Institutional Effectiveness
2018-2019

Program: Biology WFS BS

College and Department: College of Arts & Sciences – Department of Biology

Contact: Christopher Brown

Mission: 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.

Program Goals:

PG 1: Increase the percentage of students in the WFS major who complete a cooperative program ("co-op"), experiential internship, and/or study abroad during their undergraduate years.

The goal is to have 25% of Wildlife & Fisheries Science students complete one or more cooperative program ("co-op"), experiential internship, or study abroad opportunity during the time they are an undergraduate.

PG 2: Faculty in the Department of Biology will increase the incorporation of active-learning strategies in courses offered.

All departmental faculty members are expected to receive pedagogical training in active-learning techniques and strategies during their first 3 years of employment. We would like at least 75% of Department of Biology faculty to incorporate active-learning/critical-thinking strategies into their individual courses to improve the reasoning ability of our students.

PG 3: The Department of Biology will increase undergraduate retention.

Our goal is to increase the retention rate so that it equals or exceeds that of the university's average rate of retention.

PG 4: The Department of Biology will make significant progress toward increasing diversity.

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

Student Learning Outcomes:

SLO 1: Undergraduate Wildlife and Fisheries Science majors will demonstrate improved critical thinking skills.

Our goal is for students to meet or exceed the national average score on the California Critical Thinking Skills Test (CCTST).

SLO 2: Wildlife and Fisheries Science majors will participate in extracurricular activities related to their discipline.

Our goal is to have at least 25% of all Wildlife & Fisheries Science majors participate in extracurricular activities related to their discipline.

SLO 3: All students completing a degree in Wildlife and Fisheries Science at Tennessee Tech University will use scientific reasoning as codified by the structured process commonly known as the scientific method.

Our goal is to have all graduating seniors obtain a perfect score (100% correct answers) on the departmental Scientific Method Questionnaire.

SLO 4: Wildlife and Fisheries Science majors will be able to demonstrate a command of general biology concepts and the general principles in the various areas in natural resources management.

Our goal is to have our students perform above average in the ACAT Major Field Examination.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

Assessment Methods:

PG 1: Increase the percentage of students completing a co-op, internship, or study abroad

1. Senior Questionnaire

Graduating seniors are asked to complete a short Senior Questionnaire concerning extracurricular activities, including cooperative programs and internships, at the time they take their major field exam; this questionnaire includes an assessment of how valuable they considered the experiences. O7.8enmtuwT.93.3 (o)in. O71.3 (h)2.3 (ip)2.2 (s)-1.3 7deredn0 Td3.4 (v)-52 ()-2. (

Conducted annually each Spring semester. Each faculty member submits a Faculty Annual Effort report to the chairperson that discusses their efforts for the previous calendar year. The departmental chair tracks the number of faculty participating in active-learning training and mentoring, and the incorporation of active learning/critical thinking strategies by gleaning such information from these reports.

The department chair discusses each individual faculty member's progress as summarized in Faculty Annual Reports**.** Active-learning is assessed by determining the number of Department of Biology faculty that enhance their knowledge of active-learning teaching approaches by participating in on- or off-campus training and development workshops devoted nie

SLO 1: Demonstrate improved critical thinking skills

1. California Critical Thinking Skills Test (CCTST)

   The CCTST is administered during Fall and Spring semesters to graduating seniors, and evaluates students' abilities to critically think based on skills that they have learned in their courses.

2. Select Items on the National Survey of Student Engagement (NSSE)

   The NSSE was given Spring semesters 2006, 2009, 2011, 2014, 2017. The NSSE assesses students' abilities to work as a team, communicate, and critically think. These values will be compared to data from the senior questionnaire and results from course evaluation reports.

   The NSSE report changed how data are categorized from 2011 to 2014. As a result, the results provided for 2014 combines Biology in with Biochemistry or biophysics, Biomedical science, Botany, Cell and molecular biology, Chemistry; Earth science (including geology), Marine science, Mathematics, Microbiology or bacteriology, Natural science, Other biological sciences, Physical sciences (general), Physics, and Zoology. Therefore, the comparisons are not necessarily representative of Biology alone.

SLO 2: Participate in extracurricular activities

1. Select items on NSSE
2. Senior Questionnaire

SLO 3: Use scientific reasoning

zoology, vascular botany, and forestry & wildlife. Invertebrate zoology is assessed for fisheries and conservation biology majors only because wildlife majors are not required to take invertebrate zoology.

All graduating senior WFS majors are asked to take the ACAT Major Field Examination

Since 2014, at least 80% of departmental faculty incorporated active-learning/critical- thinking strategies into their individual courses (Table 3). The most commonly listed approaches were analysis and interpretation of independently gathered data in lab exercises and reviews of peer-reviewed articles. Several courses required students to work in teams to gather data that could not be collected as individuals, and they were required to provide a team report at the end of these exercises. Many lab exercises attempted to simulate real-world problems, and students were required to develop solutions to these problems. Many upper division labs are designed to be "on-going", and each week's exercise builds on techniques or information learned during the previous week. All of our majors must complete a group research project as part of the BIOL 3920 course and present their findings and interpretations in a written and oral format. There have also been attempts at doing a flipped classroom in several courses over the past several semesters. Thus, we feel that we are doing an admirable job of incorporating critical thinking and active learning in our courses, but we will continue to develop additional approaches in these areas.

Table 3. Percent of Department of Biology faculty incorporating active-earning/critical- thinking strategies in their courses during the last five years.

Academic Year

PG 3: Increase undergraduate retention

The Department of Biology has monitored enrollment trends for several years and used these trends to develop strategies to meet this goal (Table 5). Although enrollment was not viewed as a concern by the department in 2018, in order to maintain a perspective on retention, enrollment data are included. In Fall 2018, enrollment was 175 WFS students, and enrollment has remained relatively steady over the past 5 years (between 172 and 185). Wildlife is still the most popular concentration in the department, representing approximately 57% of all WFS majors. Fisheries and Conservation Biology are equally sought after concentrations with 20% and 23% of WFS students in each concentration, respectively. As we have for several years, our overall departmental retention rate (combining biology and WFS majors) falls below the University average.

Table 5. Number of students enrolled as Wildlife and Fisheries Science majors and freshman fall-to-spring retention rates (percent) for undergraduates within the Department of Biology and Tennessee Tech University.

Fall	Enrollment – WFS	Retention – Biology Dept.	Retention – TTU
2014	185	87.8	90.6
2015	179	82.1	91.9
2016	185	86.3	92.4
2017	172	84.7	90.3
2018	175	86.4	91.3

PG 4: Increase diversity

Despite efforts to increase diversity (e.g., recruiting trips) to attract minority students, resusædo704 49OC /Span <</MC3

National Association of University Fish and Wildlife Programs Data: Data from the National Association of University Fish and Wildlife Programs for 2010-2011 indicate the same trend as noted in TECH TRENDS, with minorities representing only 8.5% of undergraduate majors. Over the last 5 years, over 50% of all undergraduate Biology majors have been females. In contrast, the percentage females in the WFS B.S. program averaged less than 25% during that same period, although the numbers have crept closer to 30% over the past two academic years. In 2018, 51 of 175 WFS students were female, compared to 195 of 292 Biology majors who identify as female.

SLO 1: Demonstrate improved critical thinking skills

CCTST results for Tennessee Tech WFS majors averaged 17.3 for 2018-2019. The TTU average for this a9.8 (a35 -1.31.9 (o)-ud)2.3 r ac(18)]TJh t(a)-v-

SLO 2: Participate in extracurricular activities

National Survey of Student Engagement: NSSE data for 2014 seniors indicated that only 66% of seniors in the Biological Sciences participated in extracurricular activities; the majority averaged between one and five hours per week in participation. Our data indicate a much higher participation rate (i.e., 94.1%) than the NSSE data (Table 8).

Senior Questionnaire: During the past five years, 94.0% of graduating WFS majors indicated that they

Table 9. Student performance (percent) on the scientific method exam administered to students in BIOL

on reviving it this year and coming up with new strategies. This may make better use of the university diversity offices than have been done in the past.

SLO 1: Demonstrate improved critical thinking skills

Faculty report a much higher inclusion of critical thinking skills as a part of their courses than are represented in the IDEA evaluations. There are many other factors in the IDEA evaluations to consider and some of those factors may be considered of greater importance. The greater the number of factors included for evaluation the poorer the score may be and this, in combination with the importance of critical thinking skills relative to the other factors, may preclude inclusion of critical thinking skills and direct assessment via the IDEA evaluation. Faculty will be encouraged to include metrics that reflect the critical thinking skills in their IDEA evaluations for better assessment.

When compared with data from the National Survey of Student Engagement (NSSE) 2017 results, our students were found to be no different compared to the national average in critical thinking.

SLO 2: Participate in extracurricular activities

Historically, the departmental faculty has encouraged participation when advising, in classes, and via flyers announcing opportunities. With such methods approximately 94% of students have engaged in extracurricular activities during their academic career in the WFS degree program. To increase that number, we will make opportunities available by reaching out to students through electronic media (e.g., email) in addition to the currently used methods.

Participation by Wildlife and Fisheries Sciences majors in internships during the 2018-2019 academic increased slightly from 8.8% to 9.1%, although this likely represents no increase in the absolute number of students participating. To encourage more students to pursue internships and co-ops, we will began allowing students to substitute an internship, along with Conservation Techniques (a 3-hour Maymester

Courses that habitually have lower than average scores will be assessed to determine what can be done to improve retention of knowledge, although this does not seem to have been an issue this past academic year. We will also discuss ways to encourage students to perform well on the exam; since it has no grade associated with it, students often fail to take it seriously and may not study for it. This can lead to lower scores than might otherwise obtain.

We will continue to monitor student progress through the ACAT Major Field Examination.

Appendices

1. Biology WFS Curriculum Map
2. Senior Questionnaire
3. Scientific Method Questionnaire

Appendix 1: Biology WFS Curriculum Map

Appendix 2: Senior Questionnaire

GRADUATING SENIOR QUESTIONNAIRE

Department of Biology

1. Activities - Please check any of the extracurricular activities in which you participated during your program at Tennessee Tech, and briefly indicate if you felt that these activities contributed to your academic development.

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Appendix 3: Scientific Method Questionnaire

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Theories B. Controls C. Hypotheses D. Observations E. Replicates

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Theory B. Control C. Hypothesis D. Experiment E. Law

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Hypothesis B. Control C. Theory D. Experiment E. Replication

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Observation B. Control C. Hypothesis D. Experiment E. Replication

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