

Virginia Tech Degree Proposal
B.S. in Fish and Wildlife Conservation, FWC
(CIP: 03.0601)

Type of degree action: New Spinoff Revision Discontinuance

Program description

Faculty in the Department of Fish and Wildlife Conservation, in the College of Natural Resources and Environment at Virginia Tech, propose a new Bachelor of Science (B.S.) degree in Fish and Wildlife Conservation, to begin in Fall 2014. This new degree program is motivated by emerging issues involving the conservation and management of populations of animals, and that are prominent in local, regional and national discourse. Importantly, this new B.S. degree reflects the growing recognition of research conducted by faculty members in the Department of Fish and Wildlife Conservation at Virginia Tech, which is focusing national concern on issues such as the precipitous decline of common mammals in the Everglades National Park, the transmission of pathogens among humans and animals, and the benefits as well as risks of producing genetically engineered animals as food. Enrollment in fisheries and wildlife programs nationwide tends to rise and fall in parallel with interest in environmental issues, and are rising again, most recently due to increasing awareness of such environmental issues as global climate change, rising sea levels, and ecological sustainability needs.

Fish and wildlife conservation encompasses the study and management of aquatic and terrestrial species, their habitat, humans exploiting them, and with the goal of sustaining these living resources for future generations. The proposed degree will serve two primary audiences: (1) students interested in the program for reasons of career development, and (2) employers seeking to recruit professionally trained fisheries and wildlife scientists, managers, and conservationists. The purpose of this degree program will be to produce graduates with the requisite training to handle the full range of applied issues posed by exploitation of fishes and hunted species, protection of imperiled species, and management of nuisance or invasive species. Students in this degree program will be trained in underlying theory and management practices that contribute to adaptive and effective fish and wildlife conservation. Moreover, two lines of curricular focus are extended to all of the majors in this degree, after completing their strong common core: (1) Fish: for students interested in research and management of aquatic animals and ecosystems, including shellfish, endangered species, sport fish, and aquaculture fish, and (2) Wildlife: for students interested in research and management of terrestrial species; game birds and mammals; and other nongame birds, mammals, reptiles, and amphibians. Collectively, all graduates will be competitive for entry-level employment in fish and wildlife conservation and management, as well as successful pursuit of graduate training.

Curriculum summary

The proposed B.S. in Fish and Wildlife Conservation degree comprises 120 credits, distributed as follows:

I. Curriculum for Liberal Education (CLE; all students; 36 credit hours)**II. Degree Core Requirements (all students; 40-42 credit hours)****Fundamentals of Science – 17-18 credit hours**

CHEM 1035 General Chemistry (3)
CHEM 1036 General Chemistry (3)
CHEM 1045 General Chemistry Laboratory (1)
CHEM 1046 General Chemistry Laboratory (1)
STAT 3615 Biological Statistics (3)

Organic Chemistry restricted elective (take one of the following)

CHEM 2514 Survey of Organic Chemistry (3)
CHEM 2535: Organic Chemistry (3)

Physical Science elective (take one of the following)

CSES 3114 Soils (3) (requires concurrent enrollment in CSES 3124 Soils Lab [1])
CSES 3134 Soils in the Landscape (3)
GEOS 3034 Oceanography (3)
GEOG 3114 Introduction to Meteorology (3)
GEOS 1004 Physical Geology (3)
PHYS 2205 General Physics (3)
PHYS 2206 General Physics (3)

Degree Core Courses – 17 credit hours

NR 1114: Introduction to Renewable Natural Resources (2)
FIW 2114 Principles of Fisheries and Wildlife Management (3) (can be applied towards
CLE Area 7 requirement)
FIW 4414 Population Dynamics and Estimation (3)
FIW 4464 Human Dimensions of Fisheries and Wildlife (3)
BIOL 2704 Evolutionary Biology (3)

Legal foundation restricted elective (take one of the following)

AAEC 3314: Environmental Law (3)
FOR 4434 Forest Resource Policy (3)
UAP 4344: Law of Critical Environmental Areas (3)

Communications – 6 credit hoursSpeaking restricted elective (take one of the following)

COMM 2004 Public Speaking (3)
AEE 3634 Communicating Agriculture and Life Sciences in Speaking (3)

Writing restricted elective (take one of the following)

ENGL 3764 Technical Writing (3)
ENGL 3774 Business Writing (3)
AEE 3624 Communicating Agriculture and Life Sciences in Writing (3)

III. Major Requirements: Two distinct major concentrations are available to the students in this degree program: Fish Conservation or Wildlife Conservation, both focused on research and management issues related to conservation and environmental consultancy.

Fish Conservation Major (23 credit hours)

FiW 4424: Ichthyology (4)

FiW 4614: Fish Ecology (3)

FiW 4714: Fisheries Management (4)

FiW 3514: Fisheries Techniques (3) or FiW 4624: Marine Ecology (3)

BIOL 2804: Ecology (3)

STAT 3616: Biological Statistics (3)

FiW 4314: Conservation of Biological Diversity (4) or GEOS 3034: Introduction to Oceanography (3)

Wildlife Conservation Major (27 credits)

FiW 2314: Wildlife Biology (3)

FiW 2324: Wildlife Field Biology (3)

FiW 4214: Wildlife Field Techniques (3)

BIOL 4404: Ornithology (4)

BIOL 3204: Plant Taxonomy (3)

BIOL 4434: Mammalogy (4)

FOR 2324: Dendrology Laboratory (1)

FOR 4114: Information Technology for Natural Resources Management (3) or GEOG 4084: Introduction to Geographic Information Systems (3) or GEOG 4354:

Introduction to Remote Sensing (3) or FOR 4124: Forest Photogrammetry and Spatial Data (3)

FiW 3414: Disease Ecology and Ecosystem Management (3) or FiW 4454: Vertebrate Pest Management (3) or FiW 4534 Ecology and Management of Wetland Systems (3)

Free Electives (9-12 credits)

Relevance to university mission and strategic planning

The proposed program supports the mission of the Department of Fish and Wildlife Conservation, the College of Natural Resources and Environment, and Virginia Tech.

The mission of the Department of Fish and Wildlife Conservation

(http://fishwild.vt.edu/pdf_files/strategic_plan_07.pdf) is to be a center of academic excellence in aquaculture, conservation ecology, and fisheries and wildlife sciences by providing quality programs in teaching, research and outreach that will enhance fish and wildlife management at state, national, and international levels. We aim to graduate high quality professional fisheries and wildlife researchers and managers who will assume leadership positions in resource agencies, the professions, citizen organizations, and the private sector. We are the only teaching program in Virginia that trains fisheries or wildlife scientists that are certifiable by our professional societies. Moreover, ours is the

only program conducting research and practicing extension in fisheries and wildlife in Virginia. Against this background, this degree proposal is the expression of our finding that a recognizable degree will prove attractive to a wider range of prospective students, and will contribute to growth in enrollment and recruitment into our profession.

The College of Natural Resources provides the education necessary for professional careers in conserving, using, and sustaining renewable resources, preparing students for a career that is personally gratifying, environmentally responsible, and of direct benefit to society. Ranked among the best in the country, the college's science-based programs address the social and human elements of resource management and instill in students a sense of stewardship and land-use ethics. Our graduates are prepared to take an active role in finding new and better ways to conserve, use, and sustain the nation's vital natural resources.

Virginia Polytechnic Institute and State University is a public land-grant university serving the Commonwealth of Virginia, the nation, and the world community. The discovery and dissemination of new knowledge are central to its mission. Through its focus on teaching and learning, research and discovery, and outreach and engagement, the university creates, conveys, and applies knowledge to expand personal growth and opportunity, advance social and community development, foster economic competitiveness, and improve the quality of life.

Justification for the proposed program

Response to Current Needs

Because fish and wildlife resources are owned by the people and managed as a public trust in the United States, the largest employer of fish and wildlife professionals traditionally has been the public sector. The largest employer is the collection of state fish and wildlife management agencies, represented in the Commonwealth principally by the Virginia Department of Game and Inland Fisheries, and also by the Virginia Marine Resources Commission and other agencies overseen by the Secretary of Natural Resources. Collectively, these Commonwealth agencies employ several hundred fisheries and wildlife scientists and managers. The federal government has a leading role in managing migratory species, imperiled species, and marine species outside the three-mile limit offshore. Hence, federal agencies collectively employing several thousand fish and wildlife professionals include the U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Forest Service, U.S. Geological Survey-Biological Resources Division, Bureau of Land Management, National Park Service, and U.S. Department of Agriculture. The baccalaureate degree is the credential for entry-level employment in such agencies.

Fish and wildlife resources are inherently interesting to many people, and a variety of such issues are in the news daily (e.g., regarding wildlife management areas, blue crab management, and the collapse of marine fisheries). While we expect that many students will take this degree explicitly to find employment in the field, we are also aware that many students will just want to learn about wild living resources for personal

enlightenment as a pathway to graduate professional programs in areas such as law or public administration. For such individuals, a bachelor's degree in fish and wildlife conservation is one of many pathways into professional training.

Fish conservation major. Marine fisheries are important for production of human food and industrial products such as fish meal and oil. The capture, processing, and marketing of fishery products is an important sector of regional and international trade. Fisheries must be managed effectively in order to prove sustainable, justifying the need for professional training of fisheries conservation officers. Fishery products are at historic levels of exploitation – many fisheries have collapsed (including regional fisheries such as Chesapeake Bay oysters) or are in danger of collapse (Atlantic menhaden), leading to economic dislocation and ecological impacts. The maintenance of other fisheries (e.g., Chesapeake Bay striped bass and blue crab) underlines the value of scientifically grounded fishery management. Development and implementation of sustainable recreational fisheries plans requires fisheries professionals trained at the baccalaureate level. Monitoring and management of functioning aquatic ecosystems require the skills of fisheries professionals trained at the baccalaureate level. In the aquaculture sector, formal academic training culminating in a baccalaureate degree qualifies an individual for entry-level employment, with the possibility for progress to a supervisory position.

Wildlife conservation major. Wildlife comprises a significant natural resource, providing the basis for both consumptive and non-consumptive uses. Consumptive utilization of wildlife includes hunting for sport, meat, or trophy purposes. The most recent survey by the U.S. Fish and Wildlife Service indicated that in 2011, 13.7 million people 16 years old and older enjoyed hunting a variety of animals within the United States. They hunted 269 million days, spending \$34.0 billion. Within the Commonwealth of Virginia, 432,000 individuals hunted 10.1 million days, an average of 13 days per hunter. Collectively, they expended \$356.2 million. Harvest for the 2009-2010 season included 256,512 deer, 2,304 black bears, and 20,149 wild turkeys. Looking back, wildlife resources of the Commonwealth of Virginia were at a low point in the early 20th century as a result of overhunting and habitat degradation. Recent successes in wildlife management are the result of seven decades of research and implementation of science-based management of hunting effort and wildlife habitat. Entry-level positions as a wildlife manager require a bachelor's degree in wildlife management, wildlife conservation, or a related field. Entry-level positions in non-game wildlife management require a bachelor's degree in wildlife conservation or a closely allied area. Whether management is aimed at consumptive or non-consumptive uses of wildlife resources, the training of bachelor-level wildlife conservationists is needed for sustaining successful wildlife management. Virginia Tech is well placed to train the wildlife managers of the future.

Student Demand

Although this is a proposal for a new degree, fish conservation and wildlife conservation are existing majors; hence, we are in a position to report a long-term record of student demand. Table 1 shows the numbers of students enrolled in fisheries and wildlife sciences over the past eleven years.

Table 1. Numbers of students in fisheries and wildlife curricula at Virginia Tech, 2001-2011.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Fisheries	58	61	48	42	44	41	47	49	51	65	65
Wildlife	139	155	153	117	97	107	112	128	148	153	148
Total	197	216	201	159	141	148	159	177	199	218	213

To quantify anticipated demand for the proposed degree, a survey was designed to quantify student interest in the possibility of majoring in fish conservation or wildlife conservation. Of the 272 students who responded, 193 (69%) were freshmen and sophomores. Key findings of the survey were that 106 students (39%) were “very interested” or “somewhat interested” in a degree program in *fisheries* conservation, 22 in freshwater fisheries conservation, 41 in marine fisheries conservation, the remainder in both. Queries about interest in a degree program in *wildlife* conservation, 157 respondents were either “very interested” or somewhat interested.

Market/Employer Demand

Our graduates are able to find work in various science- and management-related environmental fields. Management in our context may entail any action aimed at manipulation of animal populations, habitat, or humans in order to meet goals set by society, often the persistence of valued wild populations. Fisheries and wildlife professionals perform many roles, including the following:

- *Fisheries and wildlife managers* work with fish and wildlife populations, habitat, and humans to meet goals and objectives set by stakeholders and society at large regarding fish and wildlife resources.
- *Aquaculturists* propagate aquatic species for purposes of human food production, supplementing fished populations, augmenting imperiled populations, or public display in aquariums.
- *Wildlife rehabilitation specialists* receive injured or diseased individuals of wildlife species and treat their injuries, hopefully to release these individuals back to the wild.
- *Environmental consultants* perform a range of tasks for clients including private landowners, public utilities, and government agencies, ranging from water quality monitoring, to land and population management, to development of environmental impact statements for proposed major projects.
- *Wildlife control specialists* at various private-sector entities contribute expertise to animal damage control, and nuisance animal removal.
- *Environmental educators* transmit knowledge and encourage intellectual growth on environmental and natural resources-related issues, not just in young people, but also in a range of life-long learners. An undergraduate degree in fisheries or wildlife conservation is well targeted for teaching environmental science, as well as general biology and ecology, to the general public.
- A subpopulation of our students takes a degree in fisheries or wildlife conservation in order to prepare for graduate education or a career not in our own field, but rather in environmental protection, law, medicine or veterinary medicine, genetics, physiology, or nutrition, or the military.

Issues of Duplication

There are no other undergraduate degree programs in fish and wildlife conservation at public institutions within the Commonwealth of Virginia.

Resource Needs/Savings

Fish and Wildlife Conservation is an existing department, with current majors aligned with this new degree program; no additional resources are sought.

RESOURCE	ESTIMATED COSTS (use NA if not applicable)
Faculty	NA
Administrative Staff	NA
Graduate Teaching/ Graduate Research Assistants	NA
Space	NA
Library	NA
Equipment	NA
Other	NA