Bachelor of Science in FISHERIES AND WILDLIFE

DEGREE HANDBOOK

DEPARTMENT OF FISHERIES AND WILDLIFE
College of Agriculture and Natural Resources
Michigan State University
East Lansing, Michigan

http://www.fw.msu.edu/

Bachelor of Science in FISHERIES AND WILDLIFE

November 2011

DEPARTMENT OF FISHERIES AND WILDLIFE

The Department of Fisheries and Wildlife is one of 11 programs within the College of Agriculture and Natural Resources at Michigan State University. The single common feature of all of these programs is the application of basic sciences to solve problems associated with the use, allocation and management of resources. The resource focus differs from program to program and the focus within the Department of Fisheries and Wildlife is on the management of natural resources with particular reference to the management of ecosystems that support wild populations of birds, mammals, fish and other vertebrates. Our mission is to provide the education, research, and outreach needed by society for the conservation and rehabilitation of fish and wildlife resources and their ecosystems.

Although fisheries and wildlife management involves the maintenance and management of populations of fish and wildlife, it is obvious that these populations cannot be managed in the abstract. Clearly, the management of wild populations involves management of the ecosystems in which they live. At its base, then, the Fisheries and Wildlife academic program is a program of applied ecology. As such, the academic programs in Fisheries and Wildlife involve the integration of many of the basic sciences. Linking biology, chemistry and physics yields the classic definition of ecology, the interactions and feedbacks among and between the physical, chemical and biological portions of the earth. To apply ecology, these interactions and feedbacks must be related in a quantitative manner which requires mathematics. However, human social, economic, political and behavioral considerations interact with the base natural constraints to impose both limits to and directions of management goals for wild populations. Thus, fisheries and wildlife management involves application of the interactions between and among both the natural sciences and the social sciences, and students following the Fisheries and Wildlife curricula must acquire a basic knowledge in each of these various sciences.

Upper level undergraduate courses in Fisheries and Wildlife involve the integration of these basic sciences in such a manner that the interaction and feedbacks between them serve as a conceptual base for the solution to problems encountered in the management of wild populations. As such, it is imperative that students in Fisheries and Wildlife acquire a basic understanding of these various sciences in their academic program.

Students in the Department of Fisheries and Wildlife typically prepare for professional work as fisheries and wildlife managers, biologists, naturalists, and applied ecologists. Others pursue related career opportunities as conservation officers, private consultants or administrators with federal, state, and private agencies and organizations concerned with environmental management. The Fisheries and Wildlife curriculum provides a common core to all students in the major, and provides an opportunity for individualized specialization within sub-disciplines in the field. With careful selection of elective courses, students can meet the requirements for certification as an Associate Fisheries Scientist or Associate Wildlife Biologist from the American Fisheries Society or The Wildlife Society, respectively. Others may choose to emphasize an area of interest,

such as geographic information systems, conservation biology, water quality management, or wetland protection, by careful use of their elective credits. It is important that students maintain regular contact with their academic adviser, for help with selecting appropriate courses in meeting their career objectives.

Undergraduate Advising Center

The Department of Fisheries and Wildlife's Undergraduate Advising Center is located in 40 Natural Resources Building; phone (517) 353-9091. Jim Schneider is the Undergraduate Academic Adviser and Jill Cruth is the office secretary. Jim Schneider is the academic adviser for all undergraduate students enrolled in the Fisheries and Wildlife major. If you have any questions or need assistance please contact our office.

Undergraduate Advising Center
Department of Fisheries and Wildlife
Michigan State University
40 Natural Resources Building
East Lansing, MI 48824-1222
E-mail fwadvise@msu.edu
Phone (517) 353-9091
Fax (517) 432-1699

Appointments to meet with Jim Schneider can be made by either stopping by or calling the Advising Center, or by using Michigan State's web-based Adviser Scheduling System (for MSU students only). The on-line Adviser Scheduling System can be accessed from the Department of Fisheries and Wildlife's web site (http://www.fw.msu.edu/undergraduates/advising.htm).

UNIVERSITY GRADUATION REQUIREMENTS

PLEASE NOTE: <u>Knowing about and completing degree requirements is the student's responsibility</u>! The *Academic Programs* catalog includes information for which the student is responsible. This handbook is intended to supplement, and not replace, these sources of information.

To be recommended for a bachelor's degree, a student must:

1. Complete one year's work, normally the year of graduation, earning at least 30 credits in courses given by Michigan State University. A senior who has earned sufficient credits from this University and met the minimum requirements as stated below, through prior arrangement with the associate dean of the college and the registrar, may be permitted to transfer not to exceed 10 of the last 30 credits from an accredited four–year college or university.

2. Earn at least 27 credits on the East Lansing campus after reaching junior standing.

3. Complete at least 20 credits at Michigan State University while enrolled in the major in the college in which the degree is to be earned.

4. Remove any deficiencies identified by MSU placement test scores, as described in the *Academic Placement Tests* and *Remedial-Developmental-Preparatory Courses* sections of the *Academic Programs* guide.

5. Complete the University mathematics requirement.

6. Complete the University writing requirement.

7. Complete the University Integrative Studies requirement.

8. Complete satisfactorily an approved program of study in a college.

9. Complete a minimum of 120 credits[1] with at least a 2.00 grade-point average.

[1] Remedial-developmental-preparatory courses **do not** count toward the 120 credits required for graduation.

FISHERIES AND WILDLIFE DEGREE REQUIREMENTS

UNIVERSITY REQUIREMENTS: See **MSU Academic Programs** catalog (http://www.reg.msu.edu/ucc/AcademicPrograms.asp)

- Minimum number of credits required: 120 credits[1]
- Minimum cumulative grade point average: 2.00

WRITING REQUIREMENT:

- Tier I: WRA 110 – 195H (4 cr.)
- Tier II: Satisfied by completing FW 434

INTEGRATIVE STUDIES REQUIREMENT: (24 cr.)

- **Arts & Humanities** (8 cr.)
  - (A) Complete one IAH course numbered below 211 (4 cr.)
  - (B) Complete one IAH course numbered 211 or higher (4 cr.).
- **Social Science** (8 cr.)
  - Complete one 200-level ISS course (4 cr.)
  - Complete one 300-level ISS course (4 cr.)
- **Biological & Physical Sciences** (8 cr.) *[alternative track]*
  - Biological Sciences - Satisfied by completing BS 161 (3 cr.), BS 162 (3 cr.) or LB 144 (4 cr.)
  - Physical Sciences - Satisfied by completing CEM 141 (4 cr.), CEM 151 (4 cr.) or LB 171 (4 cr.).
  - Laboratory Experience - Satisfied by completing (BS 171, BS 172 or LB 144) and (CEM 161 or LB 171L)
- **Diversity**
  - Must complete at least two of the "D", "N" or "I" diversity designated courses as part of the IAH and/or ISS Integrative Studies program.

[1] Remedial-developmental-preparatory courses **do not** count toward the 120 credits required for graduation.

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES REQUIREMENTS:

- MATH: satisfied by completing MTH 124 (3 cr.), MTH 132 (3 cr.) or LB 118 (5 cr.).
- ECONOMICS: Complete EC 201 (3 cr.) *OR* EC 202 (3 cr.)
- CANR Courses [C]: Complete at least 26 credits of CANR courses. The Conservation Biology, Fisheries Biology and Management, Wildlife Biology and Management, Water Sciences, Fish and Wildlife Disease Ecology and Management and Preveterinary concentrations listed below all require the minimum required CANR credits. Non-CANR courses substituted for courses in any of the concentrations listed below may require a student to complete additional CANR course credits to meet the College's 26 credit requirement.

FISHERIES AND WILDLIFE REQUIREMENTS:

BIOLOGICAL SCIENCES (9 to 10 cr.)

Complete ONE of the following groups of courses

(1)	BS	161	Cells and Molecules	3
	BS	171	Cells and Molecular Biology Laboratory	2
	BS	162	Organisms and Populations Biology	3
	BS	172	Organisms and Populations Biology Laboratory	2
(2)	LB	144	Biology I – Organismal Biology	4
	LB	145	Biology II: Cellular and Molecular Biology	5

PHYSICAL SCIENCES (11 to 13 cr.)

Complete ONE of the following groups of courses

(1)	CEM	141	General Chemistry	4
	CEM	161	Chemistry Laboratory I	1
(2)	CEM	151	General and Descriptive Chemistry	4
	CEM	161	Chemistry Laboratory I	1
(3)	LB	171	Principles of Chemistry I – Structure	4
	LB	171L	Introductory Chemistry Laboratory I	1

FISHERIES AND WILDLIFE REQUIREMENTS: (continued)

PHYSICAL SCIENCES (continued)

Complete ONE of the following courses

☐	LB	271	Physics I		3
☐	PHY	183	Physics for Scientists and Engineers I		4
☐	PHY	231	Introductory Physics I		3

Complete ONE of the following courses

☐	CSS	210	Fundamentals of Soils and Landscape Science	[C]	3
☐	CSS	470	Soil Resources	[C]	3
☐	ENT	319	Introduction to Earth System Science (Honors only)	[C]	3
☐	GEO	203	Introduction to Meteorology		3
☐	GEO	206	Physical Geography		3
☐	GLG	201	The Dynamic Earth		4

MATH and STATISTICS (6 to 7 cr.)

Complete ONE of the following courses

☐	MTH	124	Survey of Calculus I	3
☐	MTH	132	Calculus I	3
☐	LB	118	Calculus I	4

Complete ONE of the following courses

☐	STT	224	Intro to Probability and Statistics for Ecologists	3
☐	STT	231	Statistics for Scientists	3
☐	STT	421	Statistics I	3

COMMUNICATION (6 cr.)

Complete TWO of the following courses

☐	ACR	205	Ag and Nat. Resources Commun. Theory & Practice	[C]	3
☐	COM	100	Human Communication		3
☐	COM	225	Introduction to Interpersonal Communication		3
☐	COM	275	Effects of Mass Communication		3
☐	ESA	401	Ag and Nat. Resources Communication Campaigns	[C]	3
☐	FW	435	Integrated Commun. for the FW Professional	[C]	3
☐	JRN	412	Environmental Reporting (contact instructor for prerequisite override)		3
☐	WRA	320	Technical Writing (override request form required)		3
☐	WRA	331	Writing in the Public Interest (override request form required)		3
☐	WRA	341	Writing Nature & the Nature of Writing (override request form required)		3
☐	WRA	453	Grant and Proposal Writing (override request form required)		3

FISHERIES AND WILDLIFE REQUIREMENTS: (continued)

ETHICS and PHILOSOPHY (3 cr.)

Complete ONE of the following courses

☐	FW	438	Philosophy of Ecology	[C]	3
☐	FW	439	Conservation Ethics	[C]	3
☐	GEO	432	Environmental Ethics		3
☐	PHL	340	Ethics		3
☐	PHL	342	Environmental Ethics		3
☐	PHL	380	Nature of Science		3
☐	PHL	484	Philosophy of Biological Science		3

EXPERIENTIAL LEARNING (3 to 4 cr.)

Complete ONE of the following courses

☐	FW	493	Professional Internship in Fisheries and Wildlife	[C]	3
☐	FW	490	Independent Study	[C]	3
☐	FW	480	International Studies in Fish and Wildlife	[C]	3
☐	FW	499	Senior Thesis in Fisheries and Wildlife	[C]	4

FISHERES & WILDLIFE CORE (19 to 20 cr.)

Complete ALL of the following courses

☐	FW	101	Fisheries and Wildlife Fundamentals	[C]	3
☐	FW	101L	Fisheries and Wildlife Fundamentals Lab **OR**	[C]	2
	FW	238	Introductory Fisheries and Wildlife Field Experience	[C]	3
☐	FW	293	Undergraduate Seminar in Fisheries and Wildlife	[C]	1
☐	FW	364	Ecological Problem Solving	[C]	3
☐	FW	424	Population Analysis and Management	[C]	4
☐	FW	434	Human Dimension of Fish & Wildlife Management	[C]	3
☐	ZOL	355	Ecology		3

[C] = CANR Courses. Must complete at least 26 CANR course credits.

CONCENTRATIONS

Complete ONE of the following seven concentrations: (1) Conservation Biology; (2) Fisheries Biology and Management; (3) Wildlife Biology and Management; (4) Water Sciences; (5) Fish and Wildlife Disease Ecology and Management; or (6) Preveterinary;. See detailed course requirements for each concentration below. These Concentrations are all transcriptable, and will officially appear on your transcripts after you graduate.

(1) CONSERVATION BIOLOGY CONCENTRAION (24 to 26 cr.)

Complete ALL of the following courses (12 cr.)

☐	FW	443	Restoration Ecology	[C]	3
☐	FW	444	Conservation Biology	[C]	3
☐	PLB	441	Plant Ecology *OR* ZOL 370 Intro to Zoogeography		3
☐	ZOL	445	Evolution		3

Complete ONE of the following courses (3 to 4 cr.)

☐	CSS	350	Introduction to Plant Genetics	[C]	3
☐	ZOL	341	Fundamental Genetics		4

Complete ONE of the following courses (3 cr.)

☐	FW	410	Upland Ecosystem Management	[C]	3
☐	FW	414	Aquatic Ecosystem Management	[C]	3
☐	FW	416	Marine Ecosystem Management	[C]	3
☐	FW	417	Wetland Ecology and Management	[C]	3
☐	FW	479	Fisheries Management	[C]	3

Complete ONE of the following courses (3 cr.)

☐	EEP	255	Ecological Economics	[C]	3
☐	ESA	430	Law and Resources	[C]	3
☐	FOR	464	Forest Resource Economics	[C]	3
☐	FOR	466	Natural Resource Policy	[C]	3
☐	FW	445	Socio-economics and Policy of Conservation Biology	[C]	3
☐	FW	481	Global Issues in Fisheries and Wildlife	[C]	3
☐	MC	450	International Environmental Law and Policy		3
☐	ZOL	446	Environmental Issues and Public Policy		3

Complete ONE of the following courses (3 to 4 cr.)

☐	ENT	422	Aquatic Entomology	[C]	3
☐	FOR	204	Forest Vegetation	[C]	4
☐	FW	471	Ichthyology	[C]	4
☐	PLB	218	Plants of Michigan		3
☐	PLB	418	Plant Systematics		3
☐	ZOL	360	Biology of Birds		4
☐	ZOL	361	Michigan Birds		4
☐	ZOL	365	Biology of Mammals		4
☐	ZOL	384	Biology of Amphibians and Reptiles		4

Electives: Complete the necessary number of elective credits needed to reach the required 120 credit minimum (123 credits if you were required to complete MTH 1825) for graduation. There are no restrictions on what counts as an elective course, but you're strongly encouraged to speak with Jim Schneider regarding courses that will help you meet your professional objectives.

Students selecting the Conservation Biology Concentration should consider completing the requirements for the Certified Fisheries Scientist, Certified Wildlife Biologist and/or the Professional Wetland Scientist certification programs. See pages 24 - 33 for more details on specific courses you should complete.

(2) FISHERIES BIOLOGY AND MANAGEMENT (25 to 27 cr.)

Complete ALL of the following courses (13 cr.)

☐	FW 420	Stream Ecology *OR* FW 472	Limnology	[C]	3
☐	FW 471	Ichthyology		[C]	4
☐	FW 479	Fisheries Management		[C]	3
☐	FW 470	Fisheries Techniques		[C]	3

Complete ONE of the following courses (3 cr.)

☐	FW 414	Aquatic Ecosystem Management	[C]	3
☐	FW 416	Marine Ecosystem Management	[C]	3
☐	FW 417	Wetland Ecology and Management	[C]	3

Complete ONE of the following courses (3 to 4 cr.)

☐	ENT 422	Aquatic Entomology	[C]	3
☐	ZOL 306	Invertebrate Biology		4

Complete ONE of the following courses (3 to 4 cr.)

☐	PLB 418	Plant Systematics		3
☐	PLB 424	Algal Biology		4

Complete ONE of the following courses (3 to 4 cr.)

☐	CSS 350	Introduction to Plant Genetics **	[C]	3
☐	FW 473	Environmental Fish Physiology (requires BS 111 as prerequisite)	[C]	3
☐	ZOL 328	Comparative Anatomy and Biology of Vertebrates		4
☐	ZOL 341	Fundamental Genetics (requires BS 111 as prerequisite)		4
☐	ZOL 483	Environmental Physiology (requires BS 111 as prerequisite)		4

Electives: Complete the necessary number of elective credits needed to reach the required 120 credit minimum (123 credits if you were required to complete MTH 1825) for graduation. At present, there are no restrictions on what counts as an elective course, but you're strongly encouraged to speak with Jim Schneider regarding courses that will help you meet your professional objectives.

Students selecting the Fisheries Biology and Management Concentration should consider completing the requirements for the American Fisheries Society's Certified Fisheries Scientist certification program. See pages 24 - 26 for more details on specific courses you should complete.

(3) WILDLIFE BIOLOGY AND MANAGEMENT (24 to 25 cr.)

Complete ALL of the following courses (9 cr.)

☐	FW	410	Upland Ecosystem Management	[C]	3
☐	FW	417	Wetland Ecology and Management	[C]	3
☐	FW	413	Wildlife Research and Management Techniques	[C]	3

Complete TWO of the following courses (8 cr.)

☐	ZOL	360	Biology of Birds	4
☐	ZOL	365	Biology of Mammals	4
☐	ZOL	384	Biology of Amphibians and Reptiles	4

Complete ONE of the following courses (3 to 4 cr.)

☐	FOR	204	Forest Vegetation	[C]	4
☐	PLB	218	Plants of Michigan		3
☐	PLB	418	Plant Systematics		3

Complete ONE of the following courses (3 to 4 cr.)

☐	CSS	350	Introduction to Plant Genetics	[C]	3
☐	ZOL	328	Comparative Anatomy and Biology of Vertebrates		4
☐	ZOL	341	Fundamental Genetics		4
☐	ZOL	483	Environmental Physiology		4

Electives: Complete the necessary number of elective credits needed to reach the required 120 credit minimum (123 credits if you were required to complete MTH 1825) for graduation. At present, there are no restrictions on what counts as an elective course, but you're strongly encouraged to speak with Jim Schneider regarding courses that will help you meet your professional objectives.

Students selecting the Wildlife Biology and Management Concentration should consider completing the requirements for The Wildlife Society's Certified Wildlife Biologist certification program. See pages 29 - 32 for more details on specific courses you should complete.

(4) WATER SCIENCES (24 to 27 cr.)

Complete TWO of the following courses (6 cr.)

☐	FW	472	Limnology	[C]	3
☐	FW	420	Stream Ecology	[C]	3
☐	FW	417	Wetland Ecology and Management	[C]	3

Complete the following course (3cr.)

☐	FW	474	Limnological Techniques	[C]	3

Complete ONE of the following courses (3 cr.)

☐	FW	414	Aquatic Ecosystem Management	[C]	3
☐	FW	416	Marine Ecosystem Management	[C]	3
☐	FW	479	Fisheries Management	[C]	3

Complete ONE of the following courses (3 to 4 cr.)

☐	ZOL	306	Invertebrate Biology		4
☐	ENT	422	Aquatic Entomology	[C]	3
☐	FW	471	Ichthyology	[C]	4

Complete ONE of the following courses (3 to 4 cr.)

☐	PLB	418	Plant Systematics		3
☐	PLB	424	Algal Biology		4

Complete TWO of the following courses (6 or 8 cr.)

☐	FW	454	Environmental Hydrology and Watershed Management	[C]	3
☐	FW	473	Environmental Fish Physiology	[C]	3
☐	GLG	421	Environmental Geochemistry		4
☐	MMG	425	Microbial Ecology		3
☐	MMG	426	Biogeochemistry		3
☐	ZOL	303	Oceanography		3
☐	ZOL	341	Fundamental Genetics		4
☐	ZOL	353	Marine Biology		4
☐	ZOL	483	Environmental Physiology		4

Electives: Complete the necessary number of elective credits needed to reach the required 120 credit minimum (123 credits if you were required to complete MTH 1825) for graduation. There are no restrictions on what counts as an elective course, but you're strongly encouraged to speak with Jim Schneider regarding courses that will help you meet your professional objectives.

Students selecting the Water Sciences Concentration should consider completing the requirements for the Certified Fisheries Scientist and/or the Professional Wetland Scientist certification programs. See pages 24 – 32 for more details on specific courses you should complete.

(5) FISH AND WILDLIFE DISEASE ECOLOGY AND MANAGEMENT (30 to 32 cr.)

Complete ALL of the following courses (17 cr.)

☐	MMG	301	Introductory Microbiology		3
☐	FW	423	Principles of Fish and Wildlife Disease	[C]	3
☐	FW	423L	Principles of Fish and Wildlife Disease Laboratory	[C]	1
☐	FW	444	Conservation Biology	[C]	3
☐	ZOL	445	Evolution		3
☐	EPI	390	Disease in Society: Intro to Epidemiology & Public Health		4

Complete ONE of the following courses (3 to 4 cr.)

☐	CEM	143	Survey of Organic Chemistry		4
☐	CEM	251	Organic Chemistry I		3

Complete ONE of the following courses (4 cr.)

☐	ANS	314	Genetic Improvement of Domestic Animals	[C]	4
☐	ZOL	341	Fundamental Genetics		4

Complete ONE of the following courses (3 cr.)

☐	FW	410	Upland Ecosystem Management	[C]	3
☐	FW	414	Aquatic Ecosystem Management	[C]	3
☐	FW	416	Marine Ecosystem Management	[C]	3
☐	FW	417	Wetland Ecology and Management	[C]	3
☐	FW	479	Fisheries Management	[C]	3

Complete ONE of the following courses (3 to 4 cr.)

☐	FW	471	Ichthyology	[C]	4
☐	ZOL	306	Invertebrate Biology		4
☐	ZOL	316	General Parasitology		3
☐	ZOL	360	Biology of Birds		4
☐	ZOL	365	Biology of Mammals		4
☐	ZOL	384	Biology of Amphibians and Reptiles		4

Electives: Complete the necessary number of elective credits needed to reach the required 120 credit minimum (123 credits if you were required to complete MTH 1825) for graduation. There are no restrictions on what counts as an elective course, but you're strongly encouraged to speak with Jim Schneider regarding courses that will help you meet your professional objectives.

Students selecting the Fish and Wildlife Disease Ecology and Management Concentration should consider completing the requirements for the Certified Fisheries Scientist and/or the Certified Wildlife Biologist certification programs. See pages 24 - 32 for more details on specific courses you should complete.

(6) PREVETERINARY (35 to 36 cr) – This concentration meets the minimum requirements established by MSU for admission to the MSU College of Veterinary Medicine.

Complete ALL of the following courses (32 cr.)

☐	BMB	401	Basic Biochemistry		4
☐	CEM	251	Organic Chemistry I		3
☐	CEM	252	Organic Chemistry II		3
☐	CEM	255	Organic Chemistry Lab		2
☐	FW	423	Principles of Fish and Wildlife Disease	[C]	3
☐	FW	423L	Principles of Fish and Wildlife Disease Laboratory	[C]	1
☐	MMG	301	Introductory Microbiology		3
☐	MMG	302	Introductory Microbiology Laboratory		1
☐	MMG	409	Eukaryotic Cell Biology		3
☐	PHY	232	Introductory Physics II		3
☐	PHY	251	Introductory Physics Lab I		1
☐	PHY	252	Introductory Physics Lab II		1

Complete ONE of the following courses (4 cr.)

☐	ANS	314	Genetic Improvement of Domestic Animals	[C]	4
☐	ZOL	341	Fundamental Genetics		4

Complete ONE of the following courses (3 to 4 cr.)

☐	ANS	313	Principles of Animal Feeding and Nutrition	[C]	4
☐	HNF	150	Introduction to Human Nutrition		3

Electives: Complete the necessary number of elective credits needed to reach the required 120 credit minimum (123 credits if you were required to complete MTH 1825) for graduation. There are no restrictions on what counts as an elective course, but you're strongly encouraged to speak with Jim Schneider regarding courses that will help you meet your professional objectives.

USING YOUR ELECTIVES WISELY

Remaining elective credits need to fulfill the minimum 120 credit degree requirement within the Fisheries and Wildlife majors are considered FREE electives, whereby there are no course restrictions from which a student can select from. Any course not fulfilling one of the University, College, Fisheries and Wildlife Major, or Concentration requirements will be applied to student's electives. Students are encouraged to sample other MSU courses not necessarily related to natural resources: history, philosophy, a language, etc. BUT, the Department of Fisheries and Wildlife also recommends that students consider using some of their elective credits toward courses that will help them identify areas of study that they would like to pursue after graduation and those courses that would also benefit them in the professional natural resources world. **Elective courses should be discussed and reviewed with your academic advisor**.

SUGGESTED ELECTIVES

The following suggested elective topics were compiled by Department of Fisheries and Wildlife faculty.

AQUATIC ECOLOGY

ENT	422	Aquatic Entomology
ENT	469	Biomonitoring of Streams & Rivers
FW	207	Great Lakes: Bio. & Mngt.
FW	420	Stream Ecology
FW	472	Limnology
FW	474	Limno. & Fisheries Techniques
MMG	301	Introductory Microbiology
MMG	425	Microbial Ecology
MMG	426	Biogeochemistry
ESA	324	Water Res. Development
ESA	452	Watershed Concepts
ZOL	306	Invertebrate Biology

AQUACULTURE

ANS	110	Introductory Animal Agriculture
ANS	210	Animal Products
ANS	313	Princ. of Anim. Feeding & Nutrition
ANS	314	Gen. Improvement of Dom. Anim.
ANS	407	Food & Animal Toxicology
ANS	425	Principles of Animal Biotechnology
ANS	480	Anim. Syst. in Int. Development
FSC	211	Principles of Food Science
FSC	433	Food Processing: Muscle Foods
ABM	222	Agribusiness & Food Sales (W)
ABM	130	Farm Management I
ABM	430	Farm Management II
ABM	435	Financial Mgmt. in the Agri-Food Syst.
FW	472	Limnology
FW	474	Limno. & Fisheries Techniques

CONSERVATION GENETICS

ANS	404	Adv. Genetics of Farm Animals
ANS	414	Advanced Animal Breeding
CSS	350	Intro. to Plant Genetics
FW	444	Conservation Biology
ZOL	341	Fundamental Genetics
ZOL	445	Evolution

ENVIRONMENTAL POLICY & LAW

FOR	466	Natural Resource Policy
FW	211	Intro. to Gender & Env. Issues
FW	468	Great Lakes Water Policy
ESA	324	Water Res. Development
ESA	415	Environmental Impact Assessment
ESA	430	Environmental & Natural Resource Law
ESA	440	Environmental Policy Making in MI
SOC	363	Rural Sociology
SOC	452	Environment and Society
ZOL	446	Env. Isssues & Public Policy

FISH AND WILDLIFE DISEASE ECOLOGY

FW	423	Principles of Fish and Wildlife Disease
FW	423L	Principles of Fish and Wildlife Disease Lab
FW	463	Wildlife Disease Ecology
FW	444	Conservation Biology
MMG	301	Introuctory Microbiology
ZOL	316	General Parasitology
ZOL	316L	General Parasitology Lab
ZOL	445	Evolution
EPI	360	Disease in Society: Intro to Epidemiology and Public Health

FOREST ECOLOGY

FOR	202	Introduction to Forestry
FOR	204	Forest Vegetation
FOR	220	Forests & the Global Environment
FOR	306	Forest Biometry
FOR	404	Forest & Agr. Ecology
FOR	406	Silviculture
FOR	408	Forest Resource Management
FOR	412	Wildland Fire
FOR	461	Urban Forestry

HUMAN DIMENSIONS AND OUTREACH

AEE	401	Ag. & Nat. Res. Comm. Campaigns
ESA	435	Conservation Education
FW	435	Integrated Comm. for the FW Professional
PRR	200	Leisure and Society
PRR	302	Environmental Attitudes & Concepts
PRR	351	Recreation & Nat. Res. Comm.
PRR	451	Park Interp. Services & Visitor Info Sys.
SOC	452	Environment and Society

INTERNATIONAL CONSERVATION

ANR	250	Global Issues in ANR
FOR	220	Forests & the Global Environment
FW	110	Conserv. & Mgmt of Marine Res.
FW	444	Conservation Biology
FW	445	Biodiversity Conservation Policy & Practice
FW	480	Int. Studies in FW – Antarctica
FW	480	Int. Studies in FW – Egypt
FW	480	Int. Studies in FW - Madagascar
FW	480	Int. Studies in FW - South Africa
FW	481	Global Issues in Fisheries and Wildlife
MC	450	International Environmental Law & Policy

MARINE BIOLOGY

(see Specialization in Marine Ecosystem Management, page 13)

FW	110	Conserv. & Mgmt. Marine Res.
FW	416	Marine Ecosystem Management
FW	480	Int. Studies in FW - Bahamas
ZOL	303	Oceanography
ZOL	353	Marine Biology
ZOL	453	Field Studies in Marine & Estuarine Bio.

NUTRITION & PHYSIOLOGY

ANS	313	Princ. of Anim. Feeding & Nutrition
ANS	413	Monogastric Animal Nutrition
ANS	455	Avian Physiology
ANS	483	Ruminant Nutrition
PSL	250	Introductory Physiology
PSL	445	Topics in Environmental Phys.
ZOL	328	Comp. Anat. & Bio. of Vertebrates
ZOL	483	Environmental Physiology

PROFESSIONAL CERTIFICATIONS

- American Fisheries Society (www.fisheries.org)
  - Associate Fisheries Scientist Certification (see page 24)
- Ecological Society of America (www.esa.org)
  - Associate Ecologist Certification
- Society for Wetland Scientists (www.sws.org)
  - Wetland Professional in Training (see page 26)
- The Wildlife Society (www.wildlife.org)
  - Associate Wildlife Biologist Certification (see page 29)

QUANTITATIVE ECOLOGY

CSE	131	Tech. Computing & Problem Solving
MTH	132	Calculus I
MTH	133	Calculus II
MTH	234	Mulivariable Calculus
MTH	309	Linear Algebra I
STT	421	Statistics I
STT	464	Statistical Meth. for Biol. I

RESOURCE ECONOMICS & ADMINISTRATION

EC	301	Intermediate Microeconomics
EEP	201	Community Economics
EEP	255	Ecological Economics
EEP	320	Environmental Economics
EEP	335	Taxes, Gov. Spending & Public Policy
ESA	201	Environ. & Natural Res.
ESA	415	Environmental Impact Assessment
ESA	460	Natural Resource Economics
FOR	464	Forest Resource Economics
FW	211	Intro. to Gender & Env. Issues

RESTORATION ECOLOGY

ESA	415	Environmental Impact Assessment
ESA	430	Environmental & Natural Resource Law
FW	434	Restoration Ecology
FW	444	Conservation Biology
GEO	306	Environmental Geomorphology
GEO	324	Remote Sensing of the Env.
MMG	301	Introductory Microbiology

MSU MINORS (see page 22 for more details)

- Entomology
- Geographic Information Science (GIS)

MSU SPECIALIZATIONS (see pages 18-22 for more details)

- Conservation and Environmental Law Enforcement
- Connected Learning in ANR - Bailey Scholars Program
- Environmental Economics
- Environmental Studies (RISE)
- International Agriculture
- Marine Ecosystem Management
- Museum Studies
- Natural Resource Recreation
- Science, Technology, Environment and Public Policy
- Sustainability

TERRESTRIAL ECOLOGY

FOR	404	Forest & Agricultural Ecology
FOR	406	Silviculture
FOR	412	Wildland Fire
FW	413	Wildlife Research & Mgmt Tech.
FW	443	Restoration Ecology
FW	444	Conservation Biology
GEO	324	Remote Sensing of the Env.
PLB	441	Plant Ecology
ESA	452	Watershed Concepts
ZOL	313	Animal Behavior
ZOL	485	Tropical Biology
ZOL	370	Introduction to Zoogeography

WETLAND ECOLOGY

ENT	422	Aquatic Entomology
ESA	324	Water Res. Development
ESA	452	Watershed Concepts
FW	207	Great Lakes: Bio. & Mngt.
FW	420	Stream Ecology
FW	443	Restoration Ecology
FW	472	Limnology
FW	474	Limno. & Fisheries Techniques
GLG	411	Hydrogeology
MMG	301	Introductory Microbiology
MMG	425	Microbial Ecology
MMG	426	Biogeochemistry
ZOL	306	Invertebrate Biology

SPECIALIZATION IN CONSERVATION AND ENVIRONMENTAL LAW ENFORCEMENT

The Specialization in Conservation and Environmental Law Enforcement is designed to combine the natural resource expertise of the fisheries and wildlife, forestry, parks, recreation and tourism, and resource development programs, with the law enforcement expertise of the criminal justice program to serve those students with career interests in conservation or environmental law enforcement.

The specialization is available as an elective to students enrolled in bachelor's degree programs in criminal justice, fisheries and wildlife, forestry, and community agriculture and recreation resource systems. The specialization is administered by the Department of Fisheries and Wildlife. Students who are interested in enrolling should contact Jim Schneider, Department of Fisheries and Wildlife, Academic Advising Center, 40 Natural Resources Building, (517) 353-9091, schne181@msu.edu, to sign up.

With the approval of the department and college that administer the student's degree program, courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

Requirements for the Specialization in Conservation and Environmental Law Enforcement.

Students must complete:

1. ***Natural Resources Conservation and Management***
   a. Complete ONE of the following courses: (3 credits)

FW	101	Fundamentals of Fisheries and Wildlife	3
FOR	202	Introduction to Forestry	3
FOR	220	Forests and the Global Environment	3
PRR	210	Our National Parks and Recreation Lands	3
PRR	213	Introduction to Parks, Recreation, and Leisure	3
ESA	200	Issues and Applications in Resource Development	3
ESA	201	Environmental and Natural Resources	3

   b. Complete ONE of the following courses: (3 credits)

FW	444	Conservation Biology	3
FW	481	Global Issues in Fisheries and Wildlife	3
PRR	449	Management of Natural Resource Based Recreation	3
ESA	302	Natural Resource Issues	3

Conservation and Environmental Law Enforcement Specialization *(continued)*

2. Environmental Attitudes, Policy and Law

a. Complete ONE course from each of the following categories; one of the courses selected must be from outside a student's major: (5 to 7 credits)

i) Complete ONE of the following courses: (2 to 4 credits)

ESA	300	Environmental & Natural Resources Conflict Mgmt	3
FW	434	Human Dimensions of Fisheries and Wildlife Mgmt	3
FOR	330	Social Applications of Forestry	2
PRR	302	Environmental Attitudes and Concepts	3
SOC	452	Environment and Society (*must also enroll in SOC 452L*)	4

ii) Complete ONE of the following courses: (3 credits)

ESA	430	Environmental and Natural Resource Law	3
ESA	440	Environmental and Natural Resource Policy in Michigan	3
FW	445	Socio-economic and Policy of Conservation Biology	3
FW	450	International Environmental Law and Policy	3
FOR	466	Natural Resources Policy	3
PHL	354	Philosophy of Law	3
ZOL	446	Environmental Issues and Public Policy	3

3. Law Enforcement

a. Complete the following course: (3 credits)

CJ	110	Introduction to Criminal Justice	3

b. Complete TWO of the following courses: (6 credits)

CJ	210	Introduction to Forensic Science	3
CJ	220	Criminology	3
CJ	235	Investigation Procedures	3
CJ	275	Criminal Procedure	3

Upon completion of the requirements for the specialization in conservation and environmental law enforcement, the student should contact the Chairperson of the Department of Fisheries and Wildlife and request certification for the completion of the specialization. After the certification is approved by the Chairperson of the Department of Fisheries and Wildlife and the Director of Academic Affairs of the College of Agriculture and Natural Resources, the Office of the Registrar will enter on the student's academic record the name of the specialization and the date that it was completed. This certification will appear on the student's transcript.

SPECIALIZATION IN MARINE ECOSYSTEM MANAGEMENT

The Specialization in Marine Ecosystem Management is designed to provide students with a fundamental background in ecosystem management of marine natural resources. Students gain insight and experience in marine management issues relative to estuarine, coastal, and open-water marine ecosystems from the perspective of habitat, biota and human resource users. Students are also exposed to the management skills necessary to recognize and use effective techniques to conserve, preserve and restore marine ecosystem integrity for the benefit of society. This unique management emphasis serves the career interests of students well as they pursue positions in the marine sciences.

The Specialization in Marine Ecosystem Management is available as an elective to students who are enrolled in Bachelor of Science degree programs with majors in Fisheries and Wildlife, Lyman Briggs School, CARRS, and Zoology. The specialization is administered by the Department of Fisheries and Wildlife. Students who are interested in enrolling should contact Jim Schneider, Department of Fisheries and Wildlife, Academic Advising Center, 40 Natural Resources Building, 517-353-9091, schne181@msu.edu, to sign up.

With the approval of the department and college that administer the student's degree program, courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

Requirements for the Specialization in Marine Ecosystem Management

Students must complete:

1. ***Marine Ecosystem Management***

   Complete all of the following courses (14 credits):

FW	110	Conservation and Management of Marine Resources	3
FW	416	Marine Ecosystem Management	3
ZOL	303	Oceanography	4
ZOL	353	Marine Biology	4

2. ***Biodiversity***

   Complete One of the following courses (4 credits):

FW	471	Ichthyology	4
PLB	424	Algal Biology	4
ZOL	306	Invertebrate Biology	4

Marine Ecosystem Management Specialization *(continued)*

3. ***Experiential Learning in Marine Ecosystem Management***

   Complete One of the following courses, (2 or 3 credits):

   ** Course selection MUST contain a marine emphasis **

FW	480	International Studies in Fisheries and Wildlife	3
FW	493	Professional Internships in Fisheries and Wildlife	2 or 3
ZOL	453	Field Studies in Marine and Estuarine Biology	2 or 3
ZOL	496	Internship in Zoology	2 or 3
ZOL	498	Internship in Zoo and Aquarium Science	3

Upon completion of the requirements for the Specialization in Marine Ecosystem Management, the students should contact the Chairperson of the Department of Fisheries and Wildlife and request certification for the completion of the specialization. After the certification is approved by the Chairperson of the Department of Fisheries and Wildlife and the Director of Academic Affairs of the College of Agriculture and Natural Resources, the Office of the Registrar will enter on the student's academic record the name of the specialization and the date that it was completed. This certification will appear on the student's transcript.

OTHER SPECIALIZATIONS TO CONSIDER

- **Connected Learning in Agriculture and Natural Resources - Bailey Scholars Program**
  - Contact Person: Pat Crawford, 432-0732, lhbailey@msu.edu
  - http://www.bsp.msu.edu/

- **Environmental Economics**
  - Contact Person: Ruthi Bloomfield, 432-5298, bloomf19@msu.edu
  - http://www.aec.msu.edu/agecon/undergrad/envecon.htm

- **Environmental Studies**
  - Contact Person: Laurie Thorp, 432-4944, thorpl@msu.edu
  - http://www.ns.msu.edu/rise/curriculum.html

- **International Agriculture**
  - Contact Person: Russ Freed, 355-0271 ext. 1187, freed@msu.edu
  - http://www.css.msu.edu/Specializations.cfm

Other Specializations *(continued)*

- **Museum Studies**
  - Contact Person: Kristine Morrissey, 353-1943, msumsp@msu.edu
  - http://www.msu.edu/~msumsp/enter.html

- **Natural Resource Recreation**
  - Contact Person: Chuck Nelson, 432-0272, nelsonc@msu.edu
  - http://www.carrs.msu.edu/

- **Science, Technology, Environment and Public Policy**
  - Contact Person: Mark Largent, 355-3441, largent@msu.edu
  - http://jmc.msu.edu/stepps/

- **Sustainability**
  - Contact Person: Geoff Habron, 432-0073, habrong@msu.edu
  - http://sustainabilityspecialization.msu.edu/

MSU MINORS TO CONSIDER

- **Entomology**
  - Contact Person: Chris DiFonzo, 353-5328, difonzo@msu.edu
    http://www.ent.msu.edu/Academics/Undergradstudies/tabid/78/Default.aspx

- **Geographic Information Science (GIS)**
  - Contact Person: Ellen White, 353-9875, whitee@msu.edu
  - http://www.geo.msu.edu/geoungradbook/SpecSIP.html

ADDITIONAL MAJORS & SECOND UNDERGRADUATE DEGREE

Some Fisheries and Wildlife students satisfy their elective requirement by completing an additional major or a second undergraduate degree. Common additional majors or second degrees are: Agriculture and Natural Resources, Education and Communication Systems; Environmental Studies and Applications; Forestry; Parks, Recreation and Tourism Resources; and Zoology. Natural resource and other science related majors, closer to Fisheries and Wildlife, will theoretically require less total credits to complete.

ADDITIONAL MAJORS: A student should obtain information about requirements for an additional major directly from the department of the additional major. The form, *Request for Permission to Complete Two Degrees Concurrently or an Additional Major,* must be initiated by the department offering the major.

Some colleges do not offer additional majors. In a number of colleges, students completing an additional major will be required to satisfy the college-level requirements as well as the requirements for the additional major; in others, additional majors require only that the major requirements be satisfied.

The completion of the additional major will be noted on the student's final transcript. However, the notation will not appear on the diploma.

SECOND UNDERGRADUATE DEGREE: To pursue a second bachelor's degree, a student must be admitted to the second college's degree program. To be granted a second bachelor's degree, a student must earn at least 30 credits in residence in addition to the credits required for the first degree and meet the specified requirements of the second college and major.

Concurrently with First Degree

It is possible for a student to earn two bachelor's degrees concurrently. The student asks the adviser in the unit or the designated person in the college in which the second degree is to be earned to file the form *Request for Permission to Complete Two Degrees Concurrently*. The form lists all course work required to complete the degree. It must include the statement "Student must earn a minimum of 150 credits" or "153 credits" (if the student has taken MTH 1825). A student who completes the requirements for a second bachelor's degree will receive two diplomas, one for each degree program.

PROFESSIONAL CERTIFICATIONS

The American Fisheries Society Certification Requirements

The American Fisheries Society has established a professional Certification Program as a means of setting guidelines for professional recognition. Professional certification is not currently required by most employers. However, anyone thinking about a career in fisheries should consider taking courses that meet the certification guidelines. These are:

A. **Fisheries and Aquatic Sciences** - four (4) courses (12 semester hours), two of which must be directly related to fisheries science and at least one must cover principles of fisheries science and management. (Courses such as fisheries science, limnology, oceanography, fisheries management, ichthyology, aquaculture or fish culture, taxonomy of aquatic organisms, and aquatic ecology are acceptable. Courses such as vertebrate biology, wildlife management, ornithology, general ecology, etc. do not belong in this category. The course designated as fulfilling the principles of fisheries science/management requirement must include fisheries population dynamics and habitat assessment and management.)

B. **Other Biological Sciences** - when added to the above courses must total 30 semester hours in courses such as physiology, microbiology, genetics, ecology, anatomy;

C. **Physical Sciences** - 15 semester hours in course such as chemistry, physics, soils, geology, hydrology, earth science, astronomy, and meteorology.

D. **Mathematics and Statistics** - 6 semester hours, which must include one calculus and one statistics or two statistics courses.

E. **Communications** - 9 semester hours in courses such as composition, technical writing, and verbal communication (3 semester hours may be counted from communication intensive courses [W] if officially designated as such). Literature, foreign language, other humanities courses, and seminars do not count.

F. **Human Dimensions** - 6 semester hours in courses such as named courses in human dimensions of natural resources and courses in policy, planning, administration, law, ethics, public relations, leadership, conflict resolution, natural resource economics, etc.

A minimum grade of 'C' is required to receive credit. If courses are taken as pass/fail (S/N or P/F), the applicant must provide a course syllabus that indicates that an S or P grade is equivalent to a 'C' or better.

The above guidelines are meant for those graduating after July 2002, a slightly different set of guidelines previously developed for those graduating before July 2002 is also available. A copy of the old and new guidelines for professional certification can be obtained from the American Fisheries Society's website

AFS Certification Requirements *(continued)*

(http://www.fisheries.org/afs/education.html) or by writing to them at 5410 Grosvenor Lane, Bethesda, MD 20814-2199.

The following MSU courses are applicable to meet the AFS requirements for professional certification, Tier I, Associate Fisheries Specialist. Not all courses listed are required for the B.S. in Fisheries and Wildlife. Those not required, may be applied to the 26-29 credits of electives.

A. Fisheries and Aquatic Sciences (14 credits total, part of 30 required)

- FW 414 Aquatic Ecosystem Management 3 credits
- FW 424 Population Analysis and Management 4 credits
- FW 471 Ichthyology 4 credits
- FW 479 Fisheries Management 3 credits
- FW 474 Aquatic Techniques

B. Other Biological Sciences (27-28 credits total, part of 30 required)

- BS 161 Cells and Molecules 3 credits
- BS 162 Organisms and Populations 3 credits
- BS 171 Cells and Molecules Lab 2 credits
- BS 172 Organisms and Populations Lab 2 credits
- ZOL 355 Ecology 3 credits
- FW 417 Wetland Ecology and Management 3 credits
- FW 364 Ecological Problem Solving 3 credits
- Plant Taxonomy course: PLB 418 or PLB 424 3-4 credits
- Invertebrate Bio: ENT 422 or ZOL 306 3-4 credits
- Organismic Biology course: FW 473, ZOL 328, ZOL 341, or ZOL 483 3-4 credits

C. Physical Sciences (15 credits required)

- CEM 141 General Chemistry 4 credits
- CEM 161 Chemistry Laboratory I 1 credit
- PHY 231 Introductory Physics I 3 credits
- CSS 210 Fundamentals of Soil and Landscape Science 3 credits

D. Mathematics and Statistics (6 credits required)

- MTH 124 Survey of Calculus I 3 credits
- STT 224 Probability and Statistics for Ecologists 3 credits

E. Communications (9 credits required)

- WRA 110-195H (Writing, a variety of topics offered) 4 credits
- ❖ AEE 401 (3 cr.), COM 100 (3 cr.), COM 200 (4 cr.), COM 225 (3 cr.), COM 240 (4 cr.), FW 435 (3 cr.), JRN 412 (3 cr.), WRA 320 (3 cr.), WRA 331 (3 cr.), WRA 341 (3 cr.), WRA 453 (3 cr.), and 3 course credits designated as writing intensive (W). 3 credits

AFS Certification Requirements *(continued)*

F. Human Dimensions (6 credits required)

- FW 434 Human Dimensions of Fisheries and Wildlife Management 3 credits
- ❖ FOR 466 (3 cr.), ESA 415 (4 cr.), ESA 430 (3 cr.), or RD 440 (3 cr.) 3-4 credits

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Society of Wetland Scientists Professional Certification Program

The Society of Wetland Scientists has established a certification program for Professional Wetland Scientists. Certification as Wetland Professional In Training (WPIT) is considered a preliminary step for persons who have completed the educational requirements but do not meet the experience requirements. Professional Wetland Scientist (PWS) certification is awarded to those meeting both educational and experience requirements.

COLLEGE / UNIVERSITY EDUCATION:

All applicants must submit information that documents completion of the educational requirements leading to a college or university degree of Bachelor of Science, Bachelor of Arts, or equivalent or higher degree, and should have the following, or equivalent, course work:

1) Biological Sciences: Fifteen (15) semester hours in biological sciences including courses such as general biology, botany or zoology; general ecology; plant, animal, aquatic or wetlands ecology; invertebrate zoology; taxonomy; marine science; fisheries biology; plant physiology, plant taxonomy, plant pathology, plant morphology; relevant environmental sciences; and similar courses.

2) Physical Sciences: Fifteen (15) semester hours in courses in soils, chemistry, hydrology, physics, geology, sedimentology, oceanography, coastal processes, environmental engineering, and similar courses.

3) Quantitative Sciences: Six (6) semester hours in courses in math, computer sciences, basic statistics, population dynamics, experimental statistics, and similar courses.

4) Additional Educational Requirements for PWS Certification: Fifteen (15) semester hours (or equivalent in short courses or continuing education courses) of wetland-related coursework. Examples of recommended courses, continuing education, and/or training needed to attain additional competency include, but are not limited to, the following:

Wetland Plant Taxonomy	Advanced Plant Taxonomy
Wetland Hydrology	General Hydrology
Soil Morphology, Classification, & Mapping	Hydric Soil Identification
Wetland Restoration and Creation	Wetland Ecology
Applied Wetland Ecology and Management	Wetland Creation/Mitigation
Wetland Delineation/Evaluation/Classification	

Attendance at professional meetings of symposia will not qualify to meet this requirement.

Applicants seeking credit for specialized wetland courses taken outside of the university setting where no official college credit was generated must provide the following information to assist the SWSPCP in assessing the applicability or the course in meeting the minimum hour requirement for Specialized Wetland Courses:

- Name, date, location and sponsor of the course
- The number of classroom and/or field hours completed
- Provide CEUs (Continuing Education Units) if earned

The SWSPCP recognizes that Professional Wetland Scientists will have an extremely broad range of technical specialties. Curricula can be individually tailored, particularly at the advanced degree level or as part of a professional development program of continuing education and training, to prepare for any of these specialties. For example, there is currently high interest in and need for qualified professionals to consistently and accurately identify and delineate wetlands and wetland boundaries; evaluate types, nature, and function of wetlands; and/or propose plans for wetland restoration, creation, and/or mitigation.

A copy of the SWS Professional Certification Program guidelines can be obtained from the Society of Wetland Scientist's website (http://www.wetlandcert.org) or by writing to them at 1313 Dolly Madison Blvd., Suite 402, McLean, VA 22101.

The following MSU courses are applicable to meet the Society of Wetland Scientists Professional Certification Program requirements for Wetland Professional In Training (WPIT). Not all courses listed are required for the B.S. in Fisheries and Wildlife. Those not required, may be applied to the 26-29 credits of electives.

1. **Biological Sciences** (15 semester hours required)
   - BS 161 Cells and Molecules 3 credits
   - BS 162 Organisms and Populations 3 credits
   - BS 171 Cells and Molecules Lab 2 credits
   - BS 172 Organisms and Populations Lab 2 credits
   - ZOL 355 Ecology 3 credits
   - FW 410 Upland Ecosystem Management 3 credits
   - FW 414 Aquatic Ecosystem Management 3 credits
   - FW 364 Ecological Problem Solving 3 credits
   - Organismic Biology course: FW 473, ZOL 328, ZOL 341, or ZOL 483 3 - 4 credits

2. **Physical Sciences** (15 semester hours required)
   - CEM 141 General Chemistry 4 credits
   - CEM 161 Chemistry Laboratory I 1 credit
   - PHY 231 Introductory Physics I 3 credits
   - CSS 210 Fundamentals of Soil and Landscape Science 3 credits
   - ❖ Elective course(s),

3. **Quantitative Sciences** (6 semester hours required)
   - MTH 124 Survey of Calculus I 3 credits
   - STT 224 Probability and Statistics for Ecologists 3 credits
   - FW 424 Population Analysis and Management 4 credits

4. **Additional Wetland-related coursework** (15 semester hours required)
   - TSM 431 Irrigation, Drainage and Erosion Control Systems 3 credits
   - BE 481 Land and Water Conservation Engineering 3 credits
   - CSS 470 Soil Resources 3 credits
   - FOR 810 Forest Hydrology 3 credits
   - FW 417 Wetland Ecology and Management 3 credits
   - FW 443 Restoration Ecology 3 credits
   - FW 454 Environmental Hydrology and Watershed Management 3 credits
   - PLB 418 Plant Systematics 3 credits
   - ESA 452 Watershed Concepts 3 credits

The Wildlife Society Certification Program

Certification by The Wildlife Society (TWS) is based on the education and experience of an individual and is offered in two categories: Certified Wildlife Biologist (acceptable combination of education and experience requirements) and Associate Wildlife Biologist (acceptable educational requirements, but still acquiring necessary experience). An individual applies for certification by requesting information and application forms from the society's headquarters: 5410 Grosvenor Lane, Bethesda, MD 20814; or from their web site: http://www.wildlife.org/certification/index.cfm

The minimum educational requirements for certification are: completion of a course of study in a college or university leading to a Bachelor of Science or Bachelor of Arts or equivalent, or higher degree, with the following, or equivalent, course work:

1. **Biological Sciences**: Thirty-six (36) semester hours in biological sciences are required (Note: the sum of hours required in subcategories (a)-(e) is 33; the remaining 3 hours may be in any of the five subcategories) and must include:

   (a) Wildlife Management: Six (6) semester hours in courses emphasizing the principles and practices of wildlife management.

   (b) Wildlife Biology: Six (6) semester hours in courses in biology and behavior of birds, mammals, reptiles, or amphibians. Must include at least 1 course dealing with the science of mammalogy, ornithology, or herpetology. Courses should demonstrated training in understanding the biology of wildlife species and their habitat relationships as the basis for management. Ichthyology, marine biology (except courses focusing on marine mammals or reptiles), microbiology, entomology, or related courses will not count in this category, but will qualify in the Zoology category

   (c) Ecology: Three (3) semester hours in general plant or animal ecology (excludes human ecology).

   (d) Zoology: Nine (9) semester hours in courses in taxonomy, biology, physiology, anatomy, and natural history of vertebrates and invertebrates. Courses in genetics, nutrition, physiology, disease, and other biology or general zoology courses are accepted. Ichthyology or fisheries biology courses are accepted.

   (e) Botany: Nine (9) semester hours in courses in general botany, plant anatomy, plant genetics, plant morphology, plant physiology, plant taxonomy, or other botany courses. At least 1 course must deal with plant taxonomy or identification.

2. **Physical Sciences**: Nine (9) semester hours in physical sciences such as chemistry, physics, geology, or soils, with at least two (2) disciplines represented.

The Wildlife Society Certification Program *(continued)*

3. **Quantitative Sciences**: Nine (9) semester hours in quantitative sciences that must include:

   (a) Basic Statistics: Three (3) semester hours in basic statistics.

   (b) Quantitative Sciences: Six (6) semester hours in calculus, biometry, advanced algebra, systems analysis, mathematical modeling, sampling, computer science, or other quantitative science. GIS courses and introductory personal computing courses do not count in this category.

4. **Humanities and Social Sciences**: Nine (9) semester hours in humanities and social sciences, such as economics, sociology, psychology, political science, government, history, literature, or foreign language.

5. **Communications**: Twelve (12) semester hours in courses such as English composition, technical writing, journalism, public speaking, or use of mass media. Courses in literature interpretation, foreign languages, classes requiring a term paper, class projects, and seminars in non-communication courses will not count toward this category.

6. **Policy, Administration, and Law**: Six (6) semester hours in courses that demonstrate significant content or focus on natural resource policy and/or administration, wildlife or environmental law, or natural resource/land use planning will apply; as will courses that document contributions to the understanding of social, political and ethical decisions for wildlife or natural resource management. Up to three (3) semester hours in classes dealing with human dimension issues may count in this category depending on course content. Conservation Biology courses that effectively integrate legal and policy aspects of conservation planning will count toward this category. Courses that are tools supporting professional practice, e.g., photogrammetry , Land-Sat mapping, GIS techniques, or more general courses such as environmental science, resource management, law enforcement, criminology, political science, and introductory survey courses in conservation will not apply.

The Wildlife Society Certification Program *(continued)*

The following MSU courses are applicable to meet the TWS requirements for Associate Wildlife Biologist certification. Not all courses listed are required for the B.S. in Fisheries and Wildlife. Those not required, may be applied to the 26-29 credits of electives.

1. **Biological Sciences** (36 credits required):

   (a) ***Wildlife Management*** (6 credits required)
   - FW 101 (3 credits)
   - FW 101L or FW 238 (2 to 3 credits)
   - FW 410 (3 credits)
   - FW 417 (3 credits)
   - FW 424 (4 cr. course, apply 2 cr. to 1a and other 2 cr. to 3b)

   (b) ***Wildlife Biology*** (6 credits required)
   - ZOL 360 (4 credits), ZOL 365 (4 credits), or ZOL 384 (4 credits)

   (c) ***Ecology*** (3 credits required)
   - ZOL 355 (3 credits)

   (d) ***Zoology*** (9 credits required)
   - BS 162 & BS 172 (5 cr. course, apply 3 cr. to 1d and other 2 cr. to 1e)
   - BS 161 & BS 171 (5 credits)
   - CSS 350 (3 cr.), FW 473 (3 cr.), ZOL 328 (4 cr.), ZOL 341 (4 cr.), or ZOL 483 (4 cr.)

   (e) ***Botany*** (9 credits required)
   - BS 162 & BS 172 (apply the other 2 cr. from above)
   - FOR 204 (4 cr.), PLB 218 (3 cr.), or PLB 418 (3 cr.)
   - ❖ Elective course(s), need 4 to 5 credits: Suggestions: FOR 204 (4 cr.), PLB 105 & 106 (4 cr.), PLB 218 (3 cr.), PLB 301 (3 cr.), PLB 415 (3 cr.), PLB 418 (3 cr.) PLB 441 (3 cr.)

2. **Physical Sciences**: (9 credits required)
   - CEM 141 (4 credits)
   - CEM 161 (1 credit)
   - CEM 143 (4 credits)
   - CSS 210 (3 credits)
   - PHY 231 (3 credits)

The Wildlife Society Certification Program *(continued)*

3. **Quantitative Sciences**:
   (a) ***Basic Statistics*** (3 credits required)
   - STT 224, STT 231 or STT 421 (3 credits)

(b) ***Quantitative Sciences*** (6 credits required)
- MTH 124, MTH 132 or LB 118 (3 credits)
- FW 364 (3 credits)
- FW 424 (other 2 cr. from 1a)

4. **Humanities and Social Sciences**: (9 credits required)
   - EC 201 or EC 202 (3 credits)
   - IAH (8 credits)
   - ISS (8 credits)

5. **Communications**: (12 credits required)
   - WRA 110 – 195H (4 credits)
   - 6 credits from: ACR 205 (3 cr.), ESA 401 (3 cr.), COM 100 (3 cr.), COM 225 (3 cr.), COM 240 (4 cr.), COM 275 (3 cr.). FW 435 (3 cr.), JRN 412 (3 cr.), WRA 320 (3 cr.), WRA 331 (3 cr.), WRA 341 (3 cr.), WRA 453 (3 cr.)
   - ❖ Elective course, need 3 credits: see list above

6. **Policy, Administration, and Law**: (6 credits required)
   - FW 434 (3 credits)
   - ❖ Elective course, 3 credits needed: Suggestions—ESA 415 (4 credits), ESA 430 (3 credits), ESA 440 (3 credits), ESA 444 (3 credits), FOR 466 (3 credits), ZOL 446 (3 credits)

Dr. Rique Campa (353-2042; campa@msu.edu) has served on the TWS Certification Review Board, and is willing to review FW students certification application materials prior to sending it to TWS. Contact Dr. Campa, if you'd like him to review your application materials.

FEDERAL EMPLOYMENT REQUIREMENTS

The U. S. Office of Personnel Management lists the requirements for federal employment as a wildlife biologist and fishery biologist. These requirements include:

(1) **Wildlife Biologist Series** – (GS-486)
(http://www.opm.gov/qualifications/SEC-IV/B/GS0400/0486.HTM)

- A bachelor's or higher degree in biological science from an accredited college or university; or a combination of education and experience in courses equivalent to a major in biological science (i.e., at least 30 semester hours) including:
  - At least 9 semester hours in wildlife subjects such as mammalogy, ornithology, animal ecology, wildlife management, or research courses in the field of wildlife biology;
  - At least 12 semester hours in zoology in such subjects as general zoology, invertebrate zoology, vertebrate zoology, comparative anatomy, physiology, genetics, ecology, cellular biology, parasitology, entomology, or research courses in such subjects;
  - At least 9 semester hours in botany or related plant science.

(2) **Fishery Biologist Series** – (GS-482)
(http://www.opm.gov/qualifications/SEC-IV/B/GS0400/0482.HTM)

- A bachelor's or higher degree in biological science from an accredited college or university; or a combination of education and experience in courses equivalent to a major in biological science (i.e., at least 30 semester hours) including:
  - At least 6 semester hours in aquatic subjects such as limnology, ichthyology, fishery biology, aquatic botany, aquatic fauna, oceanography, fish culture, or related courses in the field of fishery biology
  - At least 12 semester hours in the animal sciences in such subjects as general zoology, vertebrate zoology, comparative anatomy, physiology, entomology, parasitology, ecology, cellular biology, genetics, or research in these fields. (Excess courses in aquatic subject may be used to meet this requirement when appropriate);

A listing of all federal job opportunities, as well as application procedures, can be found on the USAJOBS web site: http://www.usajobs.opm.gov/.

COURSE DESCRIPTIONS

A description of all MSU courses can be found in the MSU Course Descriptions publication, available for purchase at the MSU Bookstore; OR from the MSU Course Catalog Search website: (http://www.reg.msu.edu/Courses/Search.asp) – select FW Fisheries and Wildlife as the Subject Code; leaving the Course Number blank will show you all the FW courses.

TRANSFER COURSE EQUIVALENCIES

If you are considering taking courses at another institution and then transferring to MSU or have already taken courses at another college, you may want to contact us for more detailed information on transfer of courses from that college to MSU. You may find it more convenient to check the credit evaluations on the Transfer MSU web page (http://www.transfer.msu.edu/). Follow the directions from the web page for selecting the institution that you previously attended or that you plan to attend, and then the department for courses that you took there. Keep in mind that this database is frequently updated and has more information on colleges in Michigan than on colleges outside of Michigan.

SCHEDULE OF COURSES

If you would like to see what days and times specific courses at MSU are offered, check the Schedule of Courses website: (http://schedule.msu.edu/). Just select the semester, the department, and the course number to view the days and times that course is offered. If you would like to view all courses offered by a certain department just enter the wildcard " * " for course number and all courses for the selected department will be shown. Please note: not all courses are offered every semester, some maybe fall only and others spring only. If you receive the message "I did not find any sections based on your selection criteria" when looking for a specific course, try selecting a different semester.

DEPARTMENT OF FISHERIES AND WILDLIFE FACULTY & STAFF

For a complete listing of the faculty (including adjunct faculty), staff, and graduate students, check out the following: http://www.fw.msu.edu/people/index.htm. Faculty listings