Hierarchical Bayesian model for a strip-transect survey employing intense search units

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Abstract: Sea otters (*Enhydra lutris*) were reintroduced to southeast Alaska in the 1970s. Aerial strip-transect surveys were conducted in northern southeast Alaska in 2002 and 2010 and southern southeast Alaska in 2003 and 2011 to monitor the population size and range expansion. Intense search units (ISUs) were conducted during the surveys prior to 2011 to estimate detection probabilities. An ISU is searched by flying five concentric circles around a group of otters sighted on the transect. The ISU data will be explicitly incorporated into a hierarchical Bayesian model and used to estimate sighting probabilities and sea otter density. The Bayesian model partitions the survey data into a process model that describes the population density and an observation model that describes the sampling error. The hierarchical Bayesian approach provides a flexible framework to quantify the observer-specific observation error for each survey, and a hierarchical approach can be used to describe variation in observer error between different habitat types or survey sub-regions. The results of this analysis will allow for estimates of local density and growth rates in specific habitats, as well as associated uncertainty. The Bayesian model will be used to estimate a detection probability and sea otter density from the 2011 survey, which did not conduct ISUs. The population estimates and sighting probabilities from the Bayesian analysis will be compared to results estimated using a maximum likelihood approach.