



# Bayesian analysis for the growth of Mona Island iguana in headstart facility (*Cyclura cornuta stejnegeri*)

## Introduction

Mona Island is a Natural Reserve under the management of the Department of Natural Environment Resources (DNER). Mona Island iguana (*Cyclura cornuta stejnegeri*), is an endemic reptile species of this region which is considered endangered. A headstarting program has been implemented since 1999 by the DNER for Mona Island iguana.

It is desired to predict how long it will take for an animal to achieve the minimum size required for release. In early stages a linear growth equation can be a good approximation. Hierarchical linear models are used for analyzing the growth of iguanas in the headstart facility. These models incorporate explanatory variables such as sex and cohort (1999-2000) or (2004-2005)

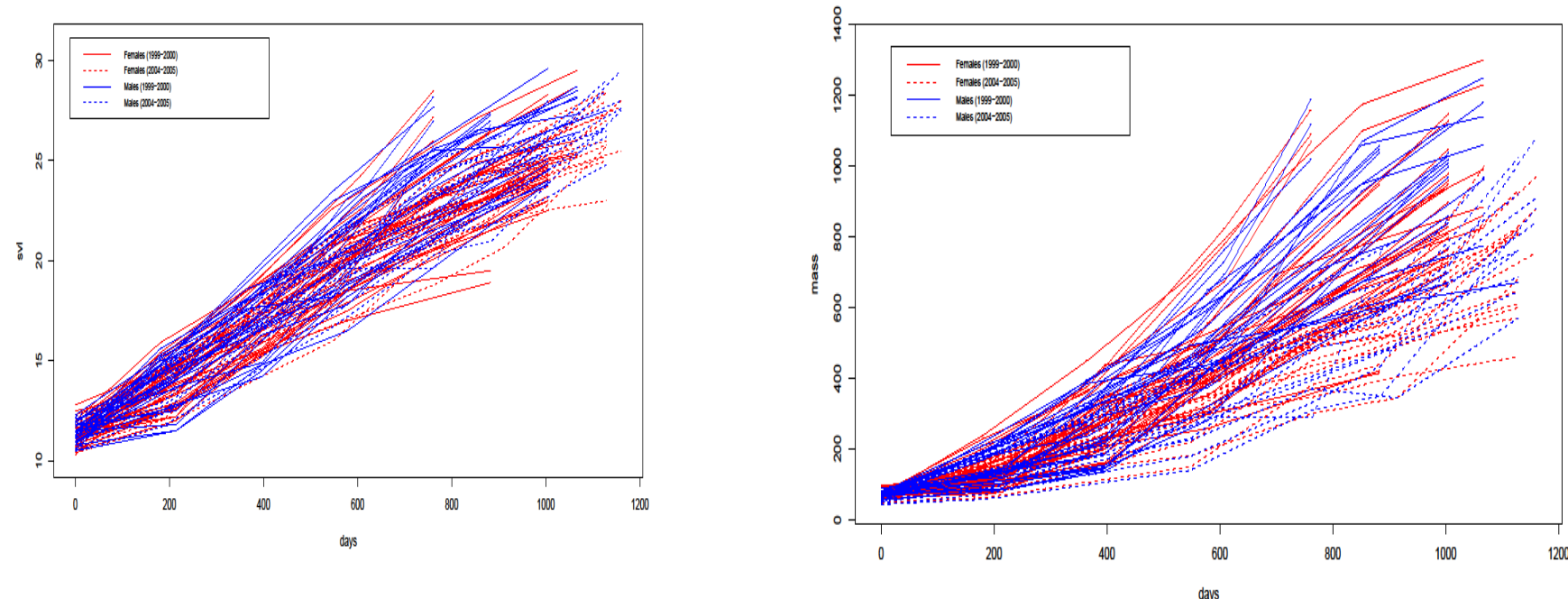
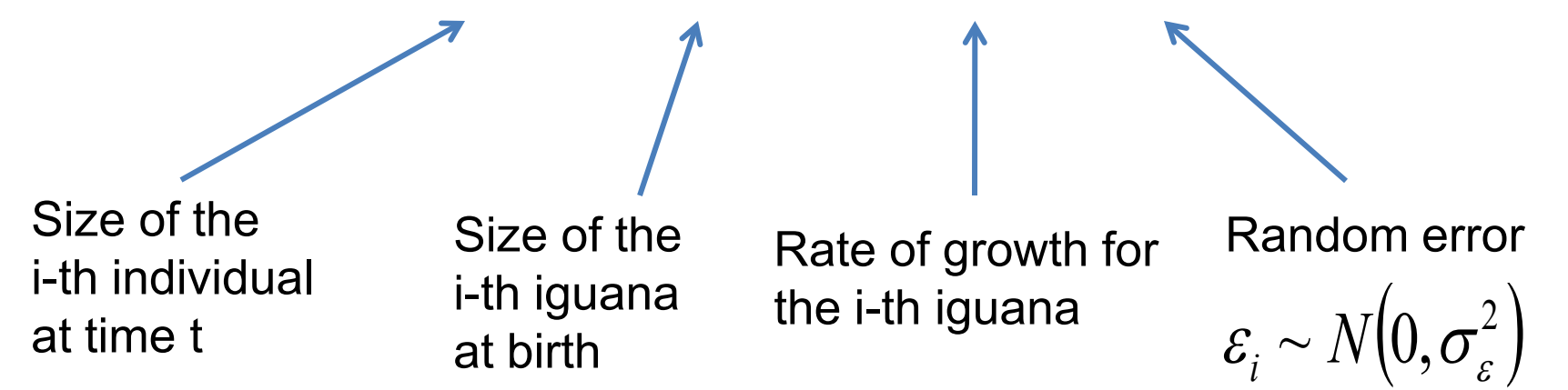


Table: Summary of individuals in the data set

Year	Sex	
	Female	Male
1999	26	14
2000	13	10
2004	13	12
2005	3	5

## Model formulation

$$S_i(t) = S_{0i} + r_i t + \epsilon_i$$



## Prior distributions

$$S_{0i} \sim \begin{cases} N(11.6, 6.7) & \text{SVL} \\ N(65.66, 33.3) & \text{Mass} \end{cases}$$

Non hierarchical models:  $r \sim \text{HalfNormal}(0,1)$

Hierarchical models:

$$\mu \sim \text{HalfNormal}(0,1)$$

Variances:

$$\sigma_\epsilon^2 \sim U(0,1000)$$

$$\sigma_r^2 \sim U(0,100)$$

## Models considered in the analysis

	Equal growth
Non Hierarchical (do not account for individual differences)	Growth rate depends on sex
	Growth rate depends on cohort
	Growth rate depends on sex and cohort
Hierarchical (account for individual differences)	Common mean rate
	Common mean rate by sex
	Common mean rate by sex and cohort

Models were fitted using WinBUGS software (Spiegelhalter et al 2003).

## Model comparison for SVL

		pD	DIC	ΔDIC
Non Hierarchical (do not account for individual differences)	Equal growth	2.98	1870.45	392.06
	Growth rate depends on sex	4.02	1857.23	378.84
	Growth rate depends on cohort	4.16	1868.73	390.34
	Growth rate depends on sex and cohort	6.06	1855.55	377.16
Hierarchical (account for individual differences)	Common mean rate	87.22	1478.39	0.00
	Common mean rate by sex	86.85	1480.64	2.25
	Common mean rate by cohort	87.35	1480.28	1.89
	Common mean rate by sex and cohort	86.95	1483.03	4.64

## Model comparison for mass

		pD	DIC	ΔDIC
Non Hierarchical (do not account for individual differences)	Equal growth	2.16	6386.23	495.89
	Growth rate depends on sex	3.17	6385.58	405.24
	Growth rate depends on cohort	3.23	6249.90	269.56
	Growth rate depends on sex and cohort	5.30	6242.61	262.27
Hierarchical (account for individual differences)	Common mean rate	85.08	5980.53	0.19
	Common mean rate by sex	85.43	5982.08	1.74
	Common mean rate by cohort	80.74	5980.34	0.00
	Common mean rate by sex and cohort	81.03	5984.40	4.06

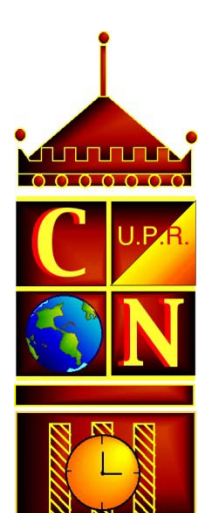
## Predicted SVL

pD = Measure of model complexity (effective number of parameters)  
DIC = Measure of goodness of fit. Lower DIC implies better fit.

According to DIC values hierarchical models have better fit than nonhierarchical models.

For SVL, DIC values seem to support the model with common mean and the model with cohort differences. Nevertheless, the common mean model was selected by biological reasons.

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