

Matching to account for confounded observational data: an example using potential vessel disturbance to walrus

Matching is rarely used in wildlife studies but often used in human social, health, and behavioral sciences to make causal inference based on observational data, which are inherently confounded. We demonstrate use of matching on confounded observational wildlife data by testing for an effect of nearby vessels on walrus behavior (effect of vessels ≤ 17 km from a walrus on proportions of time spent feeding, resting and swimming). An example of confounding in this study is nearby sea ice. Walrus are less likely to be exposed to vessels in icy waters than open waters because most vessels avoid ice. However, walrus use ice as a resting platform. As a result, not correctly accounting for the confounding effect of ice could make it appear that walrus rest less when vessels are nearby even if it is only due to lack of ice as a resting platform. Correct use of matching balances values of confounders in exposed and unexposed groups, obviating the need to obtain correct causal regression relationships of the effect of interest (vessel exposure) and all confounders (sea ice and other environmental variables) on the response variable (walrus behavior), across the entire range of confounder values that occur in the data. This is crucial because correct causal relationships are not reliably identified by the most parsimonious model. Our matching retained all vessel-exposed observations, and matched to them the unexposed observations, obtaining an effect of exposure standardized to the exposed. In other words, we estimated effect of vessel exposure on walrus behaviors under environmental conditions in which walrus are exposed to vessels. Thus, our matching limited the scope of inference to conditions observed with vessel exposure to obtain the most sensitive, unbiased possible inference under those conditions. In this talk, we define and outline useful details of matching techniques, such as propensity scores as a matching criterion and checking data balance to evaluate success of the matching procedure. Ultimately, we did not detect an effect of vessel exposure on walrus behavior; more exposures to vessels at closer distances are needed to further address this question.