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A model for water hyacinth biological control

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Response to examiners' comments: Kendall Adair Hauptfleisch
Masters Dissertation: 'A model for water hyacinth biological control.'

Page	Examiner 1 comments	Student Response
1	remove full stop after Mitsch	Changed as per suggestion.
2	explain what you mean by "new and old"	Wording changed to "potential and current" to clarify meaning.
4	Rather say "human populations" or "human settlements". The term "communities" is usually associated with biological systems.	Changed as per suggestion.
8	Human populations	Changed as per suggestion.
11	Use the correct abbreviation for approximately. This is usually ca. which stands for circa (meaning approximately in Latin). Please correct this throughout the dissertation.	Changed as per suggestion.
21	Confidence intervals	Changed as per suggestion.
23	I felt that it would be better to write this as a paragraph consisting of full sentences. A bit more detail could then be given about the validation. The two sites (Delta Park and Mbozambo Swamp) could be introduced here and the key differences between them highlighted.	Changed as per suggestion.
29	What were the light conditions for the plants?	Changed to include lighting regime.
34	Larva	Changed as per suggestion.
35	Interaction effects	Changed as per suggestion.
35	The reference to this figure can move to the previous line	Changed as per suggestion.
41	Delete space after "day"	Changed as per suggestion.
43	Give the family for this species	Changed as per suggestion.
43	Give name of genus in full and provide family name	Changed as per suggestion.
43	Do you mean higher at higher nutrient concentrations	Changed as per suggestion.
43	See previous comment about growth at high nutrient concentrations	See response to comment above on page 43.
44	Please provide family name	Changed as per suggestion.
44	Family?	Changed as per suggestion.
52	Provide coordinates for each of these sites	Changed as per suggestion.
55	"data were" not "data was"	Changed as per suggestion.
56	Full stop at the end of sentence	Changed as per suggestion.
57	Insert colon after follows	Changed as per suggestion.
85	Insert space after the full stop and before "Oviposition"	Changed as per suggestion.
85	Weevil's	Changed as per suggestion.
86	Drops or dropped	Changed as per suggestion.

89	The symbol for approximately should be ca. which stands for circa, instead of a plus and minus sign	Changed as per suggestion throughout thesis.
89	Better to call these “maxima”	Changed as per suggestion.
98	Full stop required here	Changed as per suggestion.
100	Please provide coordinates for this dam	Changed as per suggestion.
106	Interaction effects	Changed as per suggestion.

Page	**Examiner 2 comments**	**Student Response**
1	Avoid such casual/conversational phrasing in technical writing.	Changed as per suggestion.
2	Nice, clear and succinct statement of thesis objectives.	Noted with thanks.
4	The wording of this sentence is a bit awkward. I suggest rewording it as follows: "Water hyacinth remains South Africa's worst aquatic weed, affecting both ecological and human communities; hence, investigations to improve its control and management are urgently needed."	Changed as per suggestion.
4	Perhaps introduce notions of how studies number leaves of water hyacinth here in relation to age. This could help the reader to better follow along arguments about “leaf number” in Chapter 2.	Added “Because of the rosette formation of water hyacinth leaves, leaves are often numbered from youngest (nearest the middle of the plant) to oldest (towards the edge of the plant) leaf.”
8	This is repeating text from page 4 on the section “Growth of water hyacinth”. Perhaps a simple summary will suffice (e.g. “... produce large seed banks”	Changed as per suggestion.
9	I suggest a more cautious wording e.g. “seldom possible”.	Changed as per suggestion.
10	Avoid such a conversational/casual style in technical writing. Perhaps include “(including *Neochetina* weevils” after “biological control agents” in previous sentence	Changed as per suggestion.
12	The phrase “host plant” is well used and understood in the plant-insect interactions literature. So I suggest rewording this as “Host plant quality”	Changed as per suggestion.
12	Awkward phrasing. I suggest rewording it as “…made in various aspects of biological control…”	Changed as per suggestion.
12	Change to “systems”	Changed as per suggestion.
13	This sentence comes across a bit abrupt. The climate change context and its potential implications for South Africa could have been a bit better introduced.	Paragraph edited to say, “Climate is often one of the most limiting factors, affecting many biological control agent populations (McEvoy and Coombs, 2000; Zalucki and van Klinken, 2006), particularly in water hyacinth control in South Africa (Hill and Cilliers, 1999; Byrne et al., 2010; Coetzee *et al*., 2011). However, these conditions are not stable and are expected to change in the future. In South Africa, air temperatures are expected to rise between 3 - 4°C and precipitation is expected to

		decrease by up to 20% in some areas of the country, (UK Met Office, 2012). As a result, understanding the influences of climate on population dynamics and control efficacy is important in making biocontrol as successful and cost effective as possible.
15	Here and in Figures throughout the thesis, consider your use of colours carefully. For example, a reader may only view your thesis in black and white. So it may be helpful in using different line types to differentiate them	Figures throughout the thesis have been altered to include different line types and markers, in addition to different colours, to differentiate between multiple series. Figures which use shading to indicate differences (e.g. Fig 3.3) have both solid and crosshatched shading to allow differentiation, should the dissertation not be viewed in colour.
16	Awkward phrasing. I suggest rewording this "...suggesting that biomass removed by biocontrol agents needs to exceed this to reduce water hyacinth populations..."	Changed as per suggestion.
17	Given John Wilson is currently an academic at Stellenbosch in South Africa, I am surprise that you did not just call and ask him what he meant. This is always a better approach, as your use of quotes here comes across sarcastic (even if unintentionally so).	Changed to remove unintentional sarcastic tone.
17	But others have written about such aspects based on statistical models of systems, e.g. Raghu, S. Purcell, M.F. and Wright, A.D. (2013). Catchment context and the bottom-up regulation of the abundance of specialist semi-aquatic weevils on water hyacinth. Ecological Entomology 38: 117–122. doi: 10.1111/j.1365-2311.2012.01400.x	Comment noted with thanks. I feel that the point being made here is that Wilson *et al.,* (2005) understood the need to include temperature and nutrients in model where the interaction between water hyacinth and weevils is two way (water hyacinth ⇄ weevils) but they have not yet done so. While Raghu *et al., (*2013) do write about how plant nutrients influence the abundance of weevils, their conceptual model also does not include how weevils subsequently influence plant populations. However, further literature reviews, particularly concerning the bottom-up effects of nutrients on weevil abundance will be included in any published works.
17	Always clarify what you mean, when using phrases such as this.	Changed to clarify the meaning of “density-dependent systems” in relation to biomass removal through herbivory.
18	This is a general comment about thinking about the role models play in science. It is important to remember to models, by definition, are abstractions of a system in a particular context. "All models are wrong, some models are useful" George E.P. Box	Comment has been noted and understood.
22	The term "decision tree" has a specific meaning that is not necessarily congruous with	Changed as per suggestion.

	what is implied here. I suggest using the "decision framework" here.	
22	I suggest rewording this as "assessing the risk to water hyacinth biological control from climate change."	Changed as per suggestion.
23	I would have preferred to see this presented as a paragraph. Unless this is a formatting requirement of the university.	Changed as per suggestion.
24	Nice historical reference!	Noted with thanks.
26	Nice, clear statement of Aim. I suggest adding the word method" after "reduced major axis regression".	Noted with thanks. Changed as per suggestion.
27	It has in certain contexts; e.g. Raghu, S. Purcell, M.F. and Wright, A.D. (2013). Catchment context and the bottom-up regulation of the abundance of specialist semi-aquatic weevils on water hyacinth. Ecological Entomology 38: 117–122. doi: 10.1111/j.1365-2311.2012.01400.x	Comment noted with thanks. The point being made here is that no consideration of the interacting effects of temperature and nutrients on weevil herbivory have been made. Raghu *et al.,* (2013) show that water hyacinth biomass negatively affected weevil abundance but do not consider how the plant is influenced by weevil herbivory.
28	What about the survival and development rates of the larvae themselves? Is it possible to place neonates onto leaves and allow them to penetrate into the mesophyll by feeding (with the aid of punctures to the leaf surface; e.g. the way you did your feeding expts in Section 2.2.2.)?	Measuring the survival and development of the larvae is possible. However, during this study availability of both plants and space was limited, and so a complete survival and development experiment could not be conducted.
28	Was "unhatched" assumed to be "dead"? Is something known from the literature that suggests this. If not, were any of the unhatched eggs transferred to a more suitable temperature to see if there was any kind of physiological dormancy in the egg stage?	Eggs that did not hatch were not transferred to a higher temperature. However, further studies are being conducted at low temperatures (16-20°C) and this will be explored. However, these experiments will not be completed in time to be included in this thesis.
29	How does this destructive sampling method, influence your level of replication?	Sentences have been edited and reordered to clarify the level of replication i.e. eight replicates in the beginning, reduced by one each week as destructive sampling took place.
29	You need to explain why this was done.	Changed to include explanation for larval recovery.
29	This sounds colloquial. Is there a more appropriate technical term for this from the water hyacinth/Neochetina literature?	Changed to “pupal cases”.
29	See query about replication and destructive sampling above. Also, Fig 2.3 suggests n=2-8. You need to better clarify your level of replication here.	Comment on replication level addressed above. The number of replicates changed each week as another plant was destructively sampled. The first week contained eight replicates while the final week contained two replicates.
30	Be consistent. If you are going to provide software references for statistical analyses and methods (e.g. as you did in 2.2.1), you should consistently do so throughout your thesis.	Changed to be consistent.
30	You have not defined how leaves are numbered anywhere. It appears to be first defined in Fig 2.6; figure captions are not a good place to define things that used in the text as	Leaf numbering was introduced into the introduction (see comment on page 4). Leaf numbering has now also been included in methods

	Figures are stand-alone elements. Perhaps the best place to introduced leaf numbering in relation to growth patterns of water hyacinth is on page 4 of the thesis.	on page 30 to clarify which leaves were used in the experiment
30	Low replication, further confounded by sex of weevil.	Edited to clarify that two male and two female weevils were used per replicate.
31	It is fine to say this, but your replication for weevil feeding in relation to nutrient level is confounded with sex.	Comment has been noted. However, sex ratios in the field have been shown not to deviate from 1:1 (Center and Dray, 1992). Therefore, the results remain valid as an average feeding rate of both male and female weevils. See response to comment above on page 30.
31	Please check the degrees of freedom here. If there are 7 temperature levels, there should be 6 treatment degrees of freedom here.	While there were 7 temperatures in total, hatching was only observed at 4 of those temperatures. Therefore, only those 4 temperatures could influence the period taken to hatch. The degrees of freedom stated (DF=3) is therefore correct.
31	Is this F value correct? Is there a missing decimal point?	The F value is correct. The effect of temperature on egg hatching time is highly significant.
31	Here and throughout the thesis, I strongly encourage you to round to a consistent number of decimal places/significant digits. For most biological inference, rounding to two decimal places should suffice.	Throughout the thesis, numbers have been rounded to two decimal places when necessary. Only functions derived from actual data values have not been rounded as rounding will affect the relationships these functions represent in the models.
32	Convoluted wording. I suggest simplifying this to "The proportion of eggs hatching at a given temperature, decreased significantly below 20°C "	Changed as per suggestion.
33	Here and elsewhere throughout the thesis, you need to be careful about your choice of functions that are being fitted to the data. While R^2 is a measure of goodness of fit, fitting ever more complex polynomials may not necessarily make biological sense. So you should always provide a biological rationale for the choice of the function you are fitting to the data (ie. .it has to be more than "I fit this because it increases the R^2 value").	This comment has been noted and understood. The most biologically relevant functions were chosen, not necessarily the best fitting functions. Here, egg survival is expected to and is shown to increase with temperature up until a certain point and then decline above that point. As such, a parabolic function was selected as it best describes the relationship of survival with temperature.
35	Why the line break here?	Corrected.
35	See earlier comment about rounding to a consistent number of decimal places. Can you see how many different rounding levels you use in this paragraph?	Addressed in above comment on page 31.
38	Is this because of differences in the method used to estimate "t"? For example, you used Ikemoto and Takai's method. Did King use a different method?	The same method was used in both this study and King. The difference in lower developmental threshold results from the sample size and mixing of species.
38	Here and throughout the text, you should avoid using this symbol for approximate. A more appropriate symbol/abbreviation in technical writing is "~" or "ca." or "approx." The symbol "±" is reserved to express degree of variability (e.g. standard deviation of the	Changed as per suggestion.

	mean).	
39	Well presented arguments	Noted with thanks.
39	Awkward phrasing. It is the environment that selects for certain traits in populations, not the other way around as implied with this wording. This is better worded as "suggesting that the environment occupied by water hyacinth populations in South Africa have selected for Neochetina populations adapted to such conditions."	Changed as per suggestion.
40	This is an abrupt transition. Perhaps separate this sentence onward into a new paragraph.	Changed as per suggestion.
40	A word seems to be missing here; perhaps "about such factors in"?	Changed as per suggestion.
41	Technically speaking, the petiole is part of the leaf; perhaps better to say that the larvae are not known to feel on the leaf lamina.	Changed as per suggestion.
41	I suggest a more cautious wording, e.g. "will likely change".	Changed as per suggestion.
41	Nice reasoning.	Noted with thanks.
41	I suggest more cautious wording, e.g. “will likely change”.	Changed as per suggestion.
42	By my count, this is the 3rd or 4th mention of this in the Discussion. Such repetition seldom adds clarity, and can be misinterpreted as padding out the text.	Sentence removed to avoid such repetition.
42	Again, this is why the leaf numbering approach needs to be clearly explained somewhere.	See responses to comments above on pages 4 and 30.
43	lower case "catarinensis"	Changed as per suggestion.
43	Again, see: Raghu, S. Purcell, M.F. and Wright, A.D. (2013). Catchment context and the bottom-up regulation of the abundance of specialist semi-aquatic weevils on water hyacinth. Ecological Entomology 38: 117–122. doi: 10.1111/j.1365-2311.2012.01400.x	See response to comment on page 27. Additionally, Raghu *et al.,* (2013) measure weevil abundance rather than weevil feeding scars. The relationship between nutrients and weevil reproduction/abundance is elaborated on in the following paragraph on page 43.
44	Good acknowledgement of limitations of present method.	Noted with thanks.
45	Don't get lazy/colloquial with the use of this term in such a shorthand manner. This is better stated as "...was found not to be a significant influence".	Changed as per suggestion.
45	Change this to "do not appear to do so."	Changed as per suggestion.
46	Here and elsewhere throughout the thesis, if you use double quotes you need to cite where the quote is from. Avoid using air quotes for emphasis or in any other manner; otherwise it may imply that you are being sarcastic. There is little need for sarcasm in technical writing.	Changed where appropriate.
49	Be precise as to what you mean determining factors.	Edited as follows, “All populations are dynamic in time and can be characterised by specific factors, such as temperature and nutrients.”
49	You can abbreviate the genus name here.	Changed as per suggestion.
49	I suggest the following fuller wording: "A stage-structured approach to modelling insect development and population estimation has therefore been taken in this study."	Changed as per suggestion.

50	I suggest wording this "survive and reproduce".	Changed as per suggestion.
50	Nice, clear acknowledgment of the limitation of the approach being taken.	Noted with thanks.
51	See earlier comment about use of colour, and how such descriptions may not be useful to someone who is reading a black and white printout of the thesis.	See response to comment above on page 15.
51	An Appendix is technically not a Chapter. So it will suffice to refer to the Appendix as such, and not place it in a Chapter (unless of course, that is a University formatting requirement for theses).	Changed as per suggestion.
52	I really liked this summary of the modelling approach. Well done!	Noted with thanks.
53	Where are equations 1-3? Are they the regression equations from the previous Chapter? It is perhaps better to number equations by Chapter or use chapter number a prefix to them, e.g. Eq 3.1.	Equations 1-3 are contained in the previous chapter. Currently, the equation names cannot be changed to include the chapter as a prefix without breaking the hyperlinks.
54	See earlier comment about use and description of colour on Figures.	See response to comment above on page 15.
55	Be consistent in how you refer to the Appendix.	See response to comment on page 51.
56	Acknowledge the low replication levels (n=3) for some life stages.	Changed as per suggestion.
56	Lower case "bruchi". Als, given the findings in Raghu et al. 2013 of differences between N. bruchi and N. eichhorniae is such a substitution sensible?	While the weevils may respond differently to nutrients, the differences in their response to temperature are not exceptionally large. Furthermore, no data on *N. eichhorniae* pupae are available. Being that these species are so closely related, it is then sensible to substitute *N. bruchi* data for pupal development estimates.
56	See earlier comments about this. Also, a period is missing at the end of this sentence.	Changed as per suggestion.
57	Be consistent in your use of variable names. In Fig. 3.4. below you use "E" for this variable.	Comment noted with thanks. I have interpreted the subscript (t) as an indicator of time. In figures, the symbol E is used as a general representation of the variable while in equations $E_{(t)}$ is used as the equations represent the instantaneous value of E at any given point in time.
60	An array variable name appears to be missing here.	No array variable name missing. The [*] indicates the number of the arrayed variable *initiator* that needs to be equal to the value of *Day counter* for the statement to hold true.
60	See earlier comments about colour.	See response to comment above on page 15.
63	Well thought through approach	Noted with thanks.
63	A period is missing at the end of this sentence.	Changed as per suggestion.
64	You might want to depict this flow as arriving at the start of the conveyor. Otherwise a reader not familiar with its implementation in STELLA may assume that W_i only arrives at the final conveyor step, before stepping off at the next time step.	Changed as per suggestion.
64	Sensible use of conveyors.	Noted with thanks.
65	Again, as before, consistently use the variable name used in the graphical depiction of the	See response to comment above on page 57.

	model.	
65	While the manner in which you have implemented the maximum weevil density here is acceptable for how it is used in your use of your model, it is important to note that you are actually changing the value of the summing converter and NOT the stock. So if you graphed what is going on in your stock (the state variable that is capturing the dynamics of key elements of your system), it will show numbers very different to what is indicated for your converter. It is better modelling practice to actually influence the stock as this is what you are biologically/ecologically implying by setting the carrying capacity. It will be possible to set a mortality function (in a density-independent manner, because that information may be missing as acknowledge by you elsewhere in the chapter) to kill off that fraction of individuals over and above the desired carrying capacity. While you implementation is fine for your thesis, at the very least you should acknowledge your implementation (versus how it perhaps should be ideally done) in a cautionary paragraph to ensure that the reader knows this difference in implementation clearly. The same goes for how you have implemented carrying capacity for larvae later on.	Comment noted with thanks. At the time of creating the models, I was having difficulty implementing a carrying capacity. I only managed to achieve introducing a carrying capacity by using a summing converter. I am aware that the behaviour of the stock is vastly different to that of the summing convertor and I am in the process of improving such inconsistencies in the models. However, wherever the population density is used in other functions within the model, the summing convertor values are used rather than the stock values. A cautionary paragraph has not been included as the ideal implementation of carrying capacity is still under investigation and will be used in later (published) versions of these models.
66	What was done with this comparison in terms of the implementation of parameters in the model? This actually seems to be a statement of methods for Chapter 4.	Removed sentence from paragraph.
67	Again, see earlier comment about a mathematical fit based on a statistical rationale, versus the need for the function to have a biological rationale.	See response to comment on page 33.
68	See earlier comment about referring to the Appendix as a Chapter.	See response to comment on page 51.
68	I suggest citing the relevant Figure here (e.g. Fig. 2.2.) from which the equation is derived.	Changed as per suggestion.
72	See my earlier comment (p. 65) about how carrying capacity is implemented in the model. Also, does it make biological sense to have the carrying capacity set to 300 adults/sq.m., given that half of this was deemed sensible earlier. Might this be an artefact of how you are implementing K in the model, given the use of conveyors?	See response to comment on page 65.
72	"data" is plural for "datum"; so this should be "were"	Changed as per suggestion.
73	Nice use of published data.	Noted with thanks.
73	In reality a regression is not needed, and is overkill in terms of analyses. All you need is the adjustment of the regression coefficients based on the adult feeding data to be scaled by the conversion factor.	Comment noted with thanks. However, in the functions used in the model, larval feeding and adult feeding are measured in different units (g vs. mm^2). Excluding the regression will require additional conversion factors to be introduced, and will also change equations currently used to create model outputs. Any changes in the equations will require that the models be rerun and re-analysed.

		This concept may, however, be used in the future publications.
75	The ordering of your conditions in the if-then-else statement appears incorrect. A value greater than 86.3 will automatically be >= 0, and so will falsely be assigned a value based on the first condition. So you either need to assign a compound rule on your first condition (i.e. >=0 and <86.3) or move your second condition first, i.e. if "EQN" > 86.3 then 86.3 else if "EQN" >=0 then "EQN" else 0 where "EQN" is your third order polynomial.	Changed as per suggestion.
76	You need to explain the relevance of microbes in this context more carefully.	Changed as per suggestion.
76	See earlier comment on p. 65 (Eq 25) about the method of implementation of carrying capacity.	See response to comment on page 65.
77	You are dealing with both "simulation" and "validation" in this chapter; the former is the logical numerical consequences of your model structure and parameters, while the latter is the relationship between your model results and field observations. I encourage you to restructure your chapter to better reflect this. This will not be too onerous a task, and will improve clarity. You may also need to include a brief note on what simulation achieves as you current Introduction in this chapter is mostly about validation. See the following paper for one way of setting this up for a STELLA model on biological control: Raghu, S., Dhileepan, K. and Scanlan, J.C. (2007). Predicting risk and benefit a priori in biological control of invasive plant species: a systems modelling approach. Ecological Modelling 208: 247–262.	Both simulation and validation aspects have been incorporated into the title of the chapter. Minor chapter restructuring has occurred to distinguish the simulation and the validation portions of the chapter. A short paragraph on model simulation has been added into the introduction.
78	Didn't you use some data from Byrne et al., or was it just temperature data to run your simulations? If the former, then your validation may only be partly independent.	Only temperature data was used as an input into the model. Only plant and weevil population outputs such as biomass density are validated against population data from Byrne *et al.,* 2010 which remains independent.
78	I really enjoyed reading this nice summary of the literature on “validation”.	Noted with thanks.
80	Your units in this sentence are not clear. Do you mean g/g/day?	Changed as per suggestion.
81	This captions comes across a bit awkward. Perhaps rewording as follows will improve clarity:	Comment noted with thanks. Relative growth rate in Fig. 4.1 is constant (not influenced by temperature) while growth in Fig 4.2 is dependent on fluctuating temperatures in the environment. Figure

	"Output from Stage 2 (temperature) model of water hyacinth biomass under A. low variable water temperatures... and B. high variable temperatures...relative growth rate of water hyacinth from the Stage 1 model in Fig 4.1...."	4.2 caption has been adjusted to reflect this.
81	The p value here is a rounding issue in your statistical analysis software. You should indicate this as p<0.01, or increase the precision setting on your stats software.	Changed as per suggestion.
82	Use a consistent numbering method for your Equations, i.e. "Equation 41". Also, why repeat this? This is already presented as Eq. 27 on p. 68.	Removed sentence.
83	See previous comments about fitting such functions.	See response to comment on page 33.
83	As indicated before, colours come across poorly when printed in Black and White, perhaps use a different line style in addition to colour, or use two colours that have greater contrast when reproduced in grey scale.	See response to comment above on page 15.
85	Be cautious in using red and green on the same Figure; there a a fair number of people who are red-green colour-blind who may not be able to interpret this graph. All the more reason to use different line types for each life-stage	Although red and green have still been used on the same figure, series are differentiated by using different line types, e.g. solid for green series and dashed for red series.
85	This is not the case, as currently depicted. Please check to make sure there is no error in this graph.	There are two y axes on each graph, with different scales (primary vs. Secondary). It is important to point out this difference as the scale on the primary y-axis is almost two orders of magnitude larger than on the secondary y-axis.
85	Please change to weevil's	Changed as per suggestion.
85	This is not the case, as currently depicted. Please check to make sure there is no error in this graph.	See response to comment on page 85.
87	Cite the source of this data. Byrne et al. 2010?	Changed as per suggestion.
87	See previous comment about fitting such functions.	See response to comment on page 33. A third order polynomial was used to capture the sigmoidal rather than parabolic relationship that weevil feeding has with temperature. Feeding is known to increase with temperature and decline above optimal temperatures and is limited to positive values as described by the function and corresponding model equations.
88	See previous comment about fitting such functions, and the lack of need for such a regression given you are just scaling (by the conversion factor (= 85.21/0.9 = 94.677) the coefficients of the adult feeding function.	See responses to comments on pages 87 and 73.
89	See earlier comment about use of appropriate symbol, i.e. ~/ca./approx.	See response to comment on page 38. Changed throughout dissertation.
93	This is the start of the "validation" part of the chapter. All prior information is "simulation".	See response to comment on page 77.

93	See earlier comment about setting of the precision of P values in your statistics software.	Changed throughout dissertation.
94	Here is the risk of lazy use of the term "significant". For which response variable was this effect not deemed significant by your statistical analyses?	It was deemed not significant for the “season” response variable.
94	Change this to "test"	Changed as per suggestion.
94	This only appears to be the case in Year 2; appears underestimated in Spring in Year 1	Changed to reflect that underestimation only occurs in the second winter
96	Be careful about making broad inferences based on information from 2 systems. I suggest including a caveat in this sentence, e.g. "If the modelled relationships suggested in two freshwater systems representing the extremes of temperature in which water hyacinth occurs hold, temperature is unlikely to limit water hyacinth population in in South Africa."	Changed as per suggestion.
98	Your use of SE is not meaningful as it comes across as though it is a unit. I suggest editing this to "...28±29% (mean±SE), while at Mbozambo swamp only 12 zero days occurred and percent survival was 66±21% (mean±SE)."	Changed as per suggestion.
98	Provide more information on how they differ. When are the populations at DP > MS as per the Byrne et al. data?	Changed to drawn attention to differences in sites in the second year and includes a cross reference to Fig 4.16 which includes the field data.
98	Awkward phrasing. Use the language of generation times commonly used in the biological literature. For example, we typically refer to the parent generate released in the field as the F_0 generation, and the generation that results from this as F_1, and the progeny of F_1 as F_2 generation, and so on.	Changed as per suggestion.
99	In the previous page you referred to this as the "first subsequent generation". Here is where use of a consistent technical terminology will be very useful to communicate your inferences to the reader.	Changed as per suggestion.
99	Refrain from using non-standard/non-conventional abbreviations/symbols. Typically this is just stated as "degree-day". Please use "degree-day" here and elsewhere in the thesis.	Changed as per suggestion.
99	Please use "degree-day" here	Changed as per suggestion.
100	Indicate the calendar period to which this corresponds. That will help the reader make a more appropriate biological inference.	Changed to include calendar period.
100	Again, avoid air quotes like this.	Changed as per suggestion throughout dissertation.
100	Please change to "...controlling water hyacinth."	Changed as per suggestion.
101	Please change this to "scar to leaf-area"	Changed as per suggestion.
101	Please change to "leaf area"	Changed as per suggestion.
101	Please change to "relative to"	Changed as per suggestion.
101	Change to "estimated"	Changed as per suggestion.

101	Please change to "study"	Changed as per suggestion.
101	This seems spurious to me. Your model only represents biomass removal by adults and larvae of the weevil. So to this this may account for removal by fungi does not make sense. On a related note, Did Wilson (2002) exclude fungi in some way in his study (e.g. through the use of a fungicide)? Also, check spelling of "fungal" in this sentence.	The model represents removal by weevil larvae as determined by experimental work which did not account for the damaging effects of fungi and microbes. Venter *et al.,* (2013) showed that weevil-borne microbes contribute as much to reductions in photosynthesis of water hyacinth as biomass removal by weevils. High larval feeding rates (as calculated using plant weight loss) may then account for both biomass removal (actual larval feeding) and the effect of microbes on photosynthesis and subsequently plant weight loss. Wilson (2002) did not take direct measures of feeding rates, his values were estimates based on data from other sources, but no mention of fungal exclusion was made. Spelling of fungal has been corrected.
102	This can be deleted.	Changed as per suggestion.
102	change to "...33 days in the model..."	Changed as per suggestion.
102	Local extinctions may be rare in water hyacinth biocontrol, but can be common in other systems, see for ex. Hypericum control in the US where some locations have had extinction of populations.	Sentence altered to state that local extinctions are rare.
102	change to "biological control systems in the field"	Changed as per suggestion.
102	Please insert comma after "Florida,"	Changed as per suggestion.
103	Please change to "often"	Changed as per suggestion.
103	But this is not reflected in your model. According to Eqn. 42 and 43, biomass fed on/adult >> biomass fed on/larva. What were the units for feeding rate in the Wilson (2002) study? Indicating that may clarify this discrepancy and whether you needed to have modelled feeding rated differently in your study.	This is reflected in the model. Equation 42 reflects adult feeding in mm^2, where equation 43 shows larval feeding in grams. In the model, adult feeding is converted from mm^2 to kilograms (1.49×10^{-5} kg/[adult]weevil/day) and larval feeding is 0.9g or 90×10^{-5} kg. Therefore, larval feeding is approximately 60 times greater than adult feeding.
104	Be consistent in your use of tense. Most of your text is in past tense, but this paragraph is mostly in present tense.	Changed to past tense.
104	Again, avoid conversation writing style. Reword this as, "The models showed the importance of temperature in increasing biocontrol success."	Changed as per suggestion.
105	Change to "additional effects"	Changed as per suggestion.
106	Avoid such emphases/highlighting; just making a reasoned argument typically suffices in technical writing. Please remove italics	Changed as per suggestion.

106	How one models this in a biologically meaningful way will always be a challenge. Also given that biomass is the currency of your water hyacinth sub model, you will need to model water hyacinth differently to achieve this, or will need to include impacts of growth rate (as you suggested in p. 110).	Comment noted with thanks. While biomass is the currency of the model, biomass estimations are derived from the influence of plant growth rates, which are affected by temperature in the model. Water hyacinth would not necessarily need to be modelled differently but rather the growth rate estimates would need to incorporate the additional effects of weevil herbivory. This will be considered in future publications.
106	Change to "additional effects"	Changed as per suggestion.
106	This is at least the 4th mention of this point in this chapter. Avoid such repetition. This sentence can be deleted from this section.	Changed as per suggestion.
107	Change to "...can enlighten us on the deeper..."	Changed as per suggestion.
108	Do you mean stolons? Use accurate botanical descriptions of plant parts.	Changed as per suggestion.
110	Good point.	Comment noted with thanks.
110	Again, this is not the case in how you have modelled this. So resist the urge to make such speculations.	See response to comment on page 101.
111	Again, avoid air quotes. I suggest renaming the section "The ideal model".	Changed as per suggestion.
111	You are modelling plant biomass/unit area and not plant populations. So you need to word this more carefully.	Wording changed from “populations” to “models”.
111	Change to "are"	Changed as per suggestion.
112	Avoid such emphases/highlighting; please remove italics	Changed as per suggestion.
112	Please edit to: "Survival rate of larvae and pupae as well as weevil longevity are likely to vary with temperature (references), but are modelled as being constant in this study."	Changed as per suggestion.
113	I concede this is an important point, but by repeating it so many times you have risked devaluing it. Make this point forcefully no more than twice; that approach is almost always more effective.	Sentence removed.
114	It is important to understand that the goal of a model is to abstract reality, i.e. capture the key elements of a real system to allow understanding of key dynamics in ways that may not be examinable in real system. Very few models (if any) will capture all facets of reality accurately. The best one can expect is for the modelled systems dynamics to be positively correlated with observations of real systems, and for this to happen across a majority of model-real system comparisons. Such models can be useful, even if they are ultimately wrong (in the sense of not being predictive in all locations or contexts).	Comment noted with thanks. I feel that this concept has been addressed to some extent on page 108. However, later versions of the model will undergo sensitivity analyses to help identify the key elements of the system and draw as much useful information from the model as possible.
115	Unless it is university policy, please carefully consider not have the Appendix as a Chapter. This will also have implications for how you might label the tables in your Appendix; e.g. you could just called them Table A1, A2, and so on.	See response to comment on page 51. Tables have been renamed as suggested