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A multi-site, multi-species capture-recapture model to quantify and describe the survival of Atlantic salmon and sea trout smolts during their migration to sea

It has been speculated that the first migration to sea is a bottleneck of Atlantic salmon (Salmo salar) and sea trout (Salmo trutta) smolt survival. However, this belief is based on multiple studies of few individuals on single rivers, rather than a single large study. We monitored the first migration to sea of over 400 salmon and trout smolts across four estuaries discharging into the English Channel over two years using acoustic telemetry. Acoustic recordings on these individuals were treated as capture-recapture observations in a custom hidden Markov model written in NIMBLE to quantify and describe general salmon and trout smolt survival rates during their migration to sea. Spatial and temporal variations in their survival rate were described using covariates including site and abiotic variables (temperature, salinity, dissolved oxygen, flow), together with year and receiver. Species differences were described using a species covariate, together with other biotic (age, sex, length, body condition, migration speed, migration timing) variables. Results of this study will be used to improve the management of migratory species moving through area of intense and growing human activities, such as estuaries.