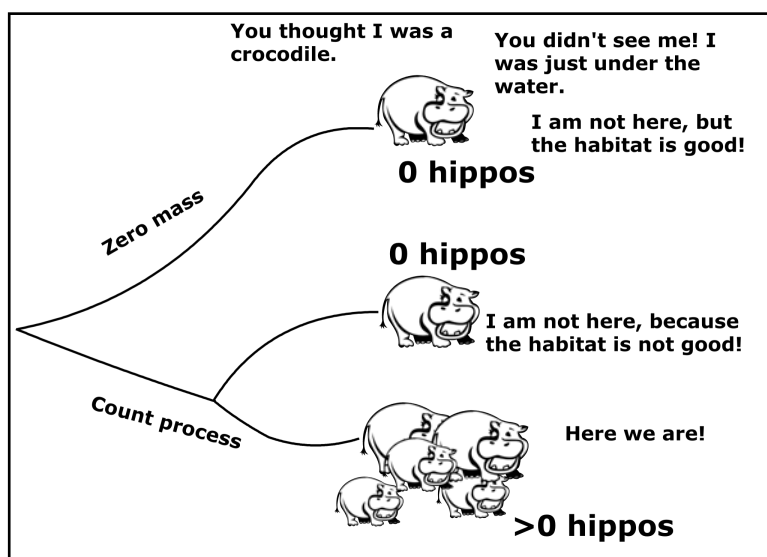


# Introduction to Zero Inflated Models with R

- Frequentist and Bayesian approaches -

Provided by: Highland Statistics Ltd

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## What is zero inflation?

Suppose you want to study hippos and the effect of habitat variables on their distribution. When sampling, you may count zero hippos at many sites and therefore zero inflated models should be used.

During the course several case studies are presented, in which the statistical theory for zero inflated models is integrated with applied analyses in a clear and understandable manner. Zero inflated models consist of two integrated GLMs and therefore we will start with a revision of GLM.

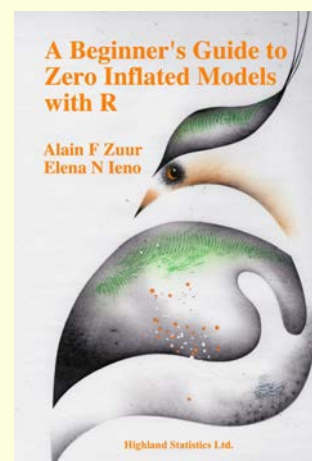
Zero inflated GLMMs for nested data (repeated measurements, short time series, clustered data, etc.) are discussed in the second part of the course. We will focus on zero inflated count data, and zero inflated continuous data.

## Date & Venue

Date and venue:

- 7 - 11 January 2019.
- Vancouver Island Conference Center, Nanaimo, Canada

Instructors: Dr. Alain Zuur  
 Dr. Elena Ieno  
 Authors of 10 books and  
 providers of over 300 courses



## KEYWORDS

Zero inflated GLM (ZIP, ZAP). Zero inflated GLMMs with random effects. Bayesian statistics, MCMC and JAGS. lme4, glmmTMB, JAGS. Overdispersion and solutions. Poisson, negative binomial, gamma, and binomial distributions. Count data. Zero inflated continuous data.



## COURSE CONTENT

### Monday:

- General introduction.
- Short revision of Poisson and negative binomial GLMs for count data and Bernoulli GLM for absence and presence data.
  - One Poisson and negative binomial GLM exercise.
  - One Bernoulli GLM exercise.
- Theory presentation on models for zero inflated count data using frequentist tools.
  - Mixture models (ZIP).
  - Hurdle models (ZAP).
- Two exercises on the analysis of zero inflated count data using the `pscl` package.

### Tuesday:

- Finishing ZIP and ZAP exercises.
- Models for zero inflated continuous data (e.g. biomass data) using frequentist tools.
- One exercise.
- Revision of linear mixed effects models and GLMM.
  - Fitting linear mixed effects models in `lme4` and `glmmTMB`.

### Wednesday morning:

- Zero inflated GLMMs for the analysis of count data using frequentist tools.
- Two exercises (ZIP and ZAP GLMMs).

### Wednesday afternoon:

- Introduction to Bayesian statistics and MCMC using JAGS.
  - JAGS is similar to WinBUGS and OpenBUGS.
  - 10-step protocol for MCMC.
- One exercise: Fitting a Poisson GLM and negative binomial GLM in JAGS.
- A video solution for a second exercise is provided.

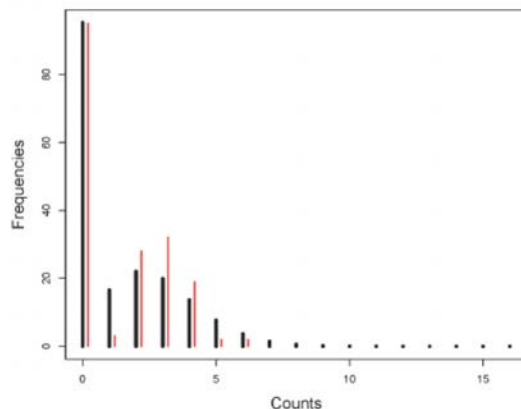
### Thursday morning:

- Fitting zero inflated GLMs using Bayesian tools.
- The zero trick to fit any distribution in JAGS.
- One exercise (fitting ZIP and ZAP GLMs in JAGS).

### Thursday afternoon and Friday

- Zero inflated GLMMs for count data using Bayesian tools
- Two exercises.
- Time allowing (R solution code is provided):
  - Zero inflated models for proportional data (zero inflated beta models, zero inflated binomial models).
  - Bayesian model selection using the Gibbs variable selection approach.

R code for all exercises is provided before the start of the course.



## GENERAL INFORMATION

### COURSE FEE: 995 CAD + 5% GST

- Credit card payments are charged in CAD currency.
- UK participants are subject to 20% VAT.
- EU participants (but non-UK) are not subject to UK VAT, but need to provide their institutional VAT number.
- Non-EU participants are not subject to VAT.
- The course fee excludes refreshments and lunch.
- You need to bring your own laptop.

### COURSE TIMES:

- Monday - Friday: 09.00am to 16.00pm
- 1 hour lunch break and a 20 minutes break both morning and afternoon.

### COURSE MATERIAL:

- Pdf files of all powerpoint presentations are provided
- These powerpoint files are based on various chapters from:
  - *A Beginner's Guide to GLM and GLMM using MCMC with R.* (2013).
  - *A Beginner's Guide to Zero Inflated Models with R.* (2016)
  - Books are not included in the course fee. The course can be followed without purchasing these books.

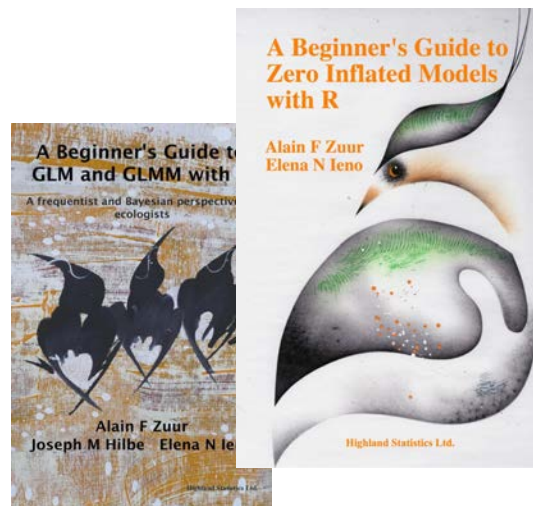
### PRE-REQUIRED KNOWLEDGE:

Working knowledge of R, data exploration, multiple linear regression, generalised linear modelling (Poisson, negative binomial, Bernoulli) is required. Working knowledge of mixed effects modelling is recommended. A short revision of GLM and mixed effects modelling is provided. This is a non-technical course.

An online quiz with approximately 30 questions is available at <http://www.courseportal.highstat.com/index.php/my-course/introduction-zero-inflated-models-frequentist-and-bayesian>

### RECOMMEND LITERATURE:

- *A Beginner's Guide to Zero Inflated Models with R.* (2016).
- This book is available from [www.highstat.com](http://www.highstat.com)



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## REGISTRATION

<http://www.highstat.com> Payment via credit card or bank transfer

Dr Alain F Zuur  
[highstat@highstat.com](mailto:highstat@highstat.com)  
[www.highstat.com](http://www.highstat.com)

