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

August 2007

DEPARTMENT OF FISHERIES AND WILDLIFE

The Department of Fisheries and Wildlife is one of 13 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

(Revised May 2003)

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 410, FW 414, FW 417, and 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]*
  - Satisfied by completing BS 110 (4 cr.), CEM 141 (4 cr.) and CEM 161 (1 cr.).
- **Diversity**
  - Must complete at least one "N" or "I" diversity designated course as part of the Integrative Studies program.

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES REQUIREMENTS:

- Complete MTH 103 (College Algebra - 3 cr.) and 114 (Trigonometry - 3 cr.) OR MTH 116 (College Algebra and Trigonometry - 5 cr.). Also satisfied by placing into a calculus course (MTH 124 or MTH 132) based on a MSU math placement test.
- EC 201 or EC 202 - Introduction to Micro or Macro Economics (3 cr.)
- Complete at least 26 credits of CANR courses. FW majors satisfy this requirement by completing CSS 210 (3 cr.), FW 100 (3 cr.), FW 324 (3 cr.), FW 364 (3 cr.), FW 410 (3 cr.), FW 414 (3 cr.), FW 417 (3 cr.), FW 424 (4 cr.), FW 434 (3 cr.) - 28 total credits. Non-CANR courses substituted for any of the above courses will require a student to complete additional CANR course credits to meet the College's 26 credit requirement.

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

FW MAJOR REQUIREMENTS:

CORE COURSES: Complete ALL of the following courses: **(59 credits)**

- ***Math and Science*** **(34 credits)**
  - BS 110 Organisms and Population 4
  - BS 111 Cells and Molecules 3
  - CEM 141 General Chemistry I 4
  - CEM 161 Chemistry Lab I 1
  - CEM 143 Survey of Organic Chemistry 4
  - CSS 210 Fundamentals of Soil and Landscape Science 3
  - MTH 116 [1] College Algebra & Trigonometry 5
  - MTH 124 Survey of Calculus I 3
  - PHY 231 Introductory Physics I 3
  - ZOL 355 Ecology 3
  - ZOL 355L Ecology Lab 1

- ***Fisheries and Wildlife*** **(25 credits)**
  - FW 100 Introduction to Fisheries and Wildlife 3
  - FW 324 Wildlife Biometry 3
  - FW 364 Ecological Problem Solving 3
  - FW 410 Upland Ecosystem Management 3
  - FW 414 Aquatic Ecosystem Management 3
  - FW 417 Wetland Ecology and Management 3
  - FW 424 Population Analysis and Management 4
  - FW 434 Human Dimensions of Fisheries & Wildlife Management 3

PLANT TAXONOMY: Complete ONE of the following courses: **(3 or 4 credits)**

- FOR 204 Forest Vegetation 4
- PLB 218 Plants of Michigan 3
- PLB 418 Plant Systematics 3

ORGANISMIC BIOLOGY: Complete ONE of the following courses: **(3 or 4 credits)**

- FW 473 Environmental Fish Physiology 3
- ZOL 328 Comparative Anatomy and Biology of Vertebrates 4
- ZOL 341 Fundamental Genetics 4
- ZOL 483 Environmental Physiology 4

[1] MTH 116 (5 cr.) may be substituted by completing both MTH 103 (3 cr.) and MTH 114 (3 cr.)

FW MAJOR REQUIREMENTS: (continued)

ANIMAL TAXONOMY: Complete ONE of the following courses: **(3 or 4 credits)**

♦ ENT	422	Aquatic Entomology	3
♦ FW	471	Ichthyology	4
♦ 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

FREE ELECTIVES: Complete **26 to 29 credits** of open electives of your choice. The Department of Fisheries and Wildlife highly recommends that you meet with Jim Schneider, academic adviser, when considering which courses to complete for your electives. **See pages 7-9 for suggested electives**.

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USING YOUR ELECTIVES WISELY

The 26-29 elective credits available to 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 or Fisheries and Wildlife Core Course requirements will be applied to a students 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
RD	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

AQUACULTURE (continued)

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
FW	475	Aquaculture

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	444	Conservation Biology
FW	475	Aquaculture
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	480	Int. Studies in FW – Antarctica
FW	480	Int. Studies in FW - Bahamas
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

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
GLG	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 20)
- Ecological Society of America (www.esa.org)
  - Associate Ecologist Certification
- Society for Wetland Scientists (www.sws.org)
  - Wetland Professional in Training (see page 22)
- The Wildlife Society (www.wildlife.org)
  - Associate Wildlife Biologist Certification (see page 25)

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 SPECIALIZATIONS (see pages 10-17 for more details)

- Agriculture and Natural Resources Biotechnology
- 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
- Spatial Information Processing (GIS)

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
RD	452	Watershed Concepts
ZOL	313	Animal Behavior
ZOL	485	Tropical Biology
ZOL	370	Introduction to Zoogeography

VETERINARY MEDICINE

A listing of MSU courses that satisfy the College of Veterinary Medicines entrance requirements are provided on Page 19.

WETLAND ECOLOGY

ENT	422	Aquatic Entomology
ESA	324	Water Res. Development
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
RD	452	Watershed Concepts
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	100	Introduction to Fisheries and Wildlife	3
FW	205	Principles of Fisheries and Wildlife Management	3
FW	284	Natural History and Conservation in Michigan	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	Introduction to Environmental Studies & Agriscience	3
ESA	201	Environmental and Natural Resources	3

   b. Complete ONE of the following courses: (2 or 3 credits)

FW	444	Conservation Biology	3
PRR	449	Management of Natural Resource Based Recreation	3
ESA	320	Resource Management and Planning	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: (6 credits)

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

FW	434	Human Dimensions of Fisheries & Wildlife Management	3
PRR	302	Environmental Attitudes and Concepts	3
ESA	300	Environmental and Natural Resource Conflict Mgmt	3

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

FOR	466	Natural Resources Policy	3
PHL	354	Philosophy of Law	3
ESA	430	Environmental and Natural Resource Law	3
ESA	433	Law and Social Change	3
ESA	444	Pesticides, People and Politics	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: (6-7 credits)

CJ	210	Introduction to Forensic Science	3
CJ	220	Criminology	3
CJ	235	Investigation Procedures	3
CJ	275	Criminal Procedure	3
CJ	292	Methods of Criminal Justice Research	3
CJ	335	Policing	3
CJ	433	Law Enforcement Intelligence Operations	3
CJ	235	Investigation Procedures	3
CJ	474	Law and Criminal Justice Policy	4

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
GLG	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

- **Agriculture and Natural Resources Biotechnology**
  - Contact Person: Taylor Johnston, 355-0271 ext. 1164, johnsto4@msu.edu
  - http://www.css.msu.edu/Specializations.cfm#BioTech

- **Connected Learning in Agriculture and Natural Resources - Bailey Scholars Program**
  - Contact Person: Glenn Sterner, 432-0735, sternerg@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: Taylor Johnston, 355-0271 ext. 1164, johnsto4@msu.edu
  - http://www.css.msu.edu/Specializations.cfm#IntAg

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/

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

ADDITIONAL MAJORS & SECOND UNDERGRADUATE DEGREE

Several Fisheries and Wildlife students have satisfied their elective requirement by completing an additional major or a second undergraduate degree. Common additional majors or second degrees have been: Agriculture and Natural Resources, Education and Communication Systems; Environmental Studies and Applications; Forestry; Parks, Recreation and Tourism Resources; and Zoology. 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.

MSU PREVETERINARY PROGRAM COURSE REQUIREMENTS

The MSU Preveterinary Program includes the following courses, which meet the College of Veterinary Medicine's admission requirements. A bachelor's degree is not required for admission to the Doctor of Veterinary Medicine program, however, a majority of those accepted to the DVM program have exceeded the minimum requirements and, in many cases, have earned a degree. Consequently, the College of Veterinary Medicine recommends that you should plan to earn a bachelor's degree in a major of your choice while preparing to apply to the professional program. Many of the preveterinary courses listed meet Fisheries and Wildlife major requirements, while the others can be applied to the 26-29 credits of degree electives. For complete details on the Veterinary Medicine program and requirements check out the preveterinary program web site (http://cvm.msu.edu/admis/other_programs/preveterinary_program_intro.htm) or contact them directly: College of Veterinary Medicine, Michigan State University, Office of the Dean, G100 Vet Med Center, East Lansing, MI 48824-1316, (517) 355-6509, (517) 432-1037 (fax), http://cvm.msu.edu/.

Students must complete <u>all</u> of the following coursework:

- WRA 1xx (4 cr.) American Thought and Language (Writing) (Required by FW)
- IAH 20x (4 cr.) Arts & Humanities course (Required by FW)
- IAH 2xx (4 cr.) Arts & Humanities course (Required by FW)
- ISS 2xx (4 cr.) Social Science course (Required by FW)
- ISS 3xx (4 cr.) Social Science course (Required by FW)
- MTH 116 (5 cr.) College Algebra & Trigonometry (Required by FW)
- CEM 141 (4 cr.) General Chemistry (Required by FW)
- CEM 161 (1 cr.) Chemistry Lab I (Required by FW)
- BS 110 (4 cr.) General Biology: Organisms and Population (Required by FW)
- BS 111 (3 cr.) General Biology: Cells and Molecules (Required by FW)
- BS 111L (2 cr.) General Biology: Cells and Molecules Lab (FW elective)
- CEM 251 (3 cr.) Organic Chemistry I (substitute for CEM 143)
- CEM 252 (3 cr.) Organic Chemistry II (FW elective)
- CEM 255 (2 cr.) Organic Chemistry Lab (FW elective)
- BMB 401 (4 cr.) Basic Biochemistry (FW elective)
- ANS 313 (4 cr.) Principles of Animal Feeding & Nutrition (FW elective)
- MMG 301 (3 cr.) Introductory Microbiology (FW elective)
- MMG 302 (1 cr.) Introductory Microbiology Laboratory (FW elective)
- MMG 409 (3 cr.) Eukaryotic Cell Biology (FW elective)
- PHY 231 (3 cr.) Introductory Physics I (Required by FW)
- PHY 251 (1 cr.) Introductory Physics Lab I (FW elective)
- PHY 232 (3 cr.) Introductory Physics II (FW elective)
- PHY 252 (1 cr.) Introductory Physics Lab II (FW elective)

Students must also select <u>one</u> of the following courses:

- ANS 314 (4 cr.) Genetic Improvement of Domestic Animals (FW elective)
- ZOL 341 (4 cr.) Fundamental Genetics (Can satisfy FW Organismic Biology requirement)

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

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

•	BS 110	Organisms and Populations	4 credits
•	BS 111	Cells and Molecules	3 credits
•	ZOL 355	Ecology	3 credits
•	ZOL 355L	Ecology Lab	1 credit
•	FW 410	Upland Ecosystem Management	3 credits
•	FW 417	Wetland Ecology and Management	3 credits
•	FW 364	Ecological Problem Solving	3 credits
•	Plant Taxonomy course: PLB 218, 418, or FOR 204		3-4 credits
•	Organismic Biology course: FW 473, ZOL 328, ZOL 341, or ZOL 483		4 credits

C. Physical Sciences (15 credits required)

•	CEM 141	General Chemistry	4 credits
•	CEM 161	Chemistry Laboratory I	1 credit
•	CEM 143	Survey of Organic Chemistry	4 credits
•	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
•	FW 324	Wildlife Biometry	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).		5 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 110 Organisms and Populations 4 credits
   - BS 111 Cells and Molecules 3 credits
   - ZOL 355 Ecology 3 credits
   - ZOL 355L Ecology Lab 1 credit
   - 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
   - CEM 143 Survey of Organic Chemistry 4 credits
   - PHY 231 Introductory Physics I 3 credits
   - CSS 210 Fundamentals of Soil and Landscape Science 3 credits

3. **Quantitative Sciences** (6 semester hours required)
   - MTH 116 College Algebra and Trigonometry 5 credits
   - MTH 124 Survey of Calculus I 3 credits
   - FW 324 Wildlife Biometry 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 412 Wetland Ecology and Management 3 credits
   - FW 443 Restoration Ecology 3 credits
   - PLB 418 Plant Systematics 3 credits
   - RD 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.

The Wildlife Society Certification Program *(continued)*

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

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 100 (3 credits)
   - FW 410 (3 credits)
   - FW 412 (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)
   - ❖ Elective course, need 2 credits: Suggestion: ZOL 313 (3 credits), ZOL 360 (4 credits), ZOL 361 (4 credits), ZOL 365 (4 credits), ZOL 384 (4 credits)

   (c) ***Ecology*** (3 credits required)
   - ZOL 355 (3 credits)
   - ZOL 355L (1 credit)

   (d) ***Zoology*** (9 credits required)
   - BS 110 (4 cr. course, apply 2 cr. to 1d and other 2 cr. to 1e)
   - BS 111 (3 credits)
   - FW 414 (3 credits)
   - FW 473 (3 credits), ZOL 328 (4 credits), ZOL 341 (4 credits), or ZOL 483 (4 credits)

   (e) ***Botany*** (9 credits required)
   - BS 110 (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)
   - FW 324 (3 credits)

   (b) ***Quantitative Sciences*** (6 credits required)
   - MTH 116 (5 credits)
   - MTH 124 (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)
   - ❖ Elective courses, need 8 credits: Suggestions— 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.)

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 matierials.

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:

- **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.

- **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://ntweb8.ais.msu.edu/ScheduleBook/schedule.asp). 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

- **WILLIAM W. TAYLOR ~** Professor & Department Chair
  - Interests: Fisheries ecology, population, and management; influence of fish on the structure and function of aquatic ecosystems; U.S.-Canada fishery resource policy and management
  - Contact Info: 7 Natural Resources; (517) 353-0647; Email: taylorw@msu.edu

- **ROBERT G. BATIE** ~ Professor
  - Interests: Marine resource conservation; conservation biology of invertebrates
  - Contact Info: 13A Natural Resources; (517) 355-4479; Email: rbatie@msu.edu

- **TED R. BATTERSON** ~ Professor & Director, North Central Regional Aquaculture Center
  - Interests: Limnology; great lakes wetlands; aquatic plant control
  - Contact Info: 13 Natural Resources; (517) 353-1962; Email: batters2@msu.edu

- **JAMES R. BENCE ~** Professor & Co-Director, Great Lakes Center for Quantitative Fisheries Science and Management
  - Interests: Great Lakes fisheries, fish population assessment, and fisheries modeling
  - Contact Info: 11D Natural Resources; (517) 432-3812; Email: bence@msu.edu

- **MARY BREMIGAN ~** Associate Professor
  - Interests: Fisheries management, aquatic communities & food web dynamics, fish recruitment
  - Contact Info: 2D Natural Resources; (517) 432-3831; Email: bremigan@msu.edu

- **THOMAS M. BURTON ~** Professor (Joint appointment with Zoology)
  - Interests: Aquatic ecology, stream and marsh ecology, pollution effects
  - Contact Info: 291 Natural Science; (517) 353-4475; Email: burtont@msu.edu

- **JORDAN BURROUGHS** – Specialist – Wildlife Outreach
  - Interests: Promote stewardship and sound decision-making about management of wildlife, their habitats, and interactions among stakeholders in wildlife management; Improve stakeholder knowledge of wildlife and wildlife management.
  - Contact Info: 40 Natural Resources Building; (517) 353-4872; Email: pusater3@msu.edu

- **HENRY (RIQUE) CAMPA III ~** Professor
  - Interests: Wildlife habitat analysis and management, wildlife nutrition, impacts of disturbances on wildlife habitats and populations.
  - Contact Info: 2A Natural Resources; (517) 353-2042; Email: campa@msu.edu

- **KENDRA CHERUVELIL ~** Assistant Professor (Joint appointment with Lyman Briggs)
  - Interests: Aquatic ecosytstem management and conservation
  - Contact Info: 139 E. Holmes Hall; (517) 353-9528; spencek1@msu.edu

- **THOMAS G. COON ~** Professor & Director, MSU Extension
  - Interests: Fish ecology, stream ecology, fishery habitat management
  - Contact Info: 108 Agriculture Hall; (517) 355-2308; Email: coontg@msu.edu

DEPARTMENT OF FISHERIES AND WILDLIFE FACULTY *(Continued)*

- **TRACY DOBSON ~** Professor
  - Interests: International conservation policies, biodiversity policy, gender and environment
  - Contact Info: 10C Natural Resources; (517) 355-2351; Email: dobson@msu.edu

- **ERIN DREELIN ~** Associate Director, Center for Water Sciences
  - Interests: Effects of urbanization on aquatic systems, sustainable development, water policy
  - Contact Info: 301 Manly Miles Building; (517) 353-7746; Email: edreelin@msu.edu

- **MOHAMED FAISAL ~** Professor
  - Interests: Fish health and marine diseases
  - Contact Info: S110 Plant Biology Building; (517) 432-8259; Email: faisal@msu.edu

- **KEN FRANK ~** Associate Professor (Joint appointment with Counseling, Educational Psychology and Special Education)
  - Interests: social networks, social structures of organizations and systems
  - Contact Info: 462 Erickson Hall; (517) 355-9567; Email: kenfrank@msu.edu

- **DONALD L. GARLING ~** Professor & Extension Specialist
  - Interests: General aquaculture, larval fish culture, fish nutrition; outreach in aquatic plant control, ponds
  - Contact Info: 9A Natural Resources, (517) 353-1989; Email: garlingd@msu.edu

- **CAROLE GIBBS ~** Assistant Professor (Joint appointment with Criminal Justice)
  - Interests: Criminological theory, corporate crime, intersectionality, environmental crime, and environmental justice
  - Contact Info: 508 Baker Hall, (517) 355-1299; gibbsca1@msu.edu

- **GEOFFREY HABRON ~** Associate Professor (Joint appointment with Sociology)
  - Interests: Multi-disciplinary, systems-thinking integrating adaptive management with community based conservation at the watershed and ecosystem scale, human dimensions, participatory action research and inquiry, marine fisheries, Latin America and the Caribbean
  - Contact Info: 40B Natural Resources; (517) 432-8086; Email: habrong@msu.edu

- **JIM HARDING ~** Academic Specialist – Outreach
  - Interests: Amphibians and reptiles
  - Contact Info: 205 Museum, (517) 353-7978; hardingj@msu.edu

- **DANIEL HAYES ~** Professor
  - Interests: Fish population dynamics, fish habitat, statistics and mathematical modeling
  - Contact Info: 334C Natural Resources; (517) 432-3781; Email: hayesdan@msu.edu

DEPARTMENT OF FISHERIES AND WILDLIFE FACULTY *(Continued)*

- **DANA INFANTE ~** Assistant Professor
  - Interests: Effects of landscape-scale features and processes (i.e., geology, land use, climate) on physical and biological features of fluvial systems; Role of spatial variability (region, scale) on fluvial system dynamics; Catchment hydrology and stream channel geomorphology; Ecological assessment; Sustainable management of fluvial systems
  - Contact Info: 115 Manly Miles; (517) 432-5038; infanted@msu.edu

- **DAVID I. JOHNSON ~** Professor
  - Interests: Environmental issues, environmental education, recycling and solid waste management
  - Contact Info: 10B Natural Resources; (517) 353-1997; Email: johnso76@msu.edu

- **MICHAEL L. JONES ~** Professor & Co-Director, Great Lakes Center for Quantitative Fisheries Science and Management
  - Interests: Fish population dynamics and modeling, adaptive management, sea lamprey management
  - Contact Info: 334F Natural Resources; (517) 432-0465; Email: jonesm30@msu.edu

- **DANIEL KRAMER ~** Assistant Professor (Joint appointment with James Madison)
  - Interests: Examining the social, economic, and policy aspects of conservation.
  - Contact Info: 312 Case Hall; (517) 432-2199; dbk@msu.edu

- **WEIMING LI ~** Associate Professor
  - Interests: Fish physiology, fish behavior, chemoreception, and molecular biology
  - Contact Info: 13B Natural Resources; (517) 353-9837; Email: liweim@msu.edu

- **JIANGUO (JACK) LIU ~** Professor - Rachel Carson Chair in Ecological Sustainability & Director, Center for Systems Integration and Sustainability
  - Interests: Systems modeling and simulations, landscape ecology, wildlife ecology, integration of ecology and economics
  - Contact Info: 13D Natural Resources; (517) 353-1810; Email: jliu@msu.edu

- **FRANK LUPI ~** Associate Professor; Joint Appointment with Agricultural Economics
  - Interests: Economics, non-market valuation, human dimensions
  - Contact Info: 416 Agriculture Hall; (517) 432-3883; Email: lupi@msu.edu

- **BRIAN A. MAURER** ~ Associate Professor
  - Interests: Wildlife ecology, biogeography and macroecology, quantitative ecology
  - Contact Info: 334E Natural Resources; (517) 353-9478; Email: maurerb@msu.edu

- **ANDREW MCADAM** ~ Assistant Professor (Joint appointment with Zoology)
  - Interests: Evolutionary ecology; quantitative genetics; mechanisms of contemporary evolution
  - Contact Info: 11D Natural Resources Building; (517) 432-0396; Email: mcadama@msu.edu

DEPARTMENT OF FISHERIES AND WILDLIFE FACULTY *(Continued)*

- **RICHARD MERRITT ~** Professor & Chair, Department of Entomology (Joint Appointment with Entomology)
  - Interests: Biology and ecology of aquatic insects, with emphasis on filter-feeding behavior and trophic dynamics of aquatic insects, mainly Diptera; effects of environmental factors and human perturbations on aquatic insect communities; biology and ecology of larval black flies and mosquitoes
  - Contact Info: 38 Natural Science; (517) 355-8309; Email: merrittr@msu.edu

- **KELLY F. MILLENBAH ~** Associate Professor & Assoc. Director, Environ. Science & Policy Program
  - Interests: Wildlife management of non-game species with an emphasis on threatened and endangered; ecological restoration
  - Contact Info: 2C Natural Resources; (517) 353-4802; Email: millenba@msu.edu

- **SCOTT PEACOR ~** Assistant Professor
  - Interests: Population and community ecology, ecological and ecosystem modeling, aquatic ecology
  - Contact Info: 10D Natural Resources; (517) 353-1910; Email: peacor@msu.edu

- **CHUCK PISTIS ~** Specialist - Program Leader, Michigan Sea Grant
  - Contact Info: 332 Natural Resources; (517) 353-5508; Email: pistis@msu.edu

- **SHAWN RILEY** ~ Associate Professor
  - Interests: Wildlife ecology and management; integration of ecological and human dimensions of wildlife management; decision-support modeling and processes, wildlife extension
  - Contact Info: 2D Natural Resources; (517) 353-9456; Email: rileysh2@msu.edu

- **GARY ROLOFF ~** Visiting Assistant Professor
  - Interests: Relationships between wildlife population dynamics and the structure, composition and spatial arrangements of habitats; wildlife responses to habitat perturbations; ecological classification systems; use of remote sensing to map and classify landscapes; landscape ecology.
  - Contact Info: 38 Natural Resource Building; (517) 432-5236; Email: roloff@msu.edu

- **JOAN B. ROSE ~** Professor – Homer Nowlin Endowed Chair in Water Research (Joint appointment with Crop and Soil Sciences)
  - Interests: water pollution microbiology, waterborne diseases and public health/public policy issues.
  - Contact Info: 15 Natural Resources Building, (517) 432-4412, Email: rosejo@msu.edu

- **ORLANDO (ACE) SARNELLE ~** Associate Professor
  - Interests: Biological limnology, trophic interactions, plankton ecology
  - Contact Info: 163A Natural Resources; (517) 353-4819; Email: sarnelle@msu.edu

- **JIM SCHNEIDER ~** Specialist – Academic Adviser
  - Interests: Academic advising, job and graduate school assistance, recruitment, curriculum
  - Contact Info: 40A Natural Resources Building; (517) 353-9091; Email: schne181@msu.edu

DEPARTMENT OF FISHERIES AND WILDLIFE FACULTY *(Continued)*

- **KIM SCRIBNER ~** Professor
  - Interests: Population and behavioral ecology, population genetics, molecular biology, evolution, and conservation biology.
  - Contact Info: 2E Natural Resources; (517) 355-4478; Email: scribne3@msu.edu

- **PATRICIA SORANNO ~** Associate Professor
  - Interests: Limnology, ecosystem ecology, and land-water interactions
  - Contact Info: 9B Natural Resources; (517) 432-4330; Email: soranno@msu.edu

- **JEAN TSAO ~** Assistant Professor
  - Interests: Ecology and evolution of disease organisms, Lyme disease, tick and vector-borne disease systems, wildlife disease ecology
  - Contact Info: 11A Natural Resources Building, (517) 353-1737, tsao@msu.edu

- **MERRITT TURETSKY** ~ Assistant Professor (Joint appointment with Plant Biology)
  - Interests: biogeochemistry and ecosystem ecology, with emphasis on wetlands and boreal systems; fire ecology and management
  - Contact Info: S306 Plant Biology Bldg., (517) 353-5554; mrt@msu.edu

- **MICHAEL WAGNER** ~ Assistant Professor
  - Interests: Behavioral and community ecology of fishes, particularly invasive species
  - Contact Info: 334 Natural Resources Bldg, (517) 353-5485, mwagner@msu.edu

- **HOWARD WANDELL** ~ Specialist - Lake and Stream Management Outreach
  - Interests: Promote the implementation of comprehensive lake and stream management through empowerment of local stakeholders and the creation of collaborative management partnerships
  - Contact Info: 334D Natural Resources; (517) 432-1491; Email: wandellh@msu.edu

- **SCOTT WINTERSTEIN ~** Professor & Department Associate Chair
  - Interests: Ecology, ethology, and dynamics of wildlife populations; biometry
  - Contact Info: 2B Natural Resources; (517) 353-2022; Email: winterst@msu.edu

- **LOIS WOLFSON ~** Specialist – Water Quality (Joint appointment with Institute of Water Research)
  - Interests: Limnology, aquatic plant management and algal ecology
  - Contact Info: 10A Natural Resources; (517) 432-1184; Email: wolfson1@msu.edu

Student: _____

PID: _____

Bachelor of Science Degree in

FISHERIES AND WILDLIFE

120 Credits Required

(Revised December 2005)

DEPARTMENT OF FISHERIES AND WILDLIFE

College of Agriculture and Natural Resources

Michigan State University

REQUIREMENTS FOR THE MAJOR

Course *Cr.* *Sem. Completed*

Complete **ALL** of the following courses

Math and Science (34 or 35 credits)

BS	110	(4)		F / S / U _____
BS	111	(3)		F / S / U _____
CEM	141	(4)		F / S / U _____
CEM	143	(4)		F / S / U _____
CEM	161	(1)		F / S / U _____
CSS	210	(3)	**[C]**	F / S / U _____
MTH	116	(5)		F / S / U _____
OR				
MTH	103	(3)		F / S / U _____
MTH	114	(3)		F / S / U _____
MTH	124	(3)		F / S / U _____
PHY	231	(3)		F / S / U _____
ZOL	355	(3)		F / S / U _____
ZOL	355L	(1)		F / S / U _____

Fisheries and Wildlife (25 credits)

FW	100	(3)	**[C]**	F / S / U _____
FW	324	(3)	**[C]**	F / S / U _____
FW	364	(3)	**[C]**	F / S / U _____
FW	410	(3)	**[C]**	F / S / U _____
FW	414	(3)	**[C]**	F / S / U _____
FW	417	(3)	**[C]**	F / S / U _____
FW	424	(4)	**[C]**	F / S / U _____
FW	434	(3)	**[C]**	F / S / U _____

Course *Cr.* *Sem. Completed*

Plant Taxonomy selection: (3 or 4 crs.)

Complete **ONE** of the following courses:
FOR 204 (4 **[C]**), PLB 218 (3) or PLB 418 (3)
F / S / U _____

Organismic Biology selection: (3 or 4 crs.)

Complete **ONE** of the following courses:
FW 473 (3 **[C]**), ZOL 328 (4), ZOL 341 (4), or ZOL 483 (4) F / S / U _____

Animal Taxonomy selection: (3 or 4 crs.)

Complete **ONE** of the following courses:
ENT 422 (3 **[C]**), FW 471 (4 **[C]**), ZOL 360 (4), ZOL 361 (4), ZOL 365 (4), or ZOL 384 (4)
F / S / U _____

Electives: (25-29 credits)

_____ ( ) F / S / U _____
_____ ( ) F / S / U _____
_____ ( ) F / S / U _____
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_____ ( ) F / S / U _____
_____ ( ) F / S / U _____
_____ ( ) F / S / U _____
_____ ( ) F / S / U _____

UNIVERSITY REQUIREMENTS

Course *Cr.* *Sem. Completed*

Writing (4 credits)

WRA 1_____ (4) F / S / U _____

[ ] Received a 1.0 or 1.5 in WRA. Must take AL 201 concurrently with IAH 20x.

Integrative Studies ** (16 credits)

IAH(A) 20____ (D, I, N) (4) F / S / U _____
IAH(B) 2_____ (D, I, N) (4) F / S / U _____
ISS 2_____ (D, I, N) (4) F / S / U _____
ISS 3_____ (D, I, N) (4) F / S / U _____

**** Diversity Requirement:** You must complete 2 different diversity designated courses ("D", "I", or "N") for 2 of the above IAH or ISS selections.

Diversity Requirement Completed _____

COLLEGE REQUIREMENTS

EC 201 or EC 202 (3) F / S / U _____

Complete 26 credits of CANR courses: Satisfied by completing CSS 210, FW 100, FW 324, FW 364, FW 410, FW 412, FW 414, FW 424, and FW 434 (28 credits). **[C]** = CANR course.

[ ] Remedial Course: ***This course and credits DO NOT count toward graduation requirements.*** **(Must complete 123 total credits)**

MTH 1825 (3) F / S / U _____

FISHERIES AND WILDLIFE

Suggested Course Scheduling, Based on Students Math Sequence

MTH 1825/103/114/124 Sequence

95-98 Required Cr.; 25-28 Electives Cr. - 123 Total Credits

Fall Semester			Spring Semester		
YEAR 1					
MTH	1825	3	MTH	103	3
FW	100 or Elective	3	CEM	141	4
WRA	1xx	4	CEM	161	1
BS	110	4	IAH(A)	20x or ISS 2xx	4
			Elective or FW 100		3
		14 cr.			15 cr.
YEAR 2					
MTH	114	3	FW	324	3
IAH(A)	20x or ISS 2xx	4	EC	201 or EC 202	3
ZOL	355	3	CSS	210	3
ZOL	355L	1	BS	111	3
Plant Taxonomy selection		3 or 4	Elective		4
		14 or 15 cr.			16 cr.
YEAR 3					
MTH	124	3	FW	364	3
IAH(B)	2xx	4	FW	410	3
PHY	231	3	ISS	3xx	4
Animal Taxonomy selection		3 or 4	CEM	143	4
Elective		3	Elective		3
		16 or 17 cr.			17 cr.
YEAR 4					
FW	412	3	FW	434	3
FW	414	3	Organismic Biology selection		3 or 4
FW	424	4	Electives		7 to 9
Electives		5 or 6			
		15 or 16 cr.			13 to 16 cr.

MTH 103/114/124 Sequence

92-95 Required Cr.; 25-28 Elective Cr. - 120 Total Credits

Fall Semester			Spring Semester		
YEAR 1					
MTH	103	3	MTH	114	3
FW	100 or Elective	3	CEM	141	4
WRA	1xx	4	CEM	161	1
BS	110	4	IAH(A)	20x or ISS 2xx	4
			Elective or FW 100		3
		14 cr.			15 cr.
YEAR 2					
MTH	124	3	FW	324	3
BS	111	3	EC	201 or EC 202	3
ZOL	355	3	CSS	210	3
ZOL	355L	1	CEM	143	4
Plant Taxonomy selection		3 or 4	IAH(A)	20x or ISS 2xx	4
Elective		3			
		16 or 17 cr.			17 cr.
YEAR 3					
IAH(B)	2xx	4	FW	364	3
PHY	231	3	FW	410	3
Animal Taxonomy selection		3 or 4	ISS	3xx	4
Elective		3	Elective		5
		13 or 14 cr.			15 cr.
YEAR 4					
FW	412	3	FW	434	3
FW	414	3	Organismic Biology selection		3 or 4
FW	424	4	Electives		7 to 9
Electives		4 or 5			
		14 or 15 cr.			13 to 16 cr.

FISHERIES AND WILDLIFE

Suggested Course Scheduling, Based on Students Math Sequence

MTH 116/124 Sequence

91-94 Required Cr.; 26-29 Elective Cr. - 120 Total Credits

Fall Semester			Spring Semester		
YEAR 1					
MTH	116	5	MTH	124	3
FW	100	3	WRA	1xx	4
BS	110	4	CEM	141	4
Elective		3	CEM	161	1
			IAH(A)	20x or ISS 2xx	4
		15 cr.			16 cr.
YEAR 2					
BS	111	3	FW	324	3
IAH(A)	20x or ISS 2xx	4	EC	201 or EC 202	3
ZOL	355	3	CSS	210	3
ZOL	355L	1	IAH(B)	2xx	4
Plant Taxonomy selection		3 or 4	Elective		3
		14 or 15 cr.			16 cr.
YEAR 3					
ISS	3xx	4	FW	364	3
CEM	143	4	FW	410	3
Animal Taxonomy selection		3 or 4	PHY	231	3
Elective		3	Elective		6
		14 or 15 cr.			15 cr.
YEAR 4					
FW	412	3	FW	434	3
FW	414	3	Organismic Biology selection		3 or 4
FW	424	4	Electives		7 or 8
Electives		4 or 6			
		14 to 16 cr.			13 to 15 cr.

MTH 124 or MTH 132 Sequence

86-89 Required Cr.; 31-34 Elective Cr. - 120 Total Credits

Fall Semester			Spring Semester		
YEAR 1					
MTH	124 or MTH 132	3	WRA	1xx	4
FW	100	3	CEM	141	4
BS	110	4	CEM	161	1
Elective		3	IAH(A)	20x or ISS 2xx	4
			Elective		3
		13 cr.			16 cr.
YEAR 2					
BS	111	3	FW	324	3
IAH(A)	20x or ISS 2xx	4	EC	201 or EC 202	3
ZOL	355	3	CSS	210	3
ZOL	355L	1	CEM	143	4
Plant Taxonomy selection		3 or 4	Elective		3
		14 or 15 cr.			16 cr.
YEAR 3					
IAH(B)	2xx	4	FW	364	3
PHY	231	3	FW	410	3
Animal Taxonomy selection		3 or 4	ISS	3xx	4
Elective		4	Elective		6
		14 or 15 cr.			16 cr.
YEAR 4					
FW	412	3	FW	434	3
FW	414	3	Organismic Biology selection		3 or 4
FW	424	4	Electives		7 to 9
Electives		5 or 6			
		15 or 16 cr.			13 to16 cr.