

**Exploring factors affecting population trajectories in harbor seals:
Efficacy of using subcutaneous VHF implants for long-term studies**

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Harbor seals (*Phoca vitulina*) declined by >63% in Prince William Sound (PWS) and began increasing at 2.2%/yr after 2002. A -63%/11yr decline continues in Glacier Bay (GB). We initiated a study comparing survival rates and health between areas. We used a surgical technique, developed and tested on 13 seals by The Marine Mammal Center (TMMC), to subcutaneously-implant VHF-transmitters into harbor seals. TMMC had radio-tracked 4 seals for >2 years and were still tracking 8 of 11 seals when our study began. In PWS, from 2003-05, we equipped 122 harbor seals with subcutaneous VHF transmitters with 5-year batteries. In 2004-06, 155 seals in GB received subcutaneous transmitters. We obtained samples from all seals to assess tooth-age, health, and diet. Along with manual radio-tracking, in 2004-05 we established three land-based telemetry-monitoring stations in GB, and in 2005, six stations were established in PWS with NPRB funding. Stations continuously scanned for radio-tagged seals. We compared population means for health and diet in each area. We used capture-mark-recapture (CMR) models with health/diet covariates and age/sex classes to estimate age-sex-specific 'apparent-survival-probabilities' and age-sex-year-specific resight-probabilities. We also investigated whether estimated apparent-survival-probabilities in the first-year post-tagging were a function of health/diet covariates. Population means for all health covariates in both areas fell within normal reference-ranges for harbor seals; some health variables had strong support in CMR models. Models may be unstable due to uneven sample sizes (biased toward females and young-of-the-year), low/skewed resight-rates, and multiple variables. Approximately 49% and 68% of seals tagged in year-0 were relocated in PWS and GB, respectively, in year-1. By year-2, the proportion of tagged-seals relocated was 34% in both areas, and by year-3, approximately 17% of seals were relocated. Resight-rates did not approximate population trajectories. We located four transmitters on beaches, and one seal – recaptured 18-months after surgery – had a partially extruding transmitter. Given low resight-rates and evidence of subcutaneous-tag rejection, we conclude that this tagging-method is not effective in harbor seals. Additionally, the population decline in GB does not appear to be health-related. Seals in both areas were in good condition, and health/condition population means were "normal". Further analyses are ongoing.



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