

**Institutional Effectiveness**  
**2021-2022**

**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.

**Student Learning Outcomes:**

SLO 1:

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 to such approaches. In addition, 100% of new Department of Biology faculty are paired with a faculty mentor who has experience with active-

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

The NSSE was given Spring semesters 2006, 2009, 2011, 2014, 2017, 2020. 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 IDEA 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

1. Scientific Method Exams:

Scientific Method Exams developed by the Biology Department are administered to students in selected classes that determine the degree to which students have learned the scientific method and to determine if they agree that our classes are adequately teaching the scientific method. Biology majors enrolled in two courses (a freshman course and an upper-division course) are required to complete a Scientific Method Exam at the end of the semester during which they take the courses. Results are evaluated by the departmental chair and the course instructors to determine the degree to which students have learned the scientific method and to determine if they agree that our classes are adequately teaching the scientific method. Comparisons are made for scores achieved by students in the freshman course and those achieved in the upper-division course.

SLO 4: Demonstrate a command of general biology concepts and principles

1. ACAT Major Field Examination:

Administered each Fall and Spring semester. The ACAT exam breaks subject matter into a number of biological categories. We can select which categories should be used in evaluating our WFS majors. This op13.6rau a(t)10.9 ( wh).ii04(c)1.1 (a)2.7 (te)gical Sld





Table 5. Number of students enrolled as Wildlife and Fisheries Science majors at the start of the Fall semester, and freshman fall-to-spring retention rates (percent), for undergraduates within the Department of Biology and Tennessee Tech University. Retention rates for 2022 are not available as of the writing of this report.

Fall	Enrollment – WFS	% Retention – Biology	% Retention – TTU
2017	172	84.7	90.3
2018	175	86.4	91.3
2019	185	87.0	89.9
2020	173	73.7	86.8
2021	156	-	-
Average		83.0	89.6

## SLO 1: Demonstrate improved critical thinking skills

Over the past 5 years, WFS majors have generally outperformed the national average on the California Critical Thinking Skills Test (CCTST; Table 7). The two exceptions were 2017-18 and 2020-21, when our students were slightly below the national average. Average scores for our majors improved slightly this year after falling for several years.

Table 7. Average score for WFS majors, and sample size (n) on the California Critical Thinking Skills Test (CCTST) during the past five years. NOTE: The test moved from a 34-point maximum score to a 100-point maximum score in 2018-19.

Academic Year	TTU WFS	n	National
2017-2018	15.0	28	16.2



communication, and critical-thinking on IDEA evaluation forms. For 2021-22 data, values represent the percentage of courses with average scores at or above 3.5 in each category.

YEAR	TEAMWORK	COMMUNICATION	CRITICAL-THINKING
2017-18	48.0%	40.2%	63.1%
2018-19	51.0%	46.8%	



### **Modifications for Improvement:**

The Biology Department planning committee is being revamped this academic year to include faculty from all levels (tenured, tenure-track, and lecturers/instructors). This committee will begin the process of reviewing our existing goals and learning outcome, and proposing to keep them, modify them, or remove them and add new goals/outcomes. This will be the first major revision of our departmental objectives in at least 10 years, and is overdue, especially since over half of our current faculty were not here when things were last updated.

### **Appendices**

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

## Appendix 1: Biology WFS Curriculum Map

Course No.	Title	Learning Outcomes			
		Critical Thinking	Extra-curricular Activities	Scientific Method	Demonstrated Knowledge
BIOL 1000	Intro. to Biol. Methods	X	X	X	
BIOL 1010	Introduction to Biology	X		X	X
BIOL 1020	Diversity of Life	X		X	X
BIOL 1080	Concepts of Biology	X	X	X	X
BIOL 1113	General Biology I	X		X	X
BIOL 1123	General Biology II	X			X
BIOL 2010	Human Anat. & Phys. I	X		X	X
BIOL 2020	Human Anat. & Phys. II	X		X	X
BIOL 2310	General Botany	X	X		X
BIOL 2350	Intro. Anat. & Phys.	X			X
BIOL/WFS 29914	Topics				X
BIOL 3040	Comparative Vert. Anat.	X			X
BIOL 3120	General Ecology (no lab)	X		X	X
BIOL/WFS 3130	General Ecology	X		X	X
BIOL 3140	Cellular Biology	X	X	X	X
BIOL 3200	General Microbiology	X		X	X
BIOL 3230	Health Science Microbiol.	X		X	X
BIOL 3240	Field Botany	X		X	X
BIOL 3330	Entomology				X
WFS/CJ 3500	Wildlife Law Enforcement		X		X
BIOL 3530	Animal Physiology	X			X
BIOL 3700	Humanism in Medicine	X			X
BIOL 3810	General Genetics	X		X	X
BIOL 3920	Biol. Comm. Skills	X	X	X	X
BIOL 4000	General Parasitology	X			X
BIOL 4040	Immunology	X			X
BIOL 4060	Hormones/Chem. Comm.	X			X
BIOL 4100	Evolutionary Biology	X	X	X	X
BIOL 4130	Enviro. Microbiology	X		X	X
BIOL 4140	Pathogenic Bacteriology	X			X
BIOL 4150	Molecular Genetics	X			X
BIOL 4160	Genetic Engineering Lab				X
BIOL/WFS 4220	Biostatistics	X		X	X
BIOL/WFS 4230	Animal Behavior	X			X
BIOL 4320	Plant Physiology	X	X	X	X
BIOL 4330	Plant Ecology	X		X	X
WFS 4500	National Wildlife Policy	X			X

BIOL 4610	Invertebrate Zoology	X		X	X
BIOL/WFS 4630	Ornithology	X			X
WFS 4640	Waterfowl Ecology & Mgt.	X			X
BIOL/WFS 4650	Marine Biology	X		X	X
WFS 4660	Wild Bird Ecology				X
WFS 4670	Wild Mammal Ecology				X
WFS 4700	Habitat Management	X		X	X
WFS 4710	Fisheries Management	X		X	X
WFS 4711	Fisheries Mgmt. (no lab)	X			X
WFS 4730	Conservation Biology	X	X	X	X
WFS 4740	Wildlife Principles	X			X
BIOL 4750	Medical Microbiology	X			X
WFS 4760	Fish Culture	X	X		X
WFS 4770	NongameSpecies Mgmt.	X	X		X
BIOL 4780	Phycology	X		X	X
WFS 4790	Wildlife Techniques	X	X	X	X
BIOL/WFS 4810	Ichthyology	X	X		X
BIOL/WFS 4820	Mammalogy	X	X		X
BIOL/WFS 4830	Herpetology	X	X		X
BIOL/WFS 4840	Limnology	X		X	X
BIOL 4850	Applied Microbiology	X		X	X
BIOL/WFS 4900	Internship				X
BIOL/WFS 49914	Advanced Topics	X	X		X

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Appendix 2: Senior Questionnaire

GRADUATING SENIOR  
QUESTIONNAIRE

Department of Biology

1.

2. **Classes** - List below required classes th

### Appendix 3: Scientific Method Questionnaire

#### Scientific Method Questionnaire

Please select the response that best completes the sentence or answers the question.

\_\_\_\_\_ 1. \_\_\_\_\_, in which the experimental variable has been omitted, are used in research as standards for comparison against which experimental data are compared.

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

\_\_\_\_\_ 2. A \_\_\_\_\_ is a tentative answer to a research question, which will be evaluated using an experiment.

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

\_\_\_\_\_ 3. \_\_\_\_\_ is the use of multiple observations in a study.

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

\_\_\_\_\_ 4. True (A) or False (B): Science is knowledge obtained by observation.

\_\_\_\_\_ 5. True (A) or False (B): A theory is a very tentative idea with little or no scientific evidence to support it.

\_\_\_\_\_ 6. True (A) or False (B): Publishing results in a peer-reviewed journal is an important part of the scientific process.

Does oatmeal really reduce bad cholesterol? You decide to answer this question. You predict that people who eat oatmeal 5 times a week for a month will have lower cholesterol than those who don't. You select 10 people, 5 of whom you put on this oatmeal diet, and 5 of whom you don't. At the end of the month you measure cholesterol in all 10 people.

\_\_\_\_\_ 7. The statement "Oatmeal reduces bad cholesterol levels" is \_\_\_\_\_ of this research.

\_\_\_\_\_ 8. Using more than 1 person in each group illustrates the concept of \_\_\_\_\_.

\_\_\_\_\_ 9. Using a group of people who do not eat oatmeal illustrates the concept of \_\_\_\_\_.

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

Please arrange the following steps of the scientific method in the correct order.

\_\_\_\_\_ design an experiment

\_\_\_\_\_ make observations

\_\_\_\_\_ publish results

\_\_\_\_\_ formulate a research hypothesis

\_\_\_\_\_ draw conclusions

\_\_\_\_\_ collect data