



## Final Annual Report

**Tennessee Tech University**

**President**

**Provost**

**College of Arts and Sciences**

**Biology**

**Biology MS**



### **Department of Biology Mission and Definition**

**Department/Unit Contact:** Robert Kissell

#### **Mission/Vision/Goal Statement**

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.

The Department of Biology has three degree programs (B.S. in Biology, B.S. in Wildlife and Fisheries Science, and M.S. in Biology). Each degree program has a separate report. Program Goals and Student Learning Outcomes for the undergraduate programs are similar since Wildlife and Fisheries Science is applied Biology; however, assessment results differ for most goals and outcomes based on the assessment techniques used. The graduate program has a unique set of goals and learning outcomes.

This section contains the MS program in Biology.



#### **Program Goal 1**

##### **Define Goal**

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

##### **Intended Outcomes / Objectives**

Goal 1 - Increase graduate student enrollment by 10% annually and thus graduation rates through recruitment, retention, and marketing.

**Program Goal 2****Define Goal**

Program Goal 2: Make significant progress toward increasing diversity.

**Intended Outcomes / Objectives**

Goal 2 - The Department of Biology will make significant progress toward desegregation and affirmative action objectives.

**Program Goal 3****Define Goal**

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

**Intended Outcomes / Objectives**

Goal 3 - Increase faculty involvement in research and the graduate program through differential teaching loads to interested tenure-track or tenured faculty members.

**Student Learning Outcome 1****Define Goal**

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.

**Intended Outcomes / Objectives**

Student Learning Outcome 1 - The Department of Biology desires an outcome of 100% of Master of Science candidates demonstrate a command of principles within general biology and the specialized disciplines in their area of interest through oral comprehensive examinations.



## Student Learning Outcome 2

### **Define Goal**

Student Learning Outcome 2: All Master of Science candidates in the Department of Biology will participate in extracurricular activities related to their disciplines.

### **Intended Outcomes / Objectives**

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

### **Define Goal**

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.

### **Intended Outcomes / Objectives**

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. This outcome will be demonstrated through the research, written thesis, and oral comprehensive examinations.



## Assessment - Goal 1

**Goal/ Outcome/ Objective:** Increase graduate student enrollment and thus graduation rates through recruitment, retention, and marketing.

**Type of Tool:** Graduation Rate, Retention Rate

### **Rationale**

TECH TRENDS Institutional Research 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.

**Frequency of Assessment:** Annually



## **Assessment - Goal 2**

**Goal/ Outcome/ Objective:** Make significant progress toward increasing diversity

**Type of Tool:** Survey

### **Rationale**

**Frequency of Assessment:** Annually



## **Assessment - Goal 3**

**Goal/ Outcome/ Objective:** Increase faculty involvement in research and the graduate program.

**Type of Tool:** Annual Unit Report

### **Rationale**

The Faculty Annual Report is conducted annually in the Spring semester. Each faculty member submits a Faculty Annual Effort report to the chairperson that discusses their efforts for the previous calendar year.

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.

**Frequency of Assessment:** Annually



## **Assessment - Student Learning Outcome 1**

**Goal/ Outcome/ Objective:** All Master of Science candidates in the Department of Biology

**Type of Tool:** Exit Exam

### **Rationale**

Comprehensive Oral Exams are 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.

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.

**Frequency of Assessment:** Each semester



### Assessment - Student Learning Outcome 2

**Goal/ Outcome/ Objective:** All Master of Science candidates in the Department of Biology will participate in extracurricular activities related to their disciplines.

**Type of Tool:**

#### Rationale

The Faculty Annual Report is 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. Data representing the participation in extracurricular events are gathered from those reports in a report provided to the Dean of the College of Arts and Sciences. The Chair of the Department of Biology in Spring 2015 began an exit interview system to gather data to better address this outcome.

**Frequency of Assessment:** Annually



### Assessment - Student Learning Outcome 3

**Goal/ Outcome/ Objective:** 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.

**Type of Tool:** Exit Exam

#### Rationale

Comprehensive Oral Exams are 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.

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.

Graduate Seminar Evaluations are 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.

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 completed 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.

**Frequency of Assessment:** Each semester



### Results - Program Goal 1

**Goal/Objective/Outcome Number:** Increase graduate student enrollment and thus graduation rates through recruitment, retention, and marketing.

#### Results

**TECH TRENDS** The Department of Biology has monitored enrollment trends for several years and used these trends to develop strategies to meet this goal (Table 1). Enrollment in the M.S. Biology degree program declined between 2010 and 2012, primarily because of retirements and resignations of faculty members who traditionally advised several graduate students. The number of M.S. students increased during the next three years, primarily because recently hired faculty members have been successful at acquiring outside funding and recruiting graduate students. The number of graduate students increased in 2014 due, in part, to graduate teaching assistantships provided by the Graduate Studies Office. Retention of M.S. students has been approximately 100%.



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

Year	Number of Graduate Students
2012	15
2013	16
2014	22
2015	21
2016	16

### Attachments

No items to display.



### Results - Program Goal 2

**Goal/Objective/Outcome Number:** Make significant progress toward increasing diversity.

#### Results

#### TECH TRENDS

Efforts to increase diversity have met with mixed results (Table 2). Very few minorities have enrolled in our graduate program; two were enrolled in 2016. During Fall 2012, 56.3% of M.S. students were female. However, during Fall 2013, the percentage of female graduate students was below 50%, with 37.5% of our M.S. students being female. In the last three years females represented at least 50% of the M.S. students in Biology (63% in 2016).

#### National Association of University Fish and Wildlife Programs Data

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 and only approached the average in 2016 reported by NAUFWP.

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



Year	Percent Minority	Percent Female
	Graduate Students	Graduate Students
2012	0.0	56.3
2013	0.0	37.5
2014	4.5	50.0
2015	0.0	52.4
2016	12.5	62.5

### Attachments

No items to display.



### Results - Program Goal 3

**Goal/Objective/Outcome Number:** Increase faculty involvement in research and the graduate program.

#### Results

#### Faculty Annual Report

No promotions occurred from 2012 through 2016 (Table 3); however, two Assistant Professors received tenure in 2016, but were not promoted. One Assistant Professor submitted his tenure and promotion package and will be awarded tenure and promotion in the next academic year (i.e., 2017).

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

Year	Associate Professor	Professor
2012	0	0
2013	0	0
2014	0	0
2015	0	0
2016	0	0

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	Percent of Departmental
	Conducting Research with Graduate Students	Faculty
2012	11	64.7
2013	10	58.8
2014	14	73.7
2015	14	77.8
2016	14	77.8

### Attachments

No items to display.



### Results - Student Learning Outcome 1

**Goal/Objective/Outcome Number:** 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.

### Results

**Comprehensive Oral Exams** 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 (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
2012	7	15	47
2013	5	16	31
2014	7	22	32
2015	9	21	43
2016	10	16	63

## Attachments

No items to display.



## Results - Student Learning Outcome 2

**Goal/Objective/Outcome Number:** All Master of Science candidates in the Department of Biology will participate in extracurricular activities related to their disciplines.

### Results

**Faculty Annual Report** Almost all graduate students participated in extracurricular activities. We are especially pleased that most graduate students attended at least one scientific meeting per year, and many presented their research findings at these meetings (Table 5).

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
2012	7	15	47
2013	5	16	31
2014	7	22	32
2015	9	21	43
2016	10	16	63



## Attachments

No items to display.



### Results - Student Learning Outcome 3

**Goal/Objective/Outcome Number:** 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.

#### Results

**Comprehensive Oral Exams** All students successfully passed their oral exams during the first attempt, and many demonstrated a mastery of the subject matter of which they were tested (Table 6).

**Graduate Seminar Evaluation** 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
2012-2013	2
2013-2014	3
2014-2015	5
2015-2016	5
2016-2017	9

## Attachments

No items to display.



### Modifications and Continuing Improvement to Program Goal 1

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

#### Program Changes and Actions due to Results



This goal will remain unchanged as we are filling all the institutionally sponsored assistantships and recruiting some students through external funds. Likewise, our retention and graduation rate are very high indicating our current model is working well.

**Link to Assessment****Link to Flight Plan:** Expand Financial Resources and Modernize Infrastructure**Modifications and Continuing Improvement to Program Goal 2**

**Goal/Objective/Outcome Number:** Program Goal 2: Make significant progress toward increasing diversity.

**Program Changes and Actions due to Results**

The department assigned an ad-hoc committee to assess what changes needed to be made to increase diversity within the program. Options were considered by the faculty during the 2016-2017 academic year. It was decided to allow recruitment of minorities by individual faculty members; that decision has already resulted in two minorities being accepted in the M.S. program for the 2017-2018 academic year.

**Link to Assessment****Link to Flight Plan:** Create Distinctive Programs and Invigorate Faculty**Modifications and Continuing Improvement to Program Goal 3**

**Goal/Objective/Outcome Number:** Program Goal 3: Increase faculty involvement in research and the graduate program.

**Program Changes and Actions due to Results**

No changes to the program goal will be made as there is still room for improvement. New hires, due to retirements, are expected to increase the number of faculty members involved in research and active with graduate students.

**Link to Assessment****Link to Flight Plan:** Create Distinctive Programs and Invigorate Faculty

**Modifications and Continuing Improvement to Student Learning Outcome 1**

**Goal/Objective/Outcome Number:** 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.

**Program Changes and Actions due to Results**

No changes to the current learning objective will be made. A program review was provided for the M.S. program during the 2015-2016 academic year. One of the suggestions that is related to this outcome was to quantify the results beyond pass and fail. Following a faculty decision as to how this suggestion is to be addressed, we will modify the student learning outcome accordingly.

**Link to Assessment****Link to Flight Plan: Academic Advising****Modifications and Continuing Improvement to Student Learning Outcome 2**

**Goal/Objective/Outcome Number:** All Master of Science candidates in the Department of Biology will participate in extracurricular activities related to their disciplines.

**Program Changes and Actions due to Results**

No changes will be made to this learning objective as there is room for improvement.

**Link to Assessment****Link to Flight Plan: Other****Modifications and Continuing Improvement to Student Learning Outcome 3**

**Goal/Objective/Outcome Number:** 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.

**Program Changes and Actions due to Results**

No changes to the current learning objective will be made. A program review was provided for the M.S. program during the 2015-2016 academic year. One of the suggestions that was related to this outcome was to quantify the results. Following a faculty decision addressing this issue, we will modify the student learning outcome accordingly.

**Link to Assessment**

**Link to Flight Plan: Other**

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**-pencil Improvement to Assessment Plan for Student Learning Outcome 1****Improvements to Assessment Plan**

The department has modified the assessment process used for oral exams such that it is quantitative.

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**-pencil Improvement to Assessment Plan for Student Learning Outcome 2****Improvements to Assessment Plan**

Questions on an exit interview survey have been included to better quantify this outcome.

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**-pencil Improvement to Assessment Plan for Student Learning Outcome 3****Improvements to Assessment Plan**

The department will modify the assessment instrument used for oral exams such that it is quantitative.

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**-pencil Improvement to Assessment Plan for Program Goal 1****Improvements to Assessment Plan**

Improvements to the assessment plan will focus on the recruitment of graduate students which relies on grant and institutional funding. Emphasis will be placed on acquiring grants and improving the institutional support for assistantships. Retention and graduation rates are high and not in need of assessment modification.

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**-pencil Improvement to Assessment Plan for Program Goal 2****Improvements to Assessment Plan**

An ad-hoc committee was assigned in the spring of 2016 with the task of improving recruitment of minorities to provide for a more diverse student body. It was decided to allow recruitment of minorities by individual faculty members; that decision has already resulted in two minorities being accepted in the M.S. program for the 2017-2018



academic year.

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### Improvement to Assessment Plan for Program Goal 3

#### **Improvements to Assessment Plan**

The department has a growing number of Assistant Professors given recent retirements and a growing number of those faculty members are seeking to pursue a research track. The faculty needs to discuss a reasonable, quantified percentage of the faculty that can be afforded time devoted to research and still balance teaching. A change to the assessment plan will be made once this is agreed upon by the faculty; discussions of this topic will be on-going in 2017-2018.