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INTRODUCTION

- Currently, it is not known how far juvenile Steller sea lions (SSLs) from the endangered western population range from rookeries within Prince William Sound (PWS), nor what the probability of sighting a sea lion may be within their core area(s) which often include surveyed haul-out locations.
- Correction factors to calculate overall population size from counts of hauled-out animals within the boundary region of PWS remain unknown.
- A Kernel Density Estimation (KDE) approach was applied to a group of juvenile SSLs (n = 65) to quantify range-use, and to delineate sea lion haulout boundaries at various surveyed locations by analyzing post-release telemetry tracking data.
- Using the KDE derived utilization distributions (UDs) for individual sea lions, a multistate mark-recapture framework was implemented to quantify encounter probability to account for haulout time at each of the surveyed locations within the study area (Figure 1).



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Surveyed Haulouts within Prince William Sound-Kenai Fjords

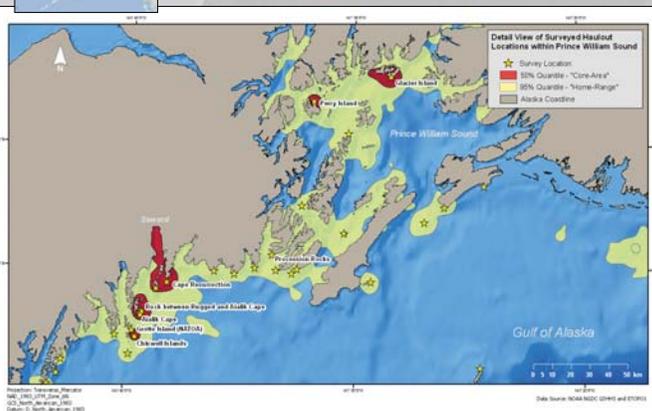


Figure 1. Surveyed haulouts used in the study (n = 8) within Prince William Sound, Alaska.

RESULTS

Were there significant differences in juvenile area use from the telemetry data?

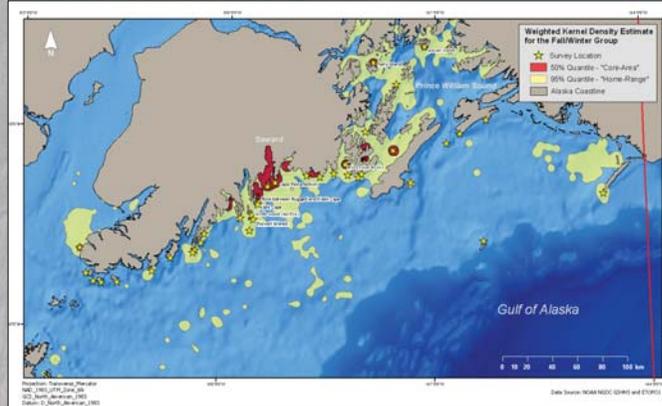
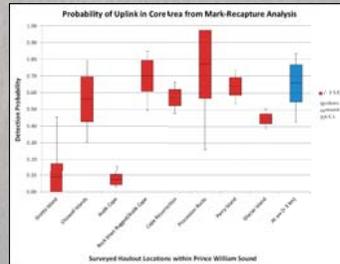


Figure 2. Weighted KDE of the Fall/Winter (FW) group (n=28) showing significantly wider distribution.

What is the probability of uplink (encounter), based on the KDE analysis?



Mark-recapture portion of analysis focused on the Spring/Summer (SS) juveniles only (n = 35)

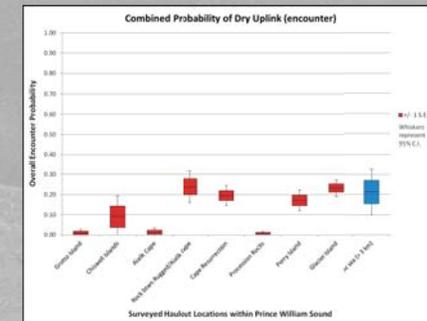
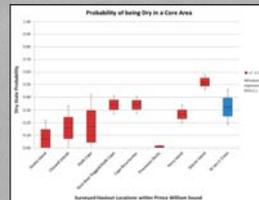


Figure 4. Uplink, dry state, and combined (product) encounter probabilities for SS study population (n = 35).

- For the KDE derived UD, the values were similar across individuals: 50% of the population fell within a range of 324-1,387 km² (mean=690.6 km², LCL=524.6 km², UCL=909.2 km² using a back-transformed 95% CI). There were no significant differences in area use associated with gender or time in captivity. However, there were significant differences in seasonal area use (U = 328, p = 0.011, r = -0.31). These are seen in Figures 2 and 3 (red line is the -144° Meridian).

← Fall/Winter Groups Distribution (juveniles collected from September to December)

↓ Spring/Summer Distribution (juveniles collected from April to August)

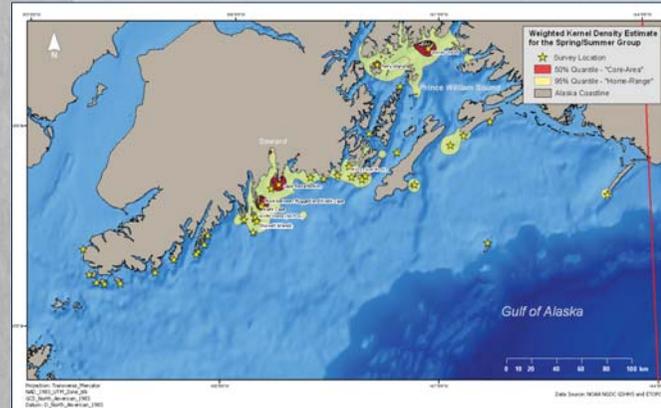


Figure 3. Weighted KDE of the Spring/Summer (SS) group (n=37) shows good fit to surveyed locations.

- The apparent uplink resolution of the satellite data (Figure 4, top panel) allowed for a fairly complete record of activity. Our "at sea" location (a proxy for foraging behavior) had an encounter probability of ≈ 0.658. This estimate closely matched another study of maternal SSLs, in which the mothers spent ≈ 66.5% of their time at sea after pup rearing constraints³.

- The majority of uplink probabilities occurred roughly between 0.42 and 0.78 for the selected haulouts, with the notable exceptions being Grotto Island and Aialik Cape.
- For the final combined encounter estimates (bottom panel), most of the probabilities fell roughly between 0.08-0.28 (location estimates rarely exceeded 0.30). A second group (which included Grotto Island, Aialik Cape, and Procession Rocks) averaged about 0.009.
- This study represents the first effort to combine a kernel analysis with the tag's TAD histogram to quantify the satellite detection probability of SSLs within a multistate modeling framework.

³ Maniscalco, J.M., P. Pilleri, and S. Atkinson. 2006. Interseasonal and interannual measures of maternal care among individual Steller sea lions (*Eumetopias jubatus*). *Journal of Mammalogy* 87:304-311.

METHODS

- Weaned juvenile SSLs (12-25 months) were captured in Prince William Sound or Resurrection Bay, Alaska, as part of a larger research project spanning from approximately 2001 to the present.
- Prior to release, external satellite-linked SDR-T16 or SPLASH tags (Wildlife Computers, USA) were mounted to the pelage of each animal along the dorsal midline between the fore-flippers.
- Range-use analysis was performed within the Geospatial Modelling Environment and imported into ESRI's ArcGIS. The KDE analysis defined the home range as the smallest area within which the animal spent 95% of its time and the core area as that which encompassed 50% of space use. These classifications have become standard in the literature.
- The input file for the multistate mark-recapture analysis treated each satellite fix, if it fell within a specified spatiotemporal context, as a "re-encounter."



In order for a position to be included:

- The animal must have been at a location that is surveyed. Additionally, only counts that were taken within a timeframe that aerial surveys are flown (generally the summer months) were considered.
- The animal must have been dry. Time-at-depth (TAD) histogram information was used to determine a dry state, and an overall sighting probability calculated using the product of the encounter and dry state probabilities. Standard errors were estimated using the Delta Method.

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