

Wildlife Study Design and Data Analysis

4 – 15 July 2016

Overview

The Boot Camp grew out of WCS Malaysia program workshops for their own staff, and have been open to all since 2009. We have run 24 sessions to date, in Malaysia, Lao PDR, Kazakhstan, Thailand, Cambodia and Bangladesh. Over 350 people have participated, many of them more than once.

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. We use a variety of practical activities to help understanding of concepts, which many biologists prefer to the usual lecture-plus-textbook approach.

We aim to give you a good understanding of basic concepts, as a springboard to learn more about the techniques relevant to your own research. We work in English, because most of the resources available for further study are in English.

We adopt a Bayesian approach right from the start of the workshop, unlike most basic statistics courses.

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 methods do this.
- We deal directly with complex ecological systems with many interacting factors; we can't do experiments. We need to use models
- 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 and must incorporate detection probability in the analysis.

What does it cover?

We will begin with the basics:

- What is statistics all about? - the nature of statistical inference.
- Collecting existing information on the parameter of interest and developing prior probabilities.
- Binomial data (present/absent, dead/alive, ...) and count data.
- The concept of sampling error and uncertainty in the results.

- The use of R statistical software for basic analysis.

Then we'll introduce Bayesian methods of dealing with uncertainty.

- Using "probability" to quantify uncertainty.
- Combining prior information with the results of our study using Bayes Rule.
- Bayesian estimates and credible intervals from binomial, count, and continuous data.
- Using random samples to describe a probability distribution, and an overview of methods used by Bayesian software.
- Using the output of a Bayesian analysis as the basis for decision making.

Next we move on to Information Theoretic (IT) methods developed in the last few decades, which are widespread in ecology.

- Frequentist vs Bayesian interpretations of probability.
- The concept of "likelihood", and maximum likelihood estimation of parameters.
- Ecological models: turning hypotheses into mathematical equations which predict the observations we should get.
- Using AIC (Akaike's Information Criterion) to compare models and to choose the most useful.

A lot of information is available on designing experiments (in particular on power and sample sizes), but in wildlife biology we rarely have the chance to experiment. Designing good observational studies is more complicated.

- Refining the research question: point estimate, relationship or trend.
- Sampling: avoiding bias and pseudoreplication; sampling strategies; temporal and spatial sampling.
- Pilot studies and simulations to refine study design.
- Data management

Once all this background has been covered, we will get on to specific wildlife variables:

1. **occupancy** from "presence/absence" data,
2. **density** from spatially explicit mark-recapture (SECR) data,
3. **survival** and other demographic parameters from mark-recapture data.

For each of these, we will run simple analyses in R for simulated data and for a real data set, talk about study design options, and review some of the more advanced analyses available.

The final day will be devoted to topics requested by participants, eg, review of key basic topics, more on advanced analyses, or discussion of participants' own projects.

Who are the trainers?

The lead trainer will be Mike Meredith, Science Advisor to WCS Malaysia Program and author of the chapters on occupancy, line transects, mark-recapture, and biodiversity in the 2nd edition of [*Problem-solving in conservation biology and wildlife management*](#) by James Gibbs, Malcolm Hunter and Eleanor Sterling (Blackwell, 2008). He will be assisted by Ngumbang Juat, who recently completed an MRes at the [Centre for Research into Ecological & Environmental Modelling](#) at St Andrews University, and other biologists who have participated in previous Boot Camps and attended "training trainer" sessions related to the Boot Camp materials and approach.

Who should attend?

The course 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, i.e, we'll assume you've forgotten the stats you learnt at university!

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.

Participants should have a background in field biology, as that's where our examples come from. Basic algebra (if $a = b/c$ then $b = c.a$ and $c = b/a$) and acquaintance with logs (knowing that $\log(a.b) = \log(a) + \log(b)$).

When?

Ten working days plus two rest days, from 4-15 July 2016, with breaks on 7th and 11th July. The sessions are intensive, and regular breaks help people stay fresh. Participants may depart at the end of the day on 15th July.

What to bring?

Please bring a laptop / notebook computer running MS Windows 7 or later, a version of Linux, or Mac OS with Snowleopard or Mavericks, with the following software installed:

- Either a recent version of LibreOffice (4.1 or later) or Microsoft Excel with the Solver Add-in (and check that you have the Solver add-in installed).
- R statistical software.
- JAGS software package.

You will find links and information on these packages [here](#)
http://www.wcsmalaysia.org/analysis/Software_summary.htm. Apart from Excel,
all this software is free of charge.

Number of participants; 16 - 20

More information

For more information on the material to be covered check the course webpage
(http://bcss.org.my/statsWorkshops/boot_camp.htm).

For specific questions or suggestions on content, contact <mmeredith@wcs.org>.