

Experimental Design and Sampling Considerations for Radiotelemetry Studies

A. Purpose of the Study: The question(s) posed will have a strong bearing on the type of study design

1. Movement, Migration and Dispersal
2. Space Use and Home Range Size
3. Resource Use and Selection
4. Population Abundance and Density
5. Survival and Fecundity

B. Manipulative vs. Observational Studies

1. Manipulative-measures response to designed changes on experimental units through the use of treatments, controls and replicates that are structured as formal hypothesis to test **cause and effect** relationships.
2. Observational-monitor conditions of interest and document patterns with out establishing cause and effect relationships.
 - a. Descriptive-observing natural processes with out a formal hypothesis being tested
 - b. Correlative- Hypothesis formed and tested; Still no cause/effect

C. Types of Manipulative Study Designs

1. Completely Randomized Designs – completely random or unrestricted assignment of treatment and controls to experimental units.
 - a. Single factor
 - b. Multifactor
2. Randomized block designs – grouping of experimental units by similarities and randomly assigning treatments and controls with in groups.
 - a. Reduces experimental error and increases statistical power
3. Additional Designs
 - a. Hierarchical (split plot and crossover)
 - b. Nested

D. Sampling Designs for Observational Studies

1. Defining the sampling unit and target population
 - a. Individual animals
2. Sampling issues- temporal and spatial heterogeneity; sampling variability.
3. Features of a sampling design – replication, randomization and control of variation.

4. Avoiding pseudoreplication

5. Types of sampling designs - both within and between animals
 - a. Simple Random
 - b. Stratified Random
 - c. Cluster
 - d. Systematic

6. Sampling intensity
 - a. Preliminary estimates of means and variances via a pilot study
 - b. Simulations – bivariate normal vs. adaptive kernel as an example
 - c. Recommended: 20-25 animals and 50 locations/animal for each location and season.

E. Analyzing Results: Testing Hypothesis vs. Building Models

1. Statistical hypothesis testing involves a priori setting of null and alternative hypothesis, and the decision to either reject or fail to reject the null.
 - a. p values
 - b. Type I and Type II errors
 - c. Some criticisms

2. Model building is non-confirmatory and sets out to provide a better understanding of the system being observed by examining the relationship between predictor and response variables. More appropriate for observational studies and may lead to greater insights.
 - a. Multiple competing models (i.e. hypothesis)
 - b. AIC

F. Sources of Bias in Radiotelemetry Studies

1. Bias resulting from a non-random selection of animals for radiotelemetry
 - a. capturing animals along roads

2. Behavior effects from radiotagging
 - a. Independent sources of data required for assessment

3. Location errors
 - a. May lead to Type I and Type II errors
 - b. Best estimated with test collars in all conditions encountered during the study

4. Errors in identifying or mapping available resources

5. Observation rate

G. The Ultimate Design?

1. Demographic responses to landscape conditions and resource selection

Literature Cited

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