Startling Seals to Save Salmon: Assessing effectiveness of an acoustic deterrent with a statistical application of CReSS-SALSA 2D

This study presents the first implementation of a new acoustic deterrent, Targeted Acoustic Startle Technology (TAST) as a conservation tool to mitigate over-predation on an endangered population of Chinook salmon (Oncorhynchus tshawytscha) by harbour seals (Phoca vitulina) at a vulnerable point along their migration path at the Ballard Locks in Seattle Washington. The device was deployed for ten days, and trained observers recorded seal occurrence and behaviour in the study area while the device was on and off. A species distribution modelling technique called Complex Regional Spatial Smoother (CReSS) was applied to the spatial data with a Spatially Adaptive Localized Smoothing Algorithm (SALSA) to automate knot selection. The model was used to predict the probability of seal occurrence over the two-dimensional study area as a function of whether the TAST was on or off, and other smooth covariates. The model predicted that overall, seal presence probability did not change as a result of the TAST, but rather the spatial distribution of seals in the study area was further and more spread out when the device was on. This study demonstrates the TAST's effectiveness, and establishes its potential as a conservation tool for reducing seal predation intensity on an endangered population of Chinook salmon.