

# Boot Camp in Wildlife Study Design and Data Analysis

The “Boot Camp” evolved out of in-house training for WCS Malaysia staff. Since 2009, they have been run by [BCSS](#) and are open to all. We have run 31 Boot Camps in 8 countries; over 460 people have attended, many of them more than once.

## What's different?

Why hold a special workshop for *wildlife* study design and data analysis? What's different from normal biostatistics?

- Our work is relevant to wildlife management, and we should produce results which are useful for decision-making; Bayesian analysis produces useful results.
- We deal directly with complex ecological systems with many interacting factors; we can't do experiments; we need to work with models with multiple effects.
- We collect binomial data (present/absent, dead/alive,...) and count data, and have small samples; normality assumptions rarely apply.
- Our results are affected by the data collection process: we rarely detect all the animals or species present; we need specific designs and analysis methods which incorporate detection probability.

## What does it cover?

This is an outline of the content for each day of the course. The content may change depending on the needs and background of participants. The aim is to ensure people have a good grasp of the basic principles, rather than trying to cover a lot of topics.

### **Part one**

This will cover basic concepts used in wildlife research and essential for the specific techniques and software included in the part two. Each day will begin with a review of the previous day's material.

#### **Day 1**

Introductions. Why wildlife data analysis techniques are different. Why we need statistics.

Sampling and sampling error: Examples and simulations of data collection and initial analysis with binary and count data; estimating parameters from samples.

Introduction to R software.

#### **Day 2**

Introduction to Bayesian approach, medical diagnosis and quality control examples, and Bayes' Rule. Bayesian analysis of count data.

Sampling continuous variables; mean, median and mode; variance and standard deviation.

### **Day 3**

Probability distributions and probability density; the normal distribution.

Bayesian analysis of continuous data, credible intervals, and comparison of samples.

Bayesian analysis of binomial data.

### **Day 4**

Differences between Bayesian and frequentist approaches. The likelihood concept and maximum likelihood estimation.

Concept of models in wildlife data analysis; use of Akaike's Information Criterion (AIC) to compare models.

Simple examples of linear regression (for trend estimation) and logistic regression using maximum likelihood estimation.

### **Day 5**

Overview of the study design process. Importance of the research question in sampling and study design. Population vs process questions.

Design of process studies: experiment vs quasi-experiment vs observational study; choice of response variable and covariates.

Sampling strategies for population studies.

Measuring response variables; acquiring covariate data.

### **Day 6**

Pitfalls in study design – bias and pseudo-replication (lack of independence).

Using simulations (in R) to explore sampling designs and effects of sample size on accuracy of estimates.

Guidelines for data management. Dates in spreadsheets. Using GPS receivers to record locations.

## ***Part two***

Now we come to the specialist wildlife stuff.

### **Day 7 : Occupancy**

Occupancy concepts and assumptions; simple analysis in R (both Bayesian and frequentist), including covariates; multi-season data; specialist applications of occupancy.

### **Day 8 : Density from mark-recapture data**

Basic mark-recapture methods and development of spatially-explicit capture-recapture (SECR) methods; assumptions and structure of SECR models; analysis of example data sets with the 'secr' package and Bayesian functions in R.

### **Day 9 : Estimating survival from mark-recapture data**

Experiment to simulate mark-recapture data for survival and simple analysis in R; analysis of a real data set with comparison of models. Closed population mark-recapture. Robust design for survival and recruitment estimation.

## **Day 10**

Discussion of participants' individual research projects; further work on topics which have already been covered or additional topics relevant to participants' projects.

Workshop assessment and closure.

## **What language will be used?**

The Boot Camp is conducted in English. The aim is to provide participants with a starting point to follow up on their own the specific kinds of study design and data analysis needed for their own research. The resources for further study and the software manuals are all in English. So it's important to become familiar with the English terminology.

Sometimes we do pause and explain specific concepts in the local language if necessary.

## **Who should attend?**

The workshop is aimed at science graduates who are involved in field-work in conservation or wildlife management, or who use the results of such field work. No previous knowledge of statistics is needed, ie, we'll assume you've forgotten the stats you learnt at university!

Participants should have a background in field biology, as that's where our examples come from.

We will assume familiarity with the use of computers - and in particular spreadsheets - and we'll ask you to bring a notebook computer to the course.