Statistical Aspects of Sampling Freshwater Fish Populations and Habitats

Daniel Hayes
Department of Fisheries and Wildlife
13 Natural Resources Building
Michigan State University
East Lansing, MI 48824-1222
Phone: 517-432-3781
E-mail: hayesdan@msu.edu

Brief Description:

The intent of this course is to provide an overview of the statistics of sampling theory. After taking the course, students will be able to 1) distinguish among sampling designs available and used in practice; 2) apply appropriate statistical estimators for a given design; 3) understand practical and theoretical advantages and disadvantages of various sampling designs.

Instruction will be accomplished with a mix of lecture and computer laboratory exercises, as well as group discussions. The principle topics to be covered will include 1) sampling designs; 2) statistical estimators associated with each sampling design; 3) advantages and disadvantages of designs; 4) case studies and applications of each sampling design.

Approximate schedule:

Aug 14
9:00 - 11:00 a.m. Course introduction, Basic statistical concepts
11:00 - 12:00 p.m. Simple Random Sampling,
1:00 - 3:00 p.m. Simple Random Sampling. Proportions, ratios.
3:00 - 5:00 p.m. Stratified Random Sampling

Aug 15
8:00 - 10:00 a.m. Cluster sampling and computer exercises
10:00 - 12:00 p.m. Systematic sampling and computer exercises
Ratio and regression sampling and computer exercises
1:00 - 3:30 p.m. Advanced concepts, group discussions of case studies

*We will take breaks around 10 and 3.

Resource Books:

General Outline

1. Course Introduction
   - Goals of course
   - Schedule

2. Basic statistical Concepts
   - Why use statistics
   - Bias and precision
   - Sampling frame
   - Mean, variance, standard error, confidence interval
   - Random sampling vs. selective or purposive sampling

3. Simple Random Sampling
   - Mean, variance, standard error, confidence interval
     - design unbiased
   - Finite population correction (fpc)
   - Types of quantities estimated
   - Population totals
   - Proportions
   - Ratios

4. Stratified Random Sampling
   - Mean, variance, standard error, confidence interval
     - design unbiased
   - Proportions

5. Cluster Sampling
   - Mean, variance, standard error, confidence interval
     - design unbiased
   - Proportions
   - Covariance (non-independence)

6. Systematic Sampling
   - Mean, variance, standard error, confidence interval
     - design unbiased
   - Single starting point vs. two starting point

7. Ratio and Regression Sampling
   - model based estimation

8. Summary
   - Advantages and disadvantages of sampling designs

9. Case Studies - student driven examples