

## Investigating the effect of variable animal-borne tag durations on parameter precision and uncertainty

Animal-borne tags record detailed data about individual animals, which might then be used to make inferences about a common process across animals. However, the duration of the recording time is often not controlled by the researchers, and hence can be highly variable. How to combine the information from animals with variable sampling durations becomes a question of interest and, in particular, evaluating what is the minimum duration that provides reliable parameter estimates is fundamental. Deep diving cetaceans are often tagged with DTAGs (Digital Acoustic Recording Tags), which collect a range of measurements including acoustic data. These animals tend to have almost metronomic behaviors, conducting a succession of deep foraging dive cycles. The duration of DTAGs is quite variable, depending on the tag version and animal physiology/behavior, some only have valid information for a few minutes, and others can contain several days of data. This raises a question: Is there a minimum number of deep dive cycles that a tag needs to contain to estimate a reliable parameter of interest? We use data from over 100 sperm whale DTAGs (tag duration varying from 20 minutes to 36 hours), collected at eight different locations over thirteen different years, to investigate this question. The parameter of interest is the rate at which the sperm whales produce their foraging clicks, which is relevant for density estimation from acoustic data. We consider a resampling approach, to evaluate how the variability and precision of the estimated cue rate change as a function of tag recording time. This allows us to identify what might be minimum amount of information required to estimate a reliable individual average and the best way to combine the information across multiple tags to estimate a mean cue rate. We discuss weighted means as a possible option, the adequacy of these depending on the within- (over time) versus between-whale variability and the mean value one wishes to estimate.