**Academic Year:** 2017-2018
**Department/Unit:** Masters of Science - Biology
**College:** Arts and Sciences
**Submission Date:** July 1, 2018
**Contact:** Dr. Robert E. Kissell, Jr.

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## I. Department Mission:

The primary mission of the Department of Biology at Tennessee Tech is to promote biological education in the region, state, and nation through teaching, research, and public service.

## II. Program Goals and Student Learning Outcomes:

**Program Goal 1:** Increase graduate student enrollment and thus graduation rates through recruitment, retention, and marketing.

**Program Goal 2:** Make significant progress toward increasing diversity.

**Program Goal 3:** Increase faculty involvement in research and the graduate program.

**Student Learning Outcome 1:** All Master of Science candidates in the Department of Biology will demonstrate a command of principles within general biology and the specialized disciplines in their area of interest.

**Student Learning Outcome 2:** All Master of Science candidates in the Department of Biology will participate in extracurricular activities related to their disciplines. These activities will include student organization membership, special field trips that are not class related, involvement in research activities of other graduate students, and attendance at scientific meetings.

**Student Learning Outcome 3:** All Master of Science candidates in the Department of Biology will acquire abilities to use scientific reasoning as codified by the structured process commonly known as the scientific method.

## III. Assessments

- **TECH TRENDS Institutional Research Reports** (Program Goals 1 and 2; Provided each Fall semester) – These reports provide institution-wide data concerning enrollment, demographics, and retention. The enrollment component of this goal is assessed by comparing enrollments from year to year.

- **National Association of University Fish and Wildlife Programs Data** (Program Goal 2; Compiled every five years) – These reports summarize data compiled from 21 member universities that have fish and wildlife academic programs. Enrollment figures by gender and race/ethnicity are included.

- **Faculty Annual Report** (Program Goal 3 and Student Learning Outcome 2; Conducted annually in Spring semester) – Each faculty member submits a Faculty Annual Effort report to the chairperson that discusses their efforts for the previous calendar year.

- **Comprehensive Oral Exams** (Student Learning Outcomes 1 and 3; Conducted at end of each graduate student's degree program) - These exams are administered by individual graduate faculty committees near the completion of each student's program.

- **Graduate Seminar Evaluations (See Appendix)** (Student Learning Outcome 3; Conducted near the end of each graduate student's degree program) - Departmental faculty attend graduate seminars where students formally present their research and ask questions to ensure that graduate students have a thorough understanding of the scientific method.

## IV. Rationale for Outcomes and Assessments (Process of Data Analysis):

- **TECH TRENDS Institutional Research Reports** are reviewed by the chair to acquire information on institution-wide enrollment and demographics. Enrollments are compared from year to year. To assess progress toward increasing diversity, the departmental chair uses demographic information to compare minority and women enrollments from year to year. These data are summarized in the Departmental Annual Report submitted to the Dean of the College of Arts and Sciences. These data are compared with those summarized by the **National Association of University Fish and Wildlife Programs.**

- The department chair will discuss each individual faculty member's progress as summarized in **Faculty Annual Reports**. On-going progress towards promotion, research projects and proposals, external funding, publications and presentations, extracurricular activities involving graduate students, and number of graduate students are summarized and included in the Departmental Annual Report submitted by the chair to the Dean of the College of Arts and Sciences. In 2002, the Department of Biology modified promotion guidelines such that research and graduate student mentorship were required for promotion to the ranks of Associate Professor and Professor. In addition, the department developed a differential teaching load policy in 2010 that provides faculty actively involved with research and graduate student mentorship with a reduced teaching load should they select the research track. The departmental chair monitors the number of faculty promoted and the number of faculty agreeing to the research track on an annual basis.

- All Masters of Science degree students must complete a research thesis and defend their thesis during an **oral comprehensive examination** conducted by their individual faculty graduate committee. Oral comprehensive examinations consist of two parts: questions regarding the thesis, and questions evaluating knowledge of general biological principles and topics within the student's area of specialization. Graduate committee membership includes a minimum of three faculty members; two from the Department of Biology whose research interests closely match those of the student, and one from an area outside

the area of specialization that may come from another department. Major advisors record questions asked and the number of correct and incorrect responses. Successful completion of the oral examination requires a unanimous vote from all committee members that the student has passed both parts of the exam. The departmental chair tracks examination results and includes the data in the Departmental Annual Report submitted to the Dean of the College of Arts and Sciences.

- Masters of Science degree students nearing the completion of their degree programs must enroll in BIOL 6930 (**Graduate Seminar**). Departmental faculty members attend graduate seminars and each seminar is independently graded by three departmental faculty members that cannot include the graduate student's major advisor. A seminar evaluation form (Appendix) is competed by each of the three faculty members, and a common grade is assigned based on the three evaluations. The seminar evaluation form includes an evaluation of the research design, such that principles in the scientific method are evaluated. Questions regarding each student's research are included to insure that each student understands the implications of their research and the scientific method.

## V. Results

**TECH TRENDS** (Program Goals 1 and 2) The Department of Biology has monitored enrollment trends for several years and used these trends to develop strategies to meet this goal [Program Goal 1 (Table 1)]. Only 16 M.S. students were enrolled during Fall 2013 and 2016. The number of graduate students increased in 2014 due, in part, to graduate teaching assistantships provided by the Graduate Studies Office. Those four assistantships were terminated in 2016. In 2017 the College of Arts and Sciences restored the four lost the year earlier. Retention of M.S. students has been approximately 100% since 2005, with all but two students graduating.

Table 1. Number of graduate students (M.S.) enrolled as Biology majors by year.

| Year | Number of Graduate Students |
|---|---|
| 2013 | 16 |
| 2014 | 22 |
| 2015 | 21 |
| 2016 | 16 |
| 2017 | 20 |

Efforts to increase diversity have met with mixed results [Program Goal 2 (Table 2)]. Very few minorities have enrolled in our graduate program; four were enrolled in 2017; this percentage, however, is the highest in recent history. During the last four years at least 50%of our M.S. students have been female.

**National Association of University Fish and Wildlife Programs Data** (Program Goal 2) Since the majority of our graduate students conduct natural resource research, NAUFWP data for 2010-2011 indicate that females represent approximately 44% of graduate students enrolled in natural resource graduate programs. The percent females in our program exceed this during the last five years except 2013. NAUFWP data for 2010-2011 also indicate that minorities represent approximately 13% of students in natural resource graduate programs. Minority representation in our graduate program is low but exceeded the average reported by NAUFWP.

Table 2. Percent of Biology majors as minorities and females by year.

| Year | Percent Minority Graduate Students | Percent Female Graduate Students |
|---|---|---|
| 2013 | 0.0 | 37.5 |
| 2014 | 4.5 | 50.0 |
| 2015 | 0.0 | 52.4 |
| 2016 | 12.5 | 62.5 |
| 2017 | 20.0 | 50.0 |

**Faculty Annual Report** (Program Goal 3 and Student Learning Outcome 2) Active involvement in research and the graduate program is linked to promotion in faculty rank within the Department of Biology (Program Goal 3). Faculty members hired as Assistant Professors prior to 2016 were required to achieve the rank of Associate Professor by having at least two refereed publications, one of which was based on research conducted while employed at TTU, and they had to submit at least one research grant proposal for external funding. To achieve Full Professor, candidates must have at least three refereed publications based on research conducted at TTU since attaining the rank of Associate Professor, candidates must have obtained sufficient external funding to support at least two graduate students since becoming an Associate Professor, and candidates must have served as major professor for at least two graduate students that have obtained their degrees. One promotion occurred in 2017, but none occurred in the previous four years (Table 3); however, two Assistant Professors received tenure in 2016, but were not promoted.

All tenure-track Assistant or Associate Professors hired on or after 1 August 2016 will meet the applicable expectations related to Tenure and Promotion under the 2016 Department of Biology Guidelines for Tenure and Promotion. All tenure-track Assistant Professors hired prior to 1 August 2016 will meet the expectations related to Tenure and Promotion under the previous guidelines (adopted 2002) that address tenure and promotion to Associate Professor. All tenure-track Assistant Professors promoted to Associate Professor following 1 August 2016 will meet the expectations related to Full Professor under in the 2016 Department of Biology Guidelines for Tenure and Promotion. Faculty members at the rank of Associate Professor prior to 1 August 2016 will meet the expectations under the previous guidelines (adopted 2002) that address promotion to Professor.

Table 3. Number of faculty promoted to the rank of Associate Professor and Professor.

| Year | Associate Professor | Professor |
|---|---|---|
| 2013 | 0 | 0 |
| 2014 | 0 | 0 |
| 2015 | 0 | 0 |
| 2016 | 0 | 0 |
| 2017 | 1 | 0 |

The Department of Biology Differential Teaching Load Policy was implemented in two phases:
(1) a two-year transition phase that began January 2010 and ended December 2011, and

(2) an effective phase that began January 2012. This policy has three options from which faculty must select before signing their annual agreement of responsibilities: (1) Teaching Option – emphasizes teaching with a course load of 5 courses per calendar year, and has no requirements for funded research projects, graduate student advisement, or scholarly publications; (2) Standard Option – teaching (4 courses per year) with a moderate level of research activity, and faculty selecting this option must meet one of three thresholds within the previous two years, and meet a second threshold by the end of the upcoming year (Thresholds include securing at least $4,000.00 in research funding (external and/or internal funds) and apply for at least one external grant, graduate student mentorship must average a minimum of one per year, and scholarly publications ("in press" or in print form and limited to peer-reviewed journal articles, book or proceedings chapters, or full-length books) consisting of two over a three-year period); and (3) Research Option – substantial research program with teaching duties (3 courses per year), and faculty selecting this option must meet two of three thresholds within the previous two years and meet the third threshold by the end of the upcoming year (Thresholds include securing external funds averaging a minimum of $20,000.00 per year over a three year period, graduate mentorship must average three per year, and scholarly publications (same restrictions as previous threshold) must average a minimum of one per year over a three year period). To date three members of the faculty have selected the research option. Numerous faculty members selected the standard option and several of the senior-most faculty selected the teaching option. However, the number of faculty members actively engaged in research with graduate students has been high (Table 4).

Table 4. Number of graduate faculty members actively engaged in research with graduate students.

| Year | Number of Faculty Conducting Research with Graduate Students | Percent of Departmental Faculty |
|---|---|---|
| 2013 | 10 | 58.8 |
| 2014 | 14 | 73.7 |
| 2015 | 14 | 77.8 |
| 2016 | 14 | 77.8 |
| 2017 | 13 | 81.3 |

Almost all graduate students participated in extracurricular activities (Student Learning Outcome 2). We are especially pleased that many graduate students attended at least one scientific meeting per year, and many presented their research findings at these meetings (Table 5)

**Comprehensive Oral Exams** (Student Learning Outcomes 1 and 3) All students successfully passed their oral exams during the first attempt in the 2016-2017 academic year, and many demonstrated a mastery of the subject matter of which they were tested [Learning Outcome 1 (Table 6)].

Table 5. Number of graduate students and the percentage of graduate students presenting research findings at scientific meetings by year.

| Year | Number of Graduate Students Presenting | Total Number of Graduate Students | Percent of Students Presenting |
|---|---|---|---|
| 2013 | 5 | 16 | 31 |
| 2014 | 7 | 22 | 32 |
| 2015 | 9 | 21 | 43 |
| 2016 | 10 | 16 | 63 |
| 2017 | 6 | 20 | 30 |

**Graduate Seminar Evaluation** (Student Learning Outcome 3) The high graduation rate (Table 6) and written demonstration of scientific reasoning in theses and oral demonstration in seminars are indications that Learning Outcome 3 is being achieved. Graduate students in the Department of Biology are extremely serious about seminar presentations, and most of them deservedly receive A's for this component of their program.

Table 6. Number of Master of Science graduates within the Department of Biology by year.

| Year | Number of Graduates |
|---|---|
| 2013-2014 | 3 |
| 2014-2015 | 5 |
| 2015-2016 | 5 |
| 2016-2017 | 9 |
| 2017-2018 | 6 |

## VI. Modifications and Continuing Improvement: Program Changes due to Assessments For Program Goal 1

The graduate program in the Department of Biology is highly dependent on outside funding. New faculty members have been very active in securing outside funding for projects. However, many state and federal agencies are limited in providing research assistantships, though some do. As such, the number of M.S. graduate students is very much limited by the number of graduate teaching assistantships available.

Link to Assessment Data: The number of M.S. students increased significantly during the past two years, primarily because of graduate teaching assistantships provided by the College of Arts and Sciences. The M.S. program is expected to grow again in the near future as additional faculty members are hired and research funding sources are identified. No new faculty members were hired this year (1 August 2017) due to budgetary limitations.

The departmental Graduate Policies Committee monitors enrollment and tracks graduate

assistantship opportunities. The departmental chair continues to encourage newly-hired faculty to accept graduate students, seek external funding, and continue to seek additional graduate assistantships.

The chair of the department ensures that enrollment and retention of graduate students is monitored. The departmental Graduate Policies Committee meets several times per year to analyze data and interpret results. Recommendations for enhancing the graduate program are discussed at departmental faculty meetings and policies affecting the program voted upon before implementation.

**For Program Goal 2**

The Department will continue to seek out minority and female students and to actively recruit these students into our programs. However, we are considering focusing on recruiting minority students more aggressively for the graduate programs.

Link to Assessment Data: The departmental Graduate Policies Committee continues to monitor these data and make recommendations to the department concerning recruitment opportunities. We intend to target traditional minority institutions that have undergraduate programs compatible with our primary areas of research (i.e., environmental biology and wildlife and fisheries) and recruit through institutional contacts.

**For Program Goal 3**

The Department of Biology will continue to encourage faculty eligible for promotion to meet or exceed the requirements for promotion to Associate Professor and Professor. By doing so, our graduate program should continue to grow. Additionally, we will encourage more faculty to select either the standard or research options when discussing their agreements on responsibilities with the departmental chairperson. Reduced teaching loads in these options should encourage research and therefore mentorship of additional graduate students.

Link to Assessment Data: Newly hired faculty members are encouraged to develop their research and graduate programs upon arrival. With the implementation of the differential teaching load, faculty members are annually encouraged to select either the standard or research option when discussing agreements of responsibility with the chairperson.

**For Student Outcome 1**

Faculty members will continue to emphasize the understanding and incorporation of general biological principles and expertise within each graduate student's area of specialization.

Link to Assessment Data: We have been very pleased with the performance of our graduate students in these areas on comprehensive oral examinations. The departmental Graduate Policies Committee will continually monitor results of comprehensive oral exams to ensure that this outcome continues to be met. Faculty members on graduate committees are responsible for ensuring that consistency and quality of comprehensive oral examinations are maintained.

**For Student Outcome 2**

Individual faculty graduate advisors have been successful in encouraging graduate students to

become involved in extracurricular activities. Almost all graduate students have presented results from their research at professional meetings. Many are also involved in clubs and organizations related to their discipline. We are pleased with their participation rate.

Link to Assessment Data: Faculty graduate advisors report graduate student extracurricular activity participation to the departmental chair in their annual activity reports. The chair summarizes these data and includes them in the departmental Annual Report submitted to the Dean of the College of Arts and Sciences. The departmental Chair administers a questionnaire to those graduating. Even though the number of graduates each year is small, this will provide a much improved method for assessing progress towards this learning outcome.

**For Student Outcome 3**

We are very pleased with the success of this learning outcome. Many graduate students publish research findings from their theses, usually co-authored with their advisors. Most of these presentations and publications are funded with external grants and contracts acquired by faculty members.

Link to Assessment Data: An ultimate produce of this outcome is the number of publications and presentations that include graduate students as the lead author or co-author. The departmental chair continues to monitor the number of publications and presentations resulting from graduate student research, as reported in faculty activity reports. These data are summarized and included in the departmental Annual Report presented to the Dean of the College of Arts and Sciences. This learning outcome is closely tied to Program Goal 3.

**APPENDIX SEMINAR EVALUATION FORM**

STUDENT NAME_____

DATE_____

TITLE OF TALK_____

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**Instructions for Faculty Evaluators**

Assign a letter grade to the seminar that you think reflects the overall quality of the presentation. Some of the major points to consider include:

1) Quality of slides or other visual aids. Tables and graphs should be easily visible and understandable. Lengthy tables copied from the thesis are not acceptable.

2) Organization of the presentation. The seminar should be presented in a logical order, i.e. introduction; materials and methods; results; conclusions; significance.

3) Quality of the research. The study should have scientific merit and should be well designed. The hypothesis tested (in some cases this may not apply) should be stated clearly. Analysis and results should clearly conform with the conclusions reached.

4) Knowledge of the subject matter. The student should be thoroughly familiar with all aspects of the research. This includes familiarity with the current and historical literature. The student should be able to answer questions regarding the design of the study, analyses of data, interpretation of results and conclusions; they should also be able to explain how the study has advanced the state of knowledge in a particular area.

5) Delivery of the presentation. The student should be dressed appropriately and should deliver the seminar in a poised, clear, and understandable manner. All attending the seminar should easily be able to hear what is being said. Reading is acceptable, assuming that eye contact is established with the audience frequently and that the seminar is conducted according to procedures considered normal for scientific presentations.

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**GRADE ASSIGNED** _____

(A = Excellent; B= Good; C = Average; D = Below Average; F = Unacceptable)

**COMMENTS AND CONSTRUCTIVE CRITICISM**

Graduate Student Exit Questionnaire

1. What was the best course you took and why?

2. What was the worst course you took and why?

3. What course(s) would you have liked to have been able to take but we did not offer?

4. What would you change with the curriculum if you could?

5. Did you participate in any extracurricular activities and if so which ones (e.g., student organization membership, special field trips that are not class related, involvement in research activities of other graduate students, and attendance at scientific meetings)?

6. What would you do to improve your experience/experience of those to follow you?

7. Did you get all you needed from your mentor in the way of direction?

8. Did you get all you needed from your mentor in the way of support (e.g., financial)?

9. What did the department not have that was needed?

10. Comments?