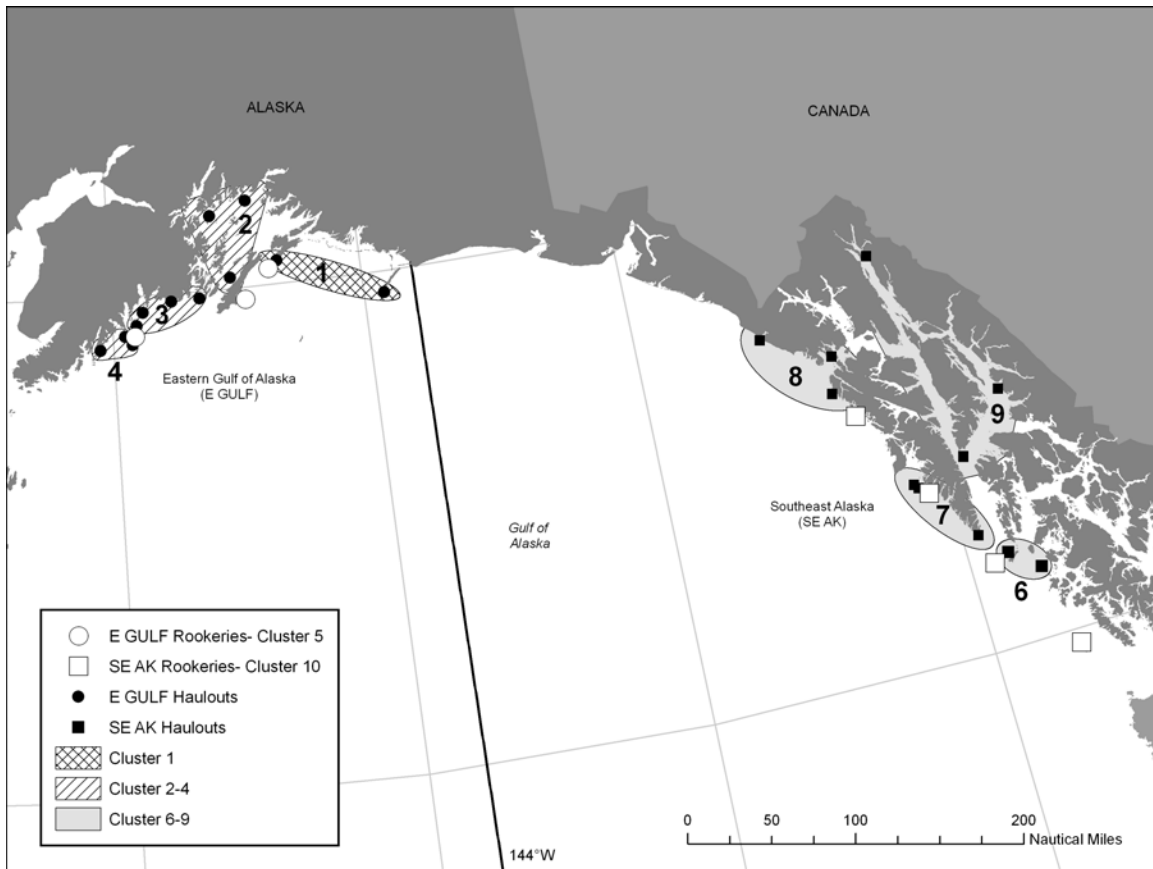


Figure 4. Counts of adult and juvenile (non-pup) Steller sea lions at 1990s trend sites (Table 1) in the range of the western stock in Alaska, 1991-2008. Totals for 2004 and 2008 are reduced 3.64% from the actual totals to reflect the higher counts obtained on vertical high-resolution (used in 2004 and 2008) than oblique 35 mm photographs (1991-2002; Fritz and Stinchcomb 2005).

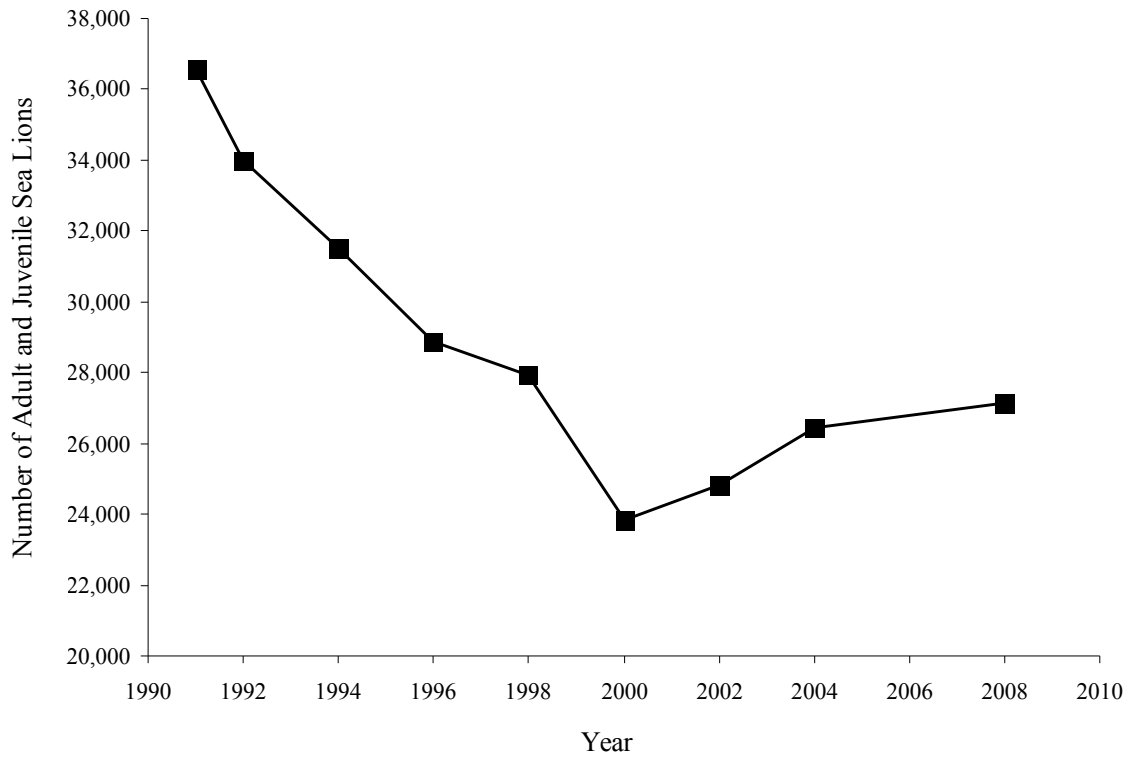


Figure 5. Counts of adult and juvenile (non-pup) Steller sea lions at 1990s trend sites (Table 1) by region in the range of the western stock in Alaska, 1991-2008. Region totals for 2004-2008 are reduced 3.64% from the actual totals to reflect the higher counts obtained on vertical high-resolution (used in 2004 and 2008) than oblique 35 mm photographs (1991-2002; Fritz and Stinchcomb 2005).

A. In the Gulf of Alaska, only the E GULF has a complete time-series of trend sites counts from 1991-2008; in the C GULF and W GULF, Long and Kak Islands were missed, respectively, in 2007. Separate time series were created without these sites for these two regions.

B. In the Aleutian Islands, the C ALEU has a complete series of trend site counts through 2004 and for 2008; in the E ALEU, Umnak/Cape Aslik was missed in 2007 while in the W ALEU, Buldir Island was missed in 2006. Separate time series were created without these sites for these two regions.

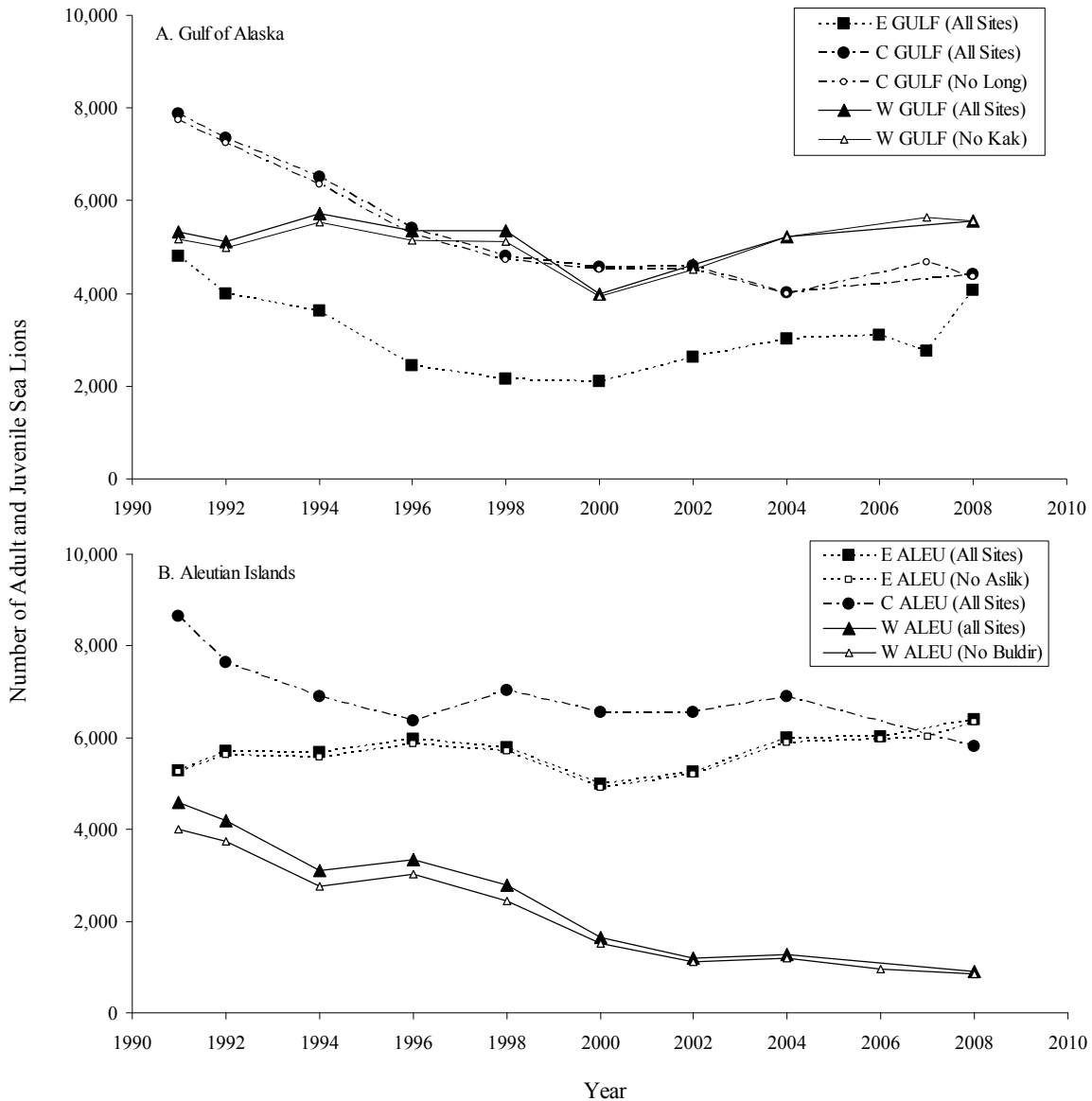


Figure 6. Counts of adult and juvenile (non-pup) Steller sea lions at 1990s trend sites (Table 1) in the eastern and western portions of the C ALEU sub-area, 1991-2008. Region totals for 2004-2008 are reduced 3.64% from the actual totals to reflect the higher counts obtained on vertical high-resolution (used in 2004 and 2008) than oblique 35 mm photographs (1991-2002; Fritz and Stinchcomb 2005). Western C ALEU includes counts at all trend sites between 177°E and 178°W (Kiska Island through the Delarof Islands). Eastern C ALEU includes counts at all trend sites between 169°-178°W (Islands of Four Mountains through Tanaga Island); counts for 2006 and 2007 were pooled by averaging and plotted at year = 2006.5.

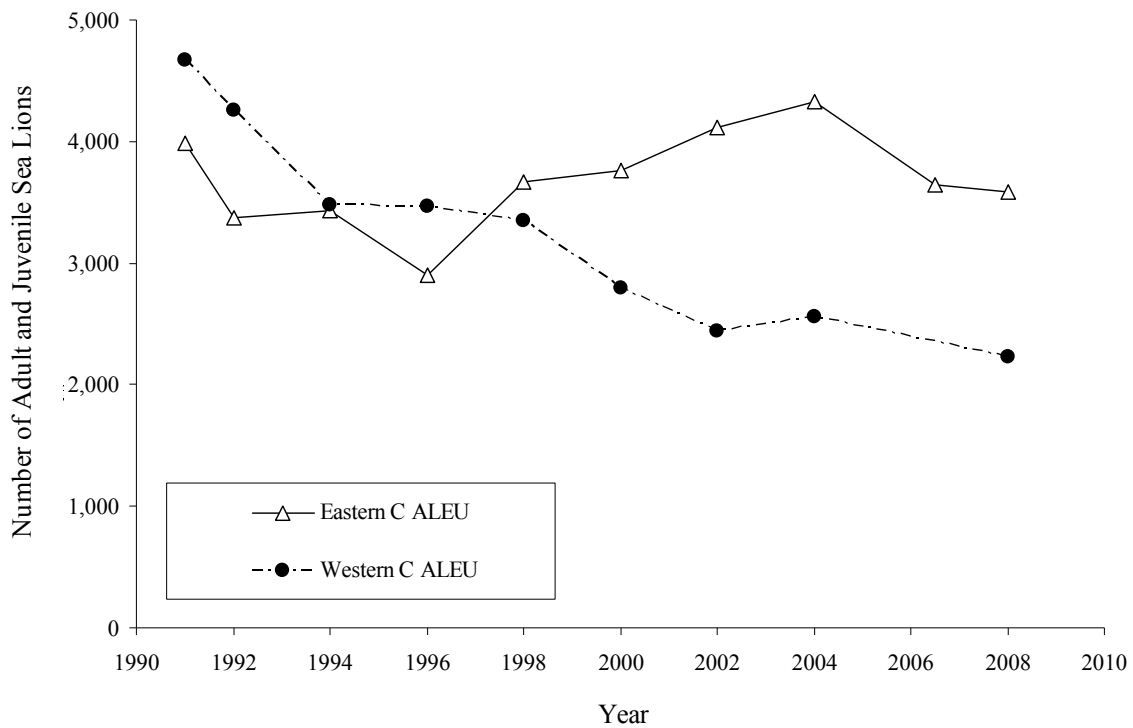


Figure 7. Change in the number of adult and juvenile (non-pup; NP) Steller sea lions counted at trend haul-out and rookery sites between 2004 and 2008 across the range of the western distinct population segment in Alaska.

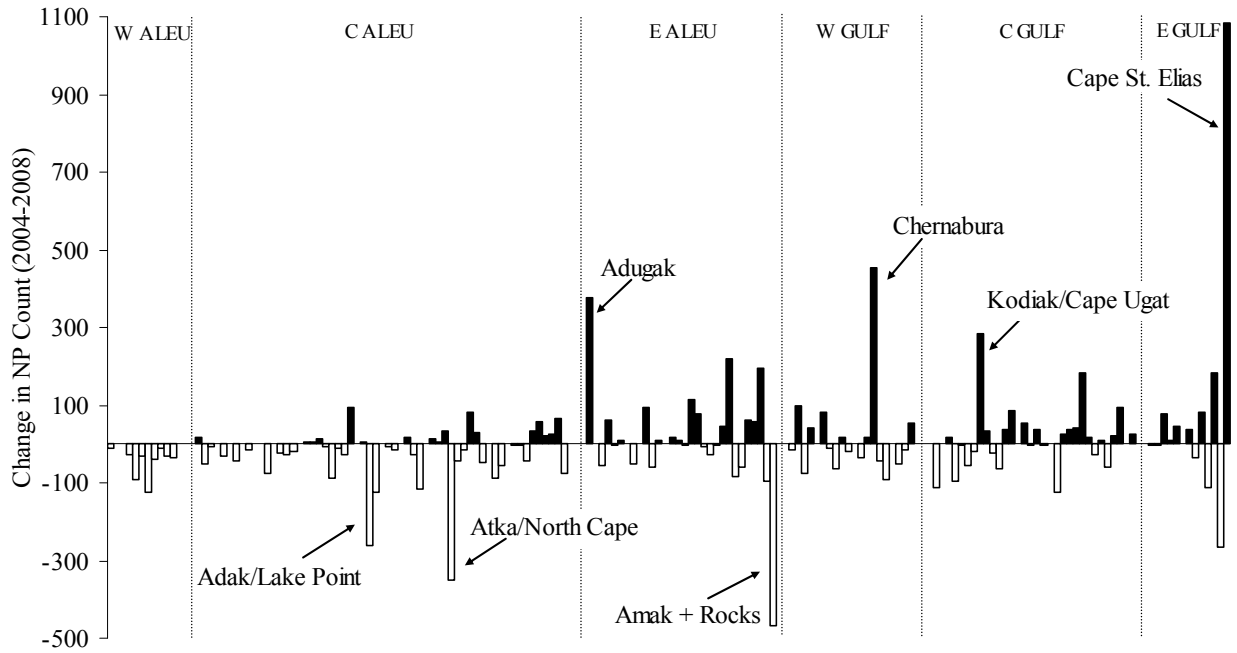


Figure 8. Counts of adult and juvenile Steller sea lions in clusters of haul-outs and rookeries in the eastern Gulf of Alaska (E GULF) and southeast Alaska (SE AK) in 2008 plotted against day of the year (1=1 June). Actual counts are plotted as points, and model estimates as lines with 95% confidence bounds. See text for details of model structure.

