Bioscience Capstone Project

Module: BIO00028H

Writing project reports

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Bioscience Capstone Project BIO00028H

Main messages

Get started on the write up as early as possible

There are no marks for quantity of results

Be aware of the submission date and plan for it

When we submit to a journal…

- Length within a specified max
- Structure as given in instructions
- Must follow the required sequence of sections
- Lots of time preparing tables & figures
- Long wait for ‘results’ of the submission

- ***Very similar regulations to your project reports*** – there are very detailed guidelines to follow.

Writing up research

- Read ‘instructions for authors’ carefully
- Get results together
- Generate tables and figures
- BE SELECTIVE
- Choose best format for presentation
- My writing sequence
  - Results, methods, introduction, discussion, abstract
- Get feedback
- Edit fiercely

Instructions for project reports

Report Format

You should consult the instructions while preparing your project report (on the VLE)

Stage 3 BSc reports (28H) have stated word limits and should be written concisely (submissions over word limit can be penalised)

Structure - part 1

ABSTRACT: A brief summary which should give the aims and major findings of the investigation.

INTRODUCTION:

- Description of the background to the investigation
- An account of relevant literature
- A clear statement of the major aims (or hypotheses) of the investigation

Tips : Balance the abstract

- You don’t have many words
- Divide into sentences approximately as:
  - 1 – 2 Introduction
  - 1 – 3 Methods
  - 2 – 4 Results
  - 1 – 2 Conclusions
- Every project is unique, but it’s important to focus on your findings and not have too much introduction in the abstract.

Tips : Introduction

- What is the question your project is asking and why it is a good question?
- It should explain the basic nature of the problem *and* how your work seeks to extend scientific knowledge in the area.
- Be concise. Space is limited, so make sure that the literature you cover is directly relevant to your project.
- Start broad, then focus in.
- End with a clear statement of what you're researching: aims (and/or hypotheses).

Structure – part 2

MATERIALS AND METHODS

- A clear and concise description of the experimental methods / survey techniques / data harvesting used in the investigation.
- Sufficient detail should be provided to enable the what you have done to be reproduced.
- Methods figures are allowed (and encouraged)
- Data figures and analysis should NOT be included in this section.

Tips on Methods

Do describe concisely but clearly the methods (including statistics) you have used, although a well-established method need only be given in outline with an appropriate reference that gives full details.

In some cases, the methods section also includes information about the materials or species being investigated, the strain, variety or population you surveyed or the location and character of the study site or area.

Structure – part 3

RESULTS:

- Clear and well-structured description of findings Appropriate narrative of the experimental rationale and the major conclusions
- May include descriptions of problem solving and troubleshooting
- Well-prepared and consistently presented tables and figures
- Numbered tables and figures with legends (captions).
- Legends (captions) should provide enough information to allow the reader to understand the table/figure as a ‘stand-alone’ entity.

Tips on Results

- Get your figures and tables ready first
- Use enough text to provide a clear narrative through those figures and tables
- Do start with some basic results
- Highlight the key findings, but don’t discuss them
- Make sure statistics are reported in the correct format
- Results section will have few or zero references

Structure – part 4

Discussion -

- Do not simply recap the results
- Explore the wider meaning of the results
- To what extent has your investigation addressed the aims provided in the introduction?
- How have your findings advanced understanding of the problem under investigation?
- How do your findings relate to previous studies in this area? Especially where they disagree.
- Based on your findings, what new investigations might be conducted?
- You can be critical of previous work.

Tips on Discussion

- Work in parallel with the introduction
- Don’t just give a commentary of the results
- How does your work compare with previous work?
- Why might you have got different results?
- How could you improve the project?

(Don’t just say ‘collect more data’!)

Structure overview

Introduction – explain what the research question is.

Methods – should allow a reader to repeat exactly what was done to acquire and analyse the data you present in the results.

Results – state results only, no discussion. Point out important results in figures and tables. Make statistical tests clear.

Discussion – point out the significance of the research in relation published work. Reflect back on the introduction and consider future research.

Structure, the little extras

- Acknowledgements
- References – following a selected, and specified, style exactly
- Tables – each with a legend (caption) and referred to from the text as ‘Table 1’ etc.
- Figures – each with a legend and referred to from the text as ‘Fig. 1’ etc.
- Appendices / Supplementary material
- No separate ‘Conclusions’ section
- Word count is required

Tips : Consider a skeleton

- You have clear guidelines about what you need to include in each section.
- Make a ‘project.docx’ today that has the headings there for each paragraph you’re going to include!
- e.g. Introduction
  - wider justification
  - key work some time ago
  - key recent work
  - specific justification for project
  - clear statement of aims / hypotheses

Tables

- Use columns rather than vertical lines.
- Usually no colours or shading.
- Use horizontal lines sparingly.
- The legend allows table to be understood without reference to text.
- Legends precede tables.

Example of a table. Note caption comes **before** the table, no vertical lines

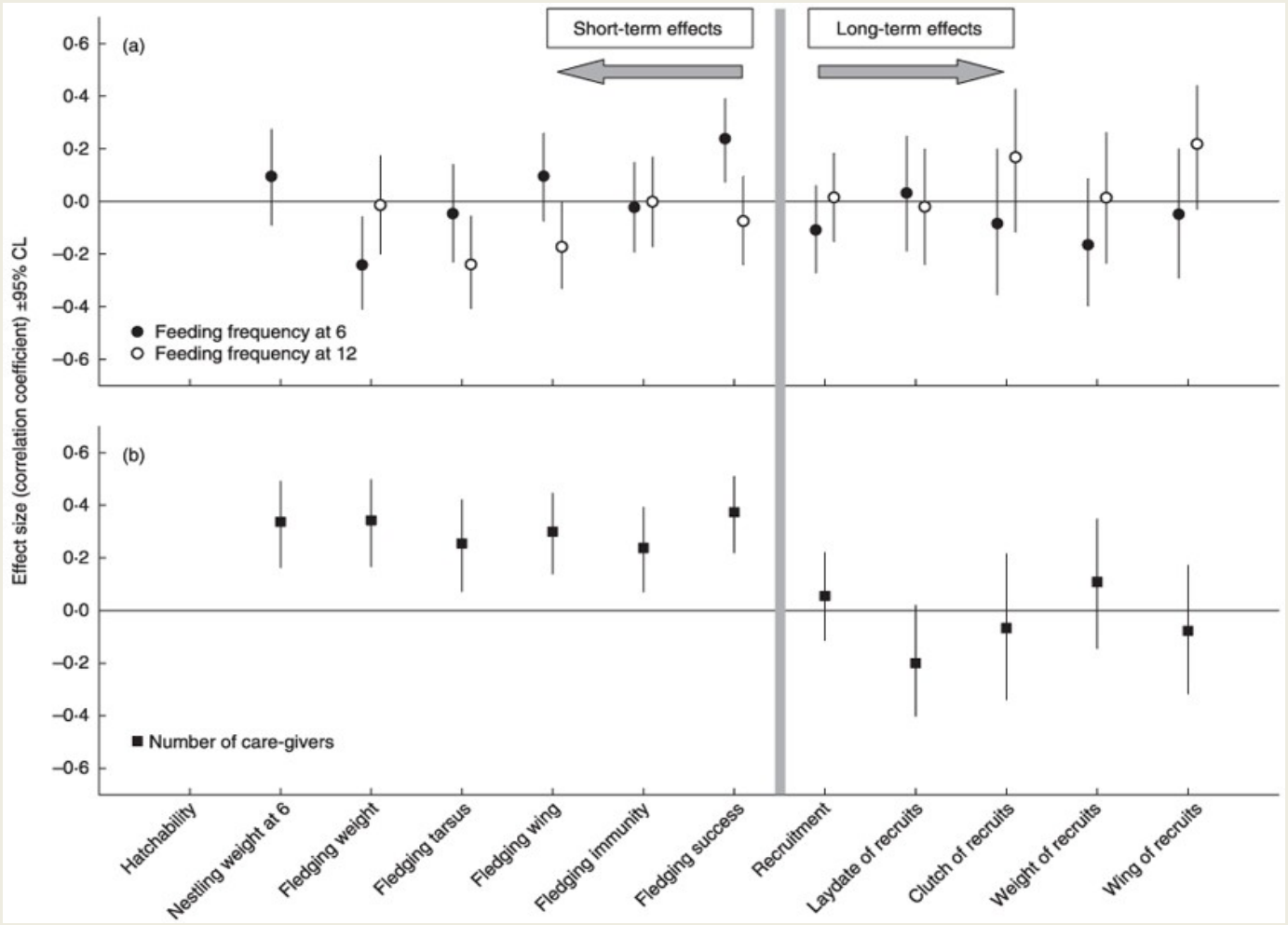
Table 1. The results of GLMMs investigating the effect of age on three 'per female-year' reproductive traits. Interactions are only shown if significant

	No. litters produced			No. pups survived to emergence			Proportion of pups survived to independence		
Random effects	Variance			Variance			Variance		
Female identity	< 0·001			0·578			0·013		
Group	0			0·217			0		
Residual	0·013			0·977			0·024		
Fixed effects	Estimate ± SE	χ^2	*P*	Estimate ± SE	χ^2	*P*	Estimate ± SE	χ^2	*P*
Intercept	−0·334 ± 0·094	–	–	−2·881 ± 0·747	–	–	−3·407 ± 0·225	–	–
Age	0·191 ± 0·041	0·488	0·485	0·411 ± 0·098	42·375	< 0·001	–	2·501	0·114
Age^2	−0·023 ± 0·004	5·829	0·016	−0·052 ± 0·010	33·172	< 0·001	–	0·002	0·963
AFR	–	0·131	0·717	–	2·153	0·142	–	0·273	0·602
ALR	0·067 ± 0·012	4·303	0·038	0·139 ± 0·057	5·544	0·019	–	0·410	0·522
Dominance	−3·407 ± 0·296	32·067	< 0·001	−1·556 ± 0·235	49·780	< 0·001	–	1·017	0·313
Female weight	–	0·452	0·502	0·004 ± 0·001	14·096	< 0·001	0·006 ± 0·000	8·364	0·004
Group size	–	0·684	0·408	–	0·536	0·464	–	0·328	0·567
Rainfall	0·001 ± 6·972	6·238	0·013	–	1·330	0·249	0·002 ± 0·000	8·424	0·004
Age × dominance	3·068 ± 0·379	3·675	0·055	–	–	–	–	–	–
Age^2 × dominance	−0·816 ± 0·113	11·018	0·001	–	–	–	–	–	–

GLMMs, generalised linear mixed effect models; AFR, age at first reproduction; ALR, age at last reproduction.

Figures

- Normally black and white, unless colour is useful.
- Avoid an Excel style ‘title’
- Make sure axes have proper labels
- Legend includes the number as Fig. 1 and a clear but succinct description follows.
- Don’t say ‘Graph to show … ‘
- Separate sub-figures are usually denoted by letters in brackets
- Be consistent with tick marks, labels etc.
- Avoid shaded backgrounds (if using ggplot2 try ‘theme_classic’ or ‘theme_b&w’)



Example of a figure

Note:

caption after figure
use of error bars
re-use of x-axis
re-use of y-axis label

Fig. 3. Effect sizes corresponding to relationships between feeding frequencies or number of care-givers and offspring traits. The sign of the presented effects corresponds to the sign of statistical covariation between feeding frequencies and dependent variables. The exception is the effect on laying date, where a statistically negative effect means a biologically positive effect. The sample size used for computation of effect sizes can be inferred from degrees of freedom of the particular test (Table S1). (a) Effects of feeding frequencies at age 6 and 12 days on offspring performance. (b) Effects of number of care-givers on offspring performance. A positive effect means better performance of offspring from nests attended by both parents.

Figures (maps)

- Normally black and white, unless colour is useful
- Legend includes the number as Fig. 1 and a clear but succinct description follows.
- Separate sub-figures are usually denoted by letters in brackets
- Scale bar and north arrow important
- Often a stylised plan of the study area

Maps are also figures

Note:

scale bar
north arrow
clear caption

Fig. 1. Distribution of predicted intake rate (mg AFDM s)1) for 1998. Sampling stations that provide sufficient intake rate (‡0Æ3 mgAFDMs)1) are black and grey otherwise. Light grey areas indicate mudflats exposed during low low-tide, dark grey areas indicate water and land is represented by the white areas.

Figures (diagrams)

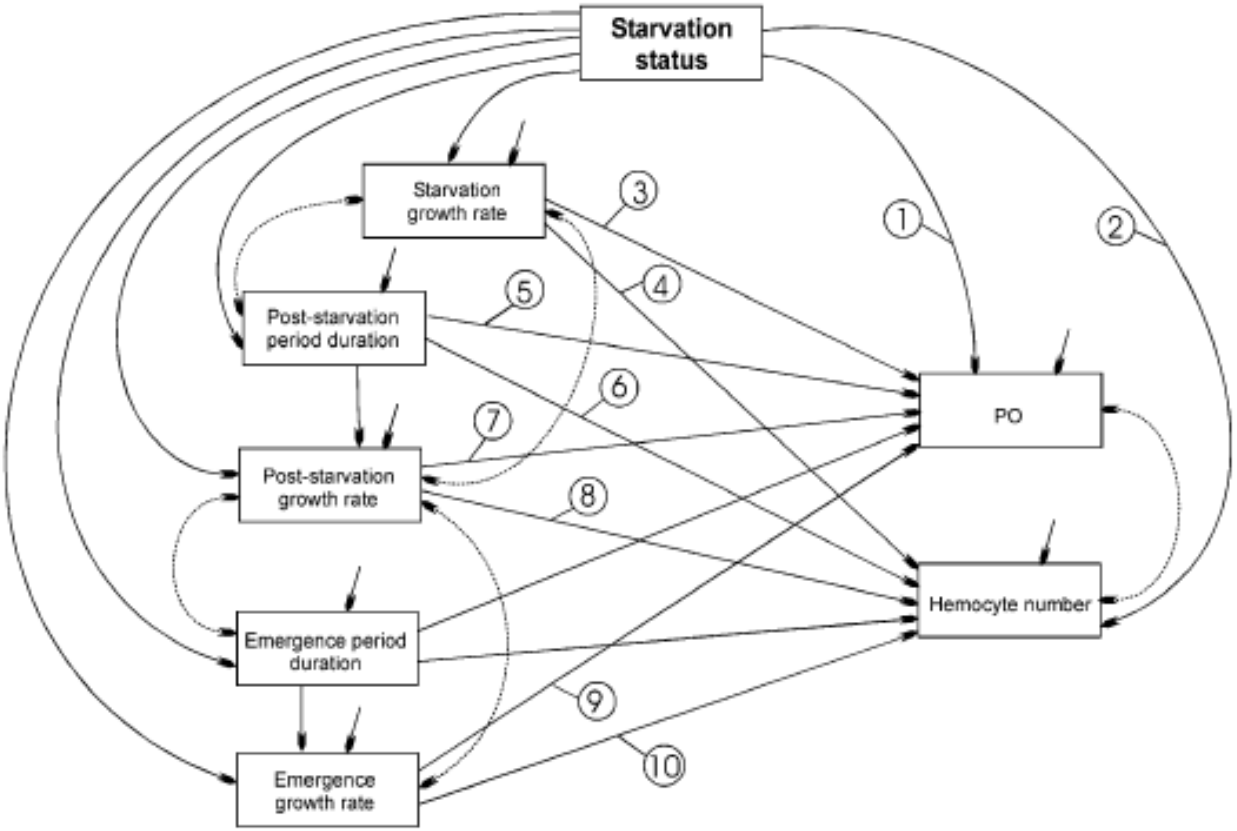


Fig. 1. Graphical representation of the a *priori* model used in the path analyses for both pesticide groups: exposed and non-exposed to pesticide stress. Solid one-headed arrows represent direct effects of one variable onto another one. Dashed, double-headed arrows represent error covariance between variables. Paths reflecting direct effects of starvation are indicated by (1)–(4). Paths reflecting direct effects of compensatory mechanisms are shown by (5)–(10).

Use an explanatory figure to help the reader
can be useful for results but ….
could describe methods, code logic etc.

Appendices / Supplementary material

- Contain material that is not vital for the reader to understand the text but provides useful background information.
- In general, these should be avoided for your project write-up.

Possible uses:

Questionnaire / Google Form you used

raw data

format of unusual data sheet

mathematical proof

computer code or R function

list of authorities for a large number of species

Avoid Plagiarism

- Make sure that all sources of information are appropriately cited.
- Don’t copy blocks of text or figures without very good reason. If you do, present copied text in a different font with a clear and full citation.
- Don’t just edit good sentences you have found. Make your text your own.
- Give the source clearly whenever you present any fact.
- References can come at the end of a sentence or with the relevant fact.
- If you’re citing the same paper over and over again, widen your reading!

Don’t hand it in late!!!

Deadlines and Penalties

- All work submitted after the publicised deadline (without valid mitigating circumstances) will be penalised by the deduction of marks.
- Penalties increase each day or part-day late.

Organise an extension if you need it.

Presentation rules

STATISTICS

Tests must be presented clearly to allow a reader with access to the data to repeat them. Statistical tests used in the study should be clearly indicated in the Methods section. It is not necessary to describe every statistical test fully, as long as it is clear from the context what was done.

SPECIES NAMES AND NOMENCLATURE

The scientific binomial name of micro-organisms, plants and animals must be written in italics.

GENES AND PROTEIN NAMES

Gene names and their messenger RNAs should be written in italics. Protein names are written in normal-type.

Scientific names

- Give in full at first mention
- Genus with upper case, species not
    - e.g. *Homo sapiens*
- Always in italics
- The genus may be abbreviated *only* when confusion is impossible

  – ‘Other birds recorded included *Alcedo atthis* and *Apus apus.* Six observations of *A. atthis* were of a single individual.’

Scientific names - authority

- Authority should be given at first mention in main text for key species

  e.g. *Drosophila melanogaster* (Meigen)

- Unless quoting another author

  e.g. ‘the procedure is identical to that used by Carpet (2021) on *Drosophila simulans*’

- Authorities in brackets and not in brackets conveys a meaning, so get it right if you’re going to use it!

  Drosophila melanogaster (Meigen)

  Drosophila simulans Sturtevant

References

- The reference list must give all references mentioned in the text and no more.
- You can use any referencing system
- Use in text:
  - “Average wingspan was used as a measure of size (Valle 1937).”
  - “Valle (1937) used average wingspan as a measure of size.”
- Three or more authors
  - Use *et al*. (Seat *et al*. 2008)
- Two authors
  - Always use both names.
- Referencing software may save a lot of time
- Pick a style now and stick to it!

References (1)

Reference style from a typical ‘Harvard’ system

Paper in journal

Boutin, C. & Harper, J.L. (1991) A comparative study of the population dynamics of five species of *Veronica* in natural habitats. *Journal of Ecology*, **79**, 199-221.

Make sure you’ve got:

author, year, title, journal, volume, pages.

Book

Pimm, S.L. (1982) *Food Webs*. Chapman and Hall, London.

References (2)

Reference style from a typical ‘Vancouver’ system

ARTICLES
https://doi.org/10.1038/s41559-021-01635-5

nature ecology & evolution

Check for updates

Hunting alters viral transmission and evolution in a large carnivore

Nicholas M. Fountain-Jones[1,2]✉, Simon...

evidence that population reduction has little impact, such as is seen for canine rabies[19] and Tasmanian devil facial tumour disease[20] dynamics. Recent advances in high-resolution pathogen sequencing and analytic approaches can now elucidate patterns of pathogen transmission and evolution[21–23] that were previously out of reach. Here, we address the effects of hunting on pathogen dynamics by

tumor disease. *Conserv. Biol.* **24**, 841–851 (2010).
21. Grubaugh, N. D. et al. Tracking virus outbreaks in the twenty-first century. *Nat. Microbiol.* **4**, 10–19 (2019).
22. Didelot, X., Fraser, C., Gardy, J. & Colijn, C. Genomic infectious disease epidemiology in partially sampled and ongoing outbreaks. *Mol. Biol. Evol.* **34**, msw075 (2017).
23. Smith, M. D. et al. Less is more: an adaptive branch-site random effects model for efficient detection of episodic diversifying selection. *Mol. Biol. Evol.* **32**, 1342–1353 (2015).
24. Logan, K. A. & Runge, J. P. et al. Effects of hunting on a puma population in

References (3)

Datasets with a DOI

Prugh, L. & Golden, C. (2013) Data from: Does moonlight increase predation risk? Meta-analysis reveals divergent responses of nocturnal mammals to lunar cycles. Dryad Digital Repository **dx.doi.org/105061/dryad.tm723**

PhD Theses

Stevenson, I.R. (1994) *Male-biased mortality in Soay sheep*. PhD thesis, University of Cambridge, Cambridge, UK.

Web sites

Only when ‘hard literature’ sources are not available. Should have longevity and be of high quality. Author and year should be included where possible. Date of access, title and full address should be given.

Units

- Use S.I. Units
  - m, g, kg, s, ha, mol
  - For temperature ^{o}C is fine although K, Kelvin is S.I.
  - For time use most appropriate of: min, h, d.
- Be very clear about the units used
- Use $^{-2}$ and $^{-1}$ e.g. individuals m^{-2} and m s^{-1}

  rather than ‘individuals per metre square’ or ‘metres per second’

Numbers

- Do not give too many decimal places

- Never imply more precision that you actually have
  - e.g. “62.92% of the observed mortality was due to predation.” is inappropriate precision in a sample of 89
- Write out numbers 10 and under in words except when qualified by a unit
  - There were nine replicates at 5^{o}C.

Statistical tests

- If a common test, just give the result in the results section:
  - e.g. “There was a significant difference between the two treatments ($t = 4.4$, d.f. = 22, $P < 0.001$).”

- Don’t use ‘significant’ without a test
- Use tables for GLM / ANOVA output etc.
- Don’t just paste in output from R
- Don’t just repeat what is in the table in the text.

Small things

- *et al*. always in italics with a point
- consistent punctuation of lists
- most acronyms in full at first mention
- always give error bars and ranges etc. with explanation
- use 1980s rather than 1980’s
- care with its vs. it’s
- don’t use contractions
- get ‘affect’ and ‘effect’ sorted
- get ‘less’ and ‘fewer’ sorted
- get ‘principle’ and ‘principal’ sorted
- usually need a comma after ‘however’

Voice

- Active voice rather than passive voice
  - at least consider which you're using
  - active is good when expressing an opinion
  - passive is good for methods

    e.g. 'The mixture was allowed to cool before …'
- Tense
  - be consistent
  - consider referring to findings of papers in present tense
  - e.g. "Bench (2019) indicates that slope is a key …"

Presentation

- Follow the guidelines / instructions for authors
- Consider the font, margins and line spacing
- Use section headings and sub-section headings in a consistent manner
- Running titles are sometimes useful
- Hard (non-breaking) spaces are a good way to avoid poor ‘hanging’

e.g. Reproductive success in the lapwing (*V. vanellus*).

How to get a first class mark (1)

In order to obtain a first class mark the write-up must address the key elements of the write-up, without major omissions, factual inaccuracies or obvious lack of understanding. The write-up must fulfil the following key indicators and at least one of the 'Excellence' indicators.

Key Indicators

Abstract: A concise and informative summary of aims and major findings.

Introduction: A concise and appropriate coverage of relevant background to the study with a clear, concise statement of aims.

Material and Methods: An accurate description of the methods in appropriate detail.

Results: The results must be presented effectively and comprehensively in a manner that allows the reader to understand the experimental rationale and major findings of the investigation.

Discussion: Major findings are discussed thoughtfully in relation to the project aims and previous work and will contain thoughtful discussion of additional experiments.

Presentation: Report is well organised. References and citations consistently and accurately presented in a standard format. Data presentation is consistent and informative.

How to get a first class mark (2)

‘Excellence’ indicators

E1: Demonstrates an ability to design sensible and subtle experiments or investigations beyond those described in the project description.

E2: Shows impressive understanding of basis of the project and the work of others on which it was based.

E3: Shows an impressive ability to recognise the significance of the results obtained, and provide thoughtful explanations for unexpected findings or discrepancies.

E4: Shows an ability to make appropriate suggestions regarding the future direction that work in this area should take, even if not carried out due to lack of time/resources.

No mention of **quantity** *of results: it’s the report that counts.*

Planning your report writing

- You only have a few weeks left
- Get on with writing things up now
- You can probably write methods and introduction already
- Agree with your supervisor when they will be able to provide comments on text
- Don’t leave statistical analysis too late
- Make sure your lab book is up-to-date too

Final tips

- Be conscious of format, style and balance in papers as you read them
- Give yourself time for a final edit
- You are telling a story!

Best of luck!