Definition of Unit
Department of Biology Mission and Definition
Reporting Year:

Providing Department:
Biology MS

Department/Unit Contact:
Christopher Brown

Mission/Vision/Goal Statement:

The primary mission of the Department of Biology at Tennessee Tech is to promote biological education in, and advance biological knowledge for, 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.

Goal/Objective/Outcome
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 increase 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 that 100% of Master of Science candidates demonstrate a command of principles within general biology and the specialized disciplines in their area of interest through successful completion of 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 their research, written thesis, and oral comprehensive examinations.

Assessment Tools

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

Frequency of Assessment:
Annually

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.

Assessment - Goal 2

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

Type of Tool:
Survey

Frequency of Assessment:
Annually

Rationale:

The Departmental Annual Report is submitted annually to the College of Arts and Sciences. These data are also compared with those summarized by the National Association of University Fish and Wildlife Programs.

Assessment - Goal 3

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

Type of Tool:
Annual Unit Report

Frequency of Assessment:
Annually

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 2016, 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.

Assessment - Student Learning Outcome 1

Goal/ Outcome/ Objective:
All Master of Science candidates in the Department of Biology will demonstrate a command of principles within general biology and the specialized disciplines in the area of interest.

Type of Tool:
Exit Exam

Frequency of Assessment:
Each semester

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.

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:

Annual Unit Report,Survey

Frequency of Assessment:

Annually

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.

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

Frequency of Assessment:
Each semester

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 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.

Results

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 [Program Goal 1 (Table 1)]. Other than during 2016, enrollment has remained relatively constant at between 19 and 22 M.S. students. 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
2014	22
2015	21
2016	16
2017	20
2018	19

Attachments:

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; four were enrolled in 2017, with this percentage being the highest in recent history. During all but the most recent year, at least 50% of our M.S. students have been female.

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 but exceeded the average reported by NAUFWP.

Table 2. Percent of Biology M.S. students that identified as minority or female, by year.

Year	Percent Minority Graduate Students	Percent Female Graduate Students
2014	4.5	50.0
2015	0.0	52.4
2016	12.5	62.5
2017	20.0	50.0
2018	?	42.1

Attachments:

Results - Program Goal 3

Goal/Objective/Outcome Number:

Increase faculty involvement in research and the graduate program.

Results:

Faculty Annual Report

Three promotions occurred in the last five years (Table 3); one Assistant Professor received tenure and was promoted in 2017, and two Assistant Professors received tenure and were promoted in 2018.

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

Year	Associate Professor	Professor
2014	0	0
2015	0	0
2016	0	0
2017	1	0
2018	2	0

To date three members of the faculty have selected the research option over the past 5 years. The majority of faculty members selected the standard option, and one of the senior-most faculty members has 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
2014	14	73.7
2015	14	77.8
2016	14	77.8
2017	13	81.3
2018	12	70.6

Attachments:

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 2018-2019 academic year, and many demonstrated a mastery of the subject matter of which they were tested by presenting either oral or poster presentations at scientific meetings at the local, regional, or national level (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
2014	7	22	32
2015	9	21	43
2016	10	16	63
2017	6	20	30
2018	8	19	42

Attachments:

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; in particular, many assist with projects other than their own research. 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 via oral or poster presentations (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
2014	7	22	32
2015	9	21	43
2016	10	16	63
2017	6	20	30
2018	8	19	42

Attachments:

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

2014-2015	5
2015-2016	5
2016-2017	9
2017-2018	6
2018-2019	7

Attachments:

Modifications and Continuing Improvement to Goals/Objectives/Outcomes

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:

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. The number of M.S. students should increase increase going forward, primarily the result of faculty obtaining grants that enable them to pursue research assistantships for students.

Link to 'Tech Tomorrow' Strategic Plan:

Experiential Learning,Research, Scholar, Intellect, and Creativity

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. We plan to continue this process.

Link to Assessment:

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.

Link to 'Tech Tomorrow' Strategic Plan:

Diversity,Research, Scholar, Intellect, and Creativity

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:

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.

Link to 'Tech Tomorrow' Strategic Plan:

Research, Scholar, Intellect, and Creativity

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. However, there has been no strong desire to move to a letter-graded system among the graduate faculty.

Link to Assessment:

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.

Link to 'Tech Tomorrow' Strategic Plan:

Research, Scholar, Intellect, and Creativity

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:

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 provides a much improved method for assessing progress towards this learning outcome.

Link to 'Tech Tomorrow' Strategic Plan:

Experiential Learning,Research, Scholar, Intellect, and Creativity

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. However, there has been no strong desire among the graduate faculty to move beyond a pass/fail decision.

Link to Assessment:

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.

Link to 'Tech Tomorrow' Strategic Plan:

Research, Scholar, Intellect, and Creativity

Improvement to Assessment Plan

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.

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.

Improvement to Assessment Plan for Student Learning Outcome 3

Improvements to Assessment Plan:

No changes will take place at this time as last year the department modified the assessment instrument used for oral exams such that it is quantitative. It will take several years to gather sufficient data to assess this approach.

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.

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 resulted in two minorities being accepted in the M.S. program for the 2017-2018 academic year. We continue to pursue this approach.

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 were on-going in 2018-2019.