

Shaffer, T.L. and D.H. Johnson. 2008. Ways of learning: observational studies versus experiments. *Journal of Wildlife Management* 72:4-13.

Abstract: Manipulative experimentation that features random assignment of treatments, replication, and controls is an effective way to determine causal relationships. Wildlife ecologists, however, often must take a more passive approach to investigating causality. Their observational studies lack one or more of the 3 cornerstones of experimentation: controls, randomization, and replication. Although an observational study can be analyzed similarly to an experiment, one is less certain that the presumed treatment actually caused the observed response. Because the investigator does not actively manipulate the system, the chance that something other than the treatment caused the observed results is increased. We reviewed observational studies and contrasted them with experiments and, to a lesser extent, sample surveys. We identified features that distinguish each method of learning and illustrate or discuss some complications that may arise when analyzing results of observational studies. Findings from observational studies are prone to bias. Investigators can reduce the chance of reaching erroneous conclusions by formulating a priori hypotheses that can be pursued multiple ways and by evaluating the sensitivity of study conclusions to biases of various magnitudes. In the end, however, professional judgment that considers all available evidence is necessary to render a decision regarding causality based on observational studies.