A GUIDE TO THE DEVELOPMENT OF A THESIS/CAPSTONE PROPOSAL AT THE NOVA SOUTHEASTERN UNIVERSITY DoMES

Students should be aware that following possibilities exist to graduate from the Department of Marine and Environmental Science:

MS in Marine Science, requires a thesis or capstone, regardless which concentration.

The MS degree assumes, as its name implies, a "mastery of science". Science, at NSU DoMES, is interpreted as a quantitative and precise, hypothesis-based approach to the accurate and unambiguous description of phenomena in the natural world. The same approach can be taken for social issues, or for Coastal Zone Management issues, for example. Hence, students must be aware that they will be held accountable to above definition.

Whether a thesis/capstone is deemed acceptable ultimately does not rest with the thesis advisor(s) alone, but with the course director and the faculty at large. It is possible that, even if a thesis/capstone committee agrees to a defense, the faculty and students may consider the work not worthy of the degree.

The thesis/capstone process falls into several parts:

- Development of a proposal
- Review of the proposal with primary advisor
- Correction of proposal
- Evaluation of proposal by advising committee
- Chair of committee forward to Department Chair who approves
- Acceptance/Rejection (if the latter, begin again at the beginning)
- Production of thesis/capstone along the lines of the proposal
- Review of thesis/capstone by primary advisor
- Review by rest of committee
- Review by course director
- If accepted, admission to defense
- If defense was acceptable, admission to final test (rubrics)
- If rubrics passed, graduation

When the student enters the thesis/capstone track, following will help in developing a proposal. The successful production of a proposal, however, does in no way imply the automatic acceptance of the thesis/capstone.

A proposal needs to consist of the following parts:

Introduction

Student will provide a one-half to one-page overview of the problem. The introduction falls into three broad parts:

Paragraph 1: Global frame of the problem (i.e. "*Climate change is an important factor influencing animal populations. The IPCC projects…blabla…*").

Paragraph 2: Local frame and why the problem is studied here (i.e. "*In Florida, the Woodstork is a particularly sensitive species. FWC have been monitoring populations for 100 years and have found that…*")

Paragraph 3: What will be done in this study (i.e. "*In this study, I will examine the detailed mechanisms leading to Woodstork decline. It is possible that primarily demographic factors (i.e. increased mortality at various life-stages) or primarily environmental factors (i.e. habitat change that reduces available nesting sites, local pollution) drive this decline. To obtain clarity, I will do…*").

These three section will "funnel in" the reader to the problem at hand. First paragraph will show what is the problem, second paragraph will show the regional setting, third paragraph will show the detailed issue treated in the paper.

Hypothesis

The hypothesis flows primarily from paragraph three of the introduction and needs to be stated as a separate section.

Student will reduce the key content and overall driving question to a simple statement (ideally one short paragraph). It is not necessary, but possible, to develop a hypothesis/alternative approach (see choice of analysis method), but the hypothesis must be clear, unambiguous and testable.

Example:

"*It is known that disturbances lead to changes in animal populations. Large-scale disturbances, such as those caused by climate change, should therefore lead to region-wide changes, while local impacts should be geographically constrained. Thus, the spatial autocorrelation in a set of sampling points spread evenly over a large area should allow inferences on the dominant type of disturbance – local or system-wide*".

Data required

All these and capstones should use data. If the topic does not lend itself to quantification (which is rarely the case) then a coherent, logical argument must be made why quantification and use of data will not improve the work.

Student will provide a clear and concise argument, based on the introduction and hypothesis, what types of data are required and why.

Example:

"*To test whether Woodstork decline is tied to altered demographic rates or large scale/local environmental impacts, I will require life-table data stretching back as long as possible, as well as GIS data that allow the mapping of local risk factors (nearby factories, rivers, highways) and vegetation distribution. In specific, the following data are needed: ….tabulation…*"

Data Acquisition

Student will demonstrate how data will be acquired.
This will be achieved by either:

- A) collection of own data
- B) utilization of existing data

If A)
Student will demonstrate in detail:

- Location of sampling
- Logistics required for sampling
- Evidence of availability of required logistics
- Sampling protocol, written out in detail
- Data structure (a half-page dummy dataset needs to be demonstrated)

If B)
Student will demonstrate in detail:

- Location of datasets (details of literature, databases, etc)
- Logistics required to obtain data (permissions, download protocols, etc.)
- Capability and location of data storage
- Data structure (at least a half-page dataset needs to be demonstrated, detailed discussion of dataset required, proposal will not be accepted before datasets are in hand)
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Example:

"*For this study, existing data provided by the Florida FWS will be used. Detailed demographic analyses of the Woodstork from Big Pond near Everglades City are provided on the website https://www.myfws.gov/Woodstork/BigPond and have already been downloaded. Permission was obtained by FWS (copy of message attached) and a copy of data is being held on my own computer as well on the Bird Lab computer in room 416B. Demographic data have the following structure:*

day	month	year	eggs	fledglings	subadults	adults
13	2	2002	4	2	1	2
14	2	2002	5	2	1	2
15	2	2002	6	1	4	3
16	2	2002	4	3	2	2

Data Analysis

Student will rationalize in essay-form what approach to analysis the data structure requires. In specific the student will define what approach he/she is using and why not one of the alternatives. Student will define what the analytical approach will be:

- Numerical
- Classical Frequentist
- Bayesian
- Model Inferential
- Probabilistic
- Descriptive

Unless the technicalities of the work require a descriptive approach and it is specifically approved by the committee, a non-quantitative, purely descriptive approach (i.e. a pure literature review without any data analysis) will be deemed unsatisfactory and the proposal will be rejected.

The student must demonstrate knowledge of the different philosophical/methodological approaches and argue for the chosen and against the rejected approaches.

Students should engage in reading some of the basics. Good literature for further understanding above points is:

Gotelli, Ellingson: Primer of Ecological Statistics (easy and good entry point)
Moore, McCabe, Craig: Introduction to the practice of statistics (easy and good entry point)
Legendre, Legendre: Numerical Ecology (advanced)
Anderson: Model based inference in the life sciences (very useful, but advanced)

Student will provide evidence how the analyses will be performed. The computing environment needs to be specified. For example, if the most complicated analyses are standard frequentist statistics, a regular statistics package may suffice. However, if models are to be built and evaluated, the computational environment (R, Matlab, etc.) and the type of model (mathematical model, statistical model, etc.) must be specified, as well as its evaluation for fit to control data. If mainly geographic data are used, the platform and its availability (p. ex. ArcGIS, etc.) must be specified.

Take note: Statistics and methods textbooks have to be consulted prior to the analyses and prior to (or during) hypothesis development, not only immediately when an analysis is about to be performed. "Mastery of Science" refers also to mastery of the tools required from the neighboring sciences - that needs time and dedication.

Example:

"*Data analysis will follow a classical frequentist path for the analysis of frequency data of Woodstork populations. This type of analysis is justified because data structure suggests…..I will first use classical data exploration techniques (scatterplots, pairplots, scattergrams, QQ plots, etc.) in order to explore obvious patterns. Spread of data and homogeneity of variances will be explored with blabla…If data are found to be homoscedastic, I will employ a factorial ANOVA, with number of organisms in the different life-stages as variable and environment (temperature, salinity, vegetation height) as factor. Blablabla….I will use R as my computational environment and have experience in coding basic routines.*"

Expected outcomes:

Here the student will detail what is expected to result from the data-analysis. The introduction and hypothesis have set the overall framework, now the student will show that he/she has some indication of where results will likely fall. This is important to ensure that the thesis remains on track and does not waver aimlessly.

Obviously, at the point of proposal development it will not yet be possible to know outcomes. However, the hypothesis should be so formulated that it will indeed be possible to present an intelligent "either/or" outcome scenario in this section.

Example:

"*Two directions of outcomes can be expected: a) Woodstorks are greatly influence by large-scale changes in the environment. If testing shows significant spatial autocorrelation in the observed decline in population levels, and the statistical models suggest indeed a correlation with environmental parameters such as blabla and blabla, then we will have to assume ….*
b) Woodstorks are only influenced by local perturbations. This outcome would be suggested if no strong spatial correlation existed in the overall decline in numbers. Heterogeneity in response to large-scale environmental variables could then be explained by…In this case, introduced pythons would likely be shown as the main culprit".

References:

Here the student will provide a full reference list of all literature and data sources.

Signatures by committee

Committee will only sign once completely satisfied. Please take note that "being in a rush" and "wanting to graduate" are no valid reasons for accepting a proposal that is not complete and well

thought-out. Students are advised that they should allow about a semester for development and acceptance of the proposal. Students are also advised that upon completion of the thesis/capstone (if previously accepted to the thesis/capstone), at least six weeks needs to be budgeted as the committee's reading period. Overall, a semester should be scheduled to complete reading, defending and completion of the administrative process.