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### Zoology

A major in Zoology is an appropriate beginning for those planning careers in teaching, research, or other employment in animal biology, environmental biology, fisheries biology, veterinary medicine, or wildlife biology. Students majoring in Zoology are required to develop an individualized curriculum in consultation with a faculty advisor within the program.

A student majoring in Zoology may work toward either a Bachelor of Arts (B.A.) or Bachelor of Science (B.S.) degree. The B.A. with a major in Zoology provides the opportunity for a broad, liberal arts education by allowing students to take 20-25 hours of courses in areas of interest outside the major. The B.A. is appropriate for students who desire a strong background in zoology, but have interests in biology-associated careers in business, law, journalism, zoo keeping, or other fields.

Students seeking a B.S. with a major in Zoology must choose one of five specializations: animal biology, environmental biology, fisheries biology, pre-veterinary science, or wildlife biology. The B.S. requires more courses in physical sciences and mathematics than does the B.A., and is appropriate for students planning careers as practicing zoologists in one of the emphasized fields, particularly those who wish to pursue graduate studies. Each B.S. student will complete an independent-study project under the supervision of their faculty mentor, submit a written summary of the project, and present their results as part of ZOOL 482 (Senior Seminar), to be taken during the final year of study.

To prepare for a major in Zoology at SIU Carbondale, students should have a solid high school background in biology, mathematics, and physical sciences, as well as practiced writing skills and a sustaining curiosity about animal life. Students transferring to SIU after two years at a community college should have completed introductory biology, introductory chemistry, and pre-calculus sequences.

Zoology majors must take ZOOL 215 (Sophomore Seminar) immediately after completing BIOL 211 and BIOL 213, or (for transfer students) during the first semester of enrollment at SIU. ZOOL 215 provides students with an orientation to the program and requirements of the major, and assigns them faculty advisors who will act as mentors until graduation.

B.A. and B.S. degrees require a minimum of 41 semester hours of biology or zoology courses. No more than 11 semester hours of biology or zoology courses that are used to satisfy degree requirements for another major may be used to meet the Zoology requirements.

SIU has an affiliate agreement with the University of Southern Mississippi's Gulf Coast Research Laboratory (GCRL). Qualified students can enroll in credit-bearing courses at GCRL with credits articulating as free electives in Zoology at SIU.

### Bachelor of Arts (B.A.) in Zoology

#### B.A. Zoology Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements <sup>1</sup>	39
Requirements for Major in Zoology	54-56

Degree Requirements	Credit Hours
BIOL 211, BIOL 212, BIOL 213, BIOL 304, BIOL 305, and BIOL 307 CHEM 200, CHEM 201, CHEM 202 CHEM 210, CHEM 211 and CHEM 212; or GEOL 220 and GEOL 223; or GEOL 221 and GEOL 224; or PHYS 203A, PHYS 253A ZOOLOGY 215 and ZOOLOGY 220 20 hours of 300-and 400-level Biology or Zoology courses. One of the following quantitative skills courses: QUAN 402 or MATH 282 or ZOOLOGY 360; CS 201 or CS 202; MATH 141 or MATH 150 <sup>2</sup>	
Additional School of Biological Sciences Requirements	7-9
Mathematics: MATH 108 and MATH 109, or MATH 111 or MATH 141 or MATH 150 Supportive Skills: at least six credit hours chosen from QUAN 402 or MATH 282 or PLB 360 or ZOOLOGY 360; CS 105 or CS 200B, CS 201 or CS 202; ENGL 290 or ENGL 291; any two-semester sequence of a foreign language (Chinese, French, Latin, German, Greek, Japanese, Spanish) <sup>3</sup>	
Electives	16-21
Total	120

<sup>1</sup> A total of nine hours of biological science, mathematics, and physical science course work is accounted for in the University Core Curriculum.

<sup>2</sup> A grade of C or better in ZOOLOGY 220 is required for completion of the Zoology B.A. BIOL 304, BIOL 305, and BIOL 307 are required courses and may not be used as electives. A maximum of three credit hours of ZOOLOGY 491, ZOOLOGY 492, and ZOOLOGY 493 together may be used as Zoology electives. Courses used to satisfy College of Science requirements may not be used to satisfy the quantitative skills requirement of the major. Only one of MATH 282, QUAN 402, and ZOOLOGY 360 may be counted toward the supportive skills or major requirements.

<sup>3</sup> The foreign language requirement can also be met by one of the following: (a) earning eight hours of 100-level credit in one language by proficiency examination; (b) completing three years of one language in high school with no grade lower than C.

## Bachelor of Science (B.S.) in Zoology

### Animal Biology Specialization

The B.S. in Zoology with a specialization in Animal Biology is designed for students who wish to obtain a broad background in zoology, but especially those contemplating graduate studies of animal behavior, biodiversity, evolution, natural history, or systematics.

## B.S Zoology - Animal Biology Specialization Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements <sup>1</sup>	39
School of Biological Sciences Requirements	7-9
Biological Sciences: completed with the Zoology major	
Mathematics: MATH 108 and MATH 109, or MATH 111	
Physical Sciences: completed with the Zoology major.	
Supportive Skills: QUAN 402 or MATH 282 or PLB 360 or ZOO 360; ENGL 290 or ENGL 291 or ENGL 391, or JRNL 310	
Requirements for Major in Zoology	68-72
BIOL 211, BIOL 212, BIOL 213, BIOL 304, BIOL 305, BIOL 306, BIOL 307, and BIOL 409 <sup>2</sup>	
CHEM 200, CHEM 201, CHEM 202, CHEM 210, CHEM 211, and CHEM 212	
CHEM 340, CHEM 341, CHEM 350, and CHEM 351; or GEOL 220, GEOL 221, GEOL 223, and GEOL 224; or PHYS 203A, PHYS 203B, PHYS 253A, and PHYS 253B	
CS 200B or CS 201 or CS 202	
MATH 139 or MATH 141 or MATH 150	
ZOO 215, ZOO 220, and ZOO 482 <sup>3</sup>	
At least 15 hours from the following: BIOL 306; ZOO 320, ZOO 385, ZOO 405, ZOO 407, ZOO 408, ZOO 409, ZOO 410, ZOO 413, ZOO 414, ZOO 415, ZOO 418, ZOO 425, ZOO 426, ZOO 433, ZOO 434, ZOO 435, ZOO 438, ZOO 444, ZOO 450, ZOO 461, ZOO 465, ZOO 467, ZOO 471, ZOO 472, ZOO 473, ZOO 478, ZOO 490, ZOO 491, ZOO 492, ZOO 493. <sup>4</sup>	
Electives: ZOO 491, ZOO 492, ZOO 493, ZOO 496, ZOO 497	0-6
Total	120

<sup>1</sup> A total of nine hours of biological science, mathematics, and physical science course work is accounted for in the University Core Curriculum.

<sup>2</sup> A minimum grade of C is required in these courses for completion of the Animal Biology specialization.

<sup>3</sup> A minimum grade of C is required in these courses for completion of the Animal Biology specialization.

<sup>4</sup> A maximum of three credit hours of ZOO 491, ZOO 492, and ZOO 493 together may be used as Zoology electives.

## Environmental Biology Specialization

The B.S. in Zoology with a specialization in Environmental Biology is designed for students interested in biological approaches to the study of environmental quality. Students in this program should also consider the Environmental Studies minor.

### B.S. Zoology - Environmental Biology Specialization Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements <sup>1</sup>	39
School of Biological Sciences Requirements	7-9
Biological Sciences: completed with the Zoology major	
Mathematics: MATH 108 and MATH 109, or MATH 111	
Physical Sciences: completed with the Zoology major	
Supportive Skills: QUAN 402 or MATH 282 or PLB 360 or ZOOL 360; ENGL 290 or ENGL 291 or ENGL 391, or JRNL 310	
Requirements for Major in Zoology	70-71
BIOL 211, BIOL 212, BIOL 213, BIOL 305, BIOL 307, BIOL 409 <sup>2</sup>	
CHEM 200, CHEM 201, CHEM 202, CHEM 210, CHEM 211, CHEM 212, CHEM 340, CHEM 341	
MATH 139 or MATH 141 or MATH 150	
ZOOL 215, ZOOL 220, ZOOL 410, ZOOL 411, ZOOL 432, ZOOL 433 or ZOOL 434, and ZOOL 482 <sup>3</sup>	
At least 12 hours from the following Zoology electives: BIOL 304; ZOOL 351, ZOOL 415, ZOOL 426, ZOOL 435, ZOOL 438, ZOOL 443, ZOOL 444, ZOOL 445, ZOOL 458, ZOOL 490, ZOOL 491, ZOOL 492, ZOOL 493 <sup>4</sup>	
At least 6 hours from the following environmental science electives: CHEM 350 and CHEM 351; CSEM 240; FOR 429; GEOG 310I, GEOG 320, GEOG 330, GEOG 401, GEOG 404, GEOG 422, GEOG 424, GEOG 426, GEOG 430, GEOG 434, GEOG 439, GEOG 471; GEOL 220 and GEOL 223, GEOL 221 and GEOL 224, GEOL 222 and GEOL 223; MICR 301; PHSL 310; PLB 438, PLB 440, PLB 443, PLB 444, PLB 452	
Electives	1-4

Degree Requirements	Credit Hours
Total	120

<sup>1</sup> A total of 12 hours of biological science, mathematics, and physical science coursework is accounted for in the University Core Curriculum

<sup>2</sup> A minimum grade of C is required in BIOL 211, BIOL 212, BIOL 213, BIOL 305, and BIOL 307 for completion of the Environmental Biology specialization.

<sup>3</sup> A minimum grade of C is required in ZOO 220 for completion of the Environmental Biology specialization.

<sup>4</sup> A maximum of three credit hours of ZOO 491, ZOO 492, and ZOO 493 together may be used as Zoology electives.

### Fisheries Biology Specialization

The B.S. in Zoology with a specialization in Fisheries Biology is designed for students whose primary interest is in the ecology and management of fishes and aquatic ecosystems. This emphasis is appropriate for those with career goals involving fisheries management, aquaculture, aquatic ecosystem management, or graduate studies in applied fish biology.

### B.S. Zoology - Fisheries Biology Specialization Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements <sup>1</sup>	39
School of Biological Sciences Requirements	7-9
Biological Sciences: completed with the Zoology major	
Mathematics: MATH 108 and MATH 109, or MATH 111	
Physical Sciences: completed with the Zoology major	
Supportive Skills: QUAN 402 or MATH 282 or PLB 360 or ZOO 360; ENGL 290 or ENGL 291 or ENGL 391, or JRNL 310	
Requirements for Major in Zoology	68-70
BIOL 211, BIOL 212, BIOL 213, BIOL 304, BIOL 305, BIOL 307, and BIOL 409 <sup>2</sup>	
CHEM 200, CHEM 201, CHEM 202, CHEM 210, CHEM 211, and CHEM 212	
CHEM 340, CHEM 341, CHEM 350, and CHEM 351; or PHYS 203A, PHYS 203B, PHYS 253A, and PHYS 253B	

Degree Requirements	Credit Hours
MATH 141 or MATH 150	
ZOOL 215, ZOOL 220, ZOOL 415, ZOOL 465, ZOOL 466, ZOOL 477, and ZOOL 482 <sup>3</sup>	
At least 9 hours from the following: ZOOL 320, ZOOL 385, ZOOL 414, ZOOL 418, ZOOL 426, ZOOL 433, ZOOL 434, ZOOL 458, ZOOL 473, ZOOL 490, ZOOL 491, ZOOL 492, ZOOL 493 <sup>4</sup>	
Electives	2-8
Total	120

<sup>1</sup> A total of nine hours of biological science, mathematics, and physical science course work is accounted for in the University Core Curriculum.

<sup>2</sup> A minimum grade of C is required in BIOL 211, BIOL 212, BIOL 213, BIOL 304, BIOL 305, and BIOL 307 for completion of the Fisheries Biology and Aquatic Conservation Specialization.

<sup>3</sup> A minimum grade of C is required in ZOOL 220 for completion of the Fisheries Biology and Aquatic Conservation Specialization.

<sup>4</sup> A maximum of three credit hours of ZOOL 491, ZOOL 492, and ZOOL 493 together may be used as Zoology electives.

## Pre-Veterinary Science Specialization

The Pre-Veterinary Science specialization is designed for Zoology majors planning to enter veterinary school. Students in this program must register with the College of Science Pre-Health Professions Advisement Office.

## B.S. Zoology - Pre-Veterinary Science Specialization Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements <sup>1</sup>	39
School of Biological Sciences Requirements	7-9
Biological Sciences: completed with the Zoology major	
Mathematics: MATH 108 and MATH 109, or MATH 111	
Physical Sciences: completed with the Zoology major	
Supportive Skills: QUAN 402 or MATH 282 or PLB 360 or ZOOL 360; ENGL 290 or ENGL 291 or ENGL 391, or JRNL 310	

Degree Requirements	Credit Hours
Requirements for Major in Zoology	71-72
BIOL 211, BIOL 212, BIOL 213, BIOL 304, BIOL 305, BIOL 306 and BIOL 409 <sup>2</sup>	
CHEM 200, CHEM 201, CHEM 202, CHEM 210, CHEM 211, CHEM 212, CHEM 340, CHEM 341, CHEM 350 and CHEM 351	
CS 200B or CS 201 or MATH 139 or MATH 141	
PHYS 203A, PHYS 203B, PHYS 253A, and PHYS 253B	
ZOOL 215, ZOOL 220, and ZOOL 482 <sup>3</sup>	
At least nine hours of zoology electives from the following: ZOOL 320, ZOOL 407, ZOOL 409, ZOOL 413, ZOOL 418, ZOOL 426, ZOOL 432, ZOOL 433, ZOOL 434, ZOOL 438, ZOOL 440, ZOOL 461, ZOOL 467, ZOOL 471, ZOOL 478, ZOOL 491, ZOOL 492, ZOOL 493 <sup>4</sup>	
At least six hours of pre-vet electives from the following: ANS 337; BIOL 307; MICR 301, MICR 302, MICR 403, MICR 460; PHSL 310, PHSL 410A, PHSL 410B, PHSL 430	
Electives	0-1
Total	120

<sup>1</sup> A total of nine hours of biological science, mathematics, and physical science course work is accounted for in the University Core Curriculum.

<sup>2</sup> A minimum grade of C is required in BIOL 211, BIOL 212, BIOL 213, BIOL 304, BIOL 305, and BIOL 306 for completion of the Pre-Veterinary Science specialization.

<sup>3</sup> A minimum grade of C is required in ZOOL 220, for completion of the Pre-Veterinary Science specialization.

<sup>4</sup> A maximum of three credit hours of ZOOL 491, ZOOL 492, and ZOOL 493 together may be used as Zoology electives.

## Wildlife Biology Specialization

The B.S. in Zoology with a specialization in Wildlife Biology is designed for students whose primary interests are in wildlife ecology, management, and conservation. Course requirements in this track include those specified by The Wildlife Society's certification program.

## B.S. Zoology - Wildlife Biology Specialization Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements <sup>1</sup>	39
School of Biological Sciences Requirements	7-9
Biological Sciences: completed with the Zoology major	
Mathematics: MATH 108 and MATH 109, or MATH 111	
Physical Sciences: completed with the Zoology major	
Supportive Skills: QUAN 402 or MATH 282 or PLB 360 or ZOOL 360; ENGL 290 or ENGL 291 or ENGL 391, or JRNL 310	
Requirements for Major in Zoology	70-72
BIOL 211, BIOL 212, BIOL 213, BIOL 304, BIOL 305, and BIOL 307 <sup>2</sup>	
CHEM 200, CHEM 201, CHEM 202, CHEM 210, CHEM 211, CHEM 212	
MATH 139 or MATH 141 or MATH 150	
CSEM 240; PHYS 203A and PHYS 253A	
ZOOL 215, ZOOL 220, ZOOL 410, ZOOL 468, and ZOOL 482 <sup>3</sup>	
Three hours of policy from the following: CMST 412; FOR 325; GEOG 422, GEOG 426, GEOG 471; ZOOL 464	
Three hours of management from the following: FOR 405, FOR 451; ZOOL 445, ZOOL 462A and ZOOL 462B, ZOOL 469 <sup>4</sup>	
Six hours of wildlife biology from the following: ZOOL 408, ZOOL 461, ZOOL 462A and ZOOL 462B, ZOOL 467, ZOOL 478 <sup>5</sup>	
At least three hours of zoology electives from the following: ZOOL 320, ZOOL 385, ZOOL 407, ZOOL 408, ZOOL 413, ZOOL 414, ZOOL 418, ZOOL 433, ZOOL 434, ZOOL 461, ZOOL 462A, ZOOL 462B, ZOOL 465, ZOOL 466, ZOOL 467, ZOOL 469, ZOOL 471, ZOOL 478, ZOOL 491, ZOOL 492, ZOOL 493 <sup>6</sup>	



Degree Requirements	Credit Hours
At least three hours of plant systematics from the following: FOR 202, PLB 300, PLB 304, PLB 449, PLB 451 <sup>7</sup>	
At least three hours of botany from the following: FOR 201; PLB 300, PLB 320, PLB 400, PLB 415, PLB 440, PLB 443, PLB 445 <sup>8</sup>	
Electives	0-4
Total	120

<sup>1</sup> A total of nine hours of biological science, mathematics, and physical science course work is accounted for in the University Core Curriculum.

<sup>2</sup> A minimum grade of C is required in BIOL 211, BIOL 212, BIOL 213, BIOL 304, BIOL 305 and BIOL 307 for completion of the Wildlife Biology and Conservation specialization.

<sup>3</sup> A minimum grade of C is required in ZOO 220 for completion of the Wildlife Biology and Conservation specialization.

<sup>4</sup> No course duplications are allowed between elective categories. A maximum of three credit hours of ZOO 491, ZOO 492, and ZOO 493 together may be used as Zoology electives.

<sup>5</sup> No course duplications are allowed between elective categories. A maximum of three credit hours of ZOO 491, ZOO 492, and ZOO 493 together may be used as Zoology electives.

<sup>6</sup> No course duplications are allowed between elective categories. A maximum of three credit hours of ZOO 491, ZOO 492, and ZOO 493 together may be used as Zoology electives.

<sup>7</sup> No course duplications are allowed between elective categories. A maximum of three credit hours of ZOO 491, ZOO 492, and ZOO 493 together may be used as Zoology electives.

<sup>8</sup> No course duplications are allowed between elective categories. A maximum of three credit hours of ZOO 491, ZOO 492, and ZOO 493 together may be used as Zoology electives.

## Zoology Minor

A minor in Zoology consists of BIOL 211, BIOL 212, BIOL 213, ZOO 220, and 12 hours of ZOO courses suitable for majors. One course from BIOL 304, BIOL 305, BIOL 306, BIOL 307, and BIOL 409 may also be counted toward the 12-hour requirement, but no University Core Curriculum courses may be included.

## Honors Program

An honors program is available to those juniors and seniors in zoology who maintain a grade point average of 3.25 or better, overall and in the major. To enroll in ZOO 493, the student must complete a departmental form that requires the project title; a description of the proposed project; and the signatures of the student, the faculty advisor, and the chair of the department. The student must complete six hours of ZOO 493 with a grade of B or better, file with the department a final report on the research, and present the results at a public seminar in order to graduate with departmental honors in zoology. At the time of graduation, an indication of participation in the program is made on the diploma and transcript for students who complete the requirements. Concurrent participation in the University Honors Program is encouraged.

## Zoology Courses

**ZOOL115 - General Biology** 115-3 General Biology. (Same as PLB 115) (University Core Curriculum) [IAI Course: L1 900L] Introduction to fundamental biological concepts for non-life science majors interested in learning about interrelationships of human, plant and animal communities. Integrated lecture and laboratory cover topics that include structure and function of living systems, reproduction and inheritance, evolution, biological diversity and environmental biology. Laboratory applies scientific methods to the study of living systems. Laboratory/field trip fee: \$15.

**ZOOL118 - Principles of Animal Biology** 118-4 Principles of Animal Biology. (University Core Curriculum course) [IAI Course: L1 902L] Introduction to the basic concepts of animal biology including chemical organization of protoplasm; organization of matter into cells, tissues, organs and organ systems; classification and distribution of animals; ecology; heredity and organic evolution; economic biology and conservation, and animal behavior. Credit may not be used toward a major in zoology. Three lecturers and one 2-hour laboratory per week. Prerequisite: high school biology. Laboratory fee: \$30.

**ZOOL215 - Sophomore Seminar Zoology** 215-1 Sophomore Seminar in Zoology. Development of the skills and background knowledge required to be a modern zoologist. Students will receive an orientation to the Zoology Department and the requirements of their major, be assigned a faculty advisor, introduced to philosophy of science, critical thinking, and scientific literature, and learn the basics of scientific writing and oral presentation. One meeting per week. Prerequisites: BIOL 200A and BIOL 200B, or BIOL 211 and BIOL 212, or BIOL 211 and BIOL 213, or BIOL 212 and BIOL 213, with grades of C or better.

**ZOOL220 - Animal Diversity** 220-5 Animal Diversity. (University Core Curriculum course) Diversity and taxonomy of animals, emphasizing structure, function, life cycles, behavior, and phylogeny. Three lectures and two two-hour laboratories per week. Prerequisite: BIOL 200A and BIOL 200B, or BIOL 212 and BIOL 213 with grades of C or better. Laboratory/field trip fee: \$40.

**ZOOL312I - Conservation Nat Resources** 312I-3 Conservation of Natural Resources. (University Core Curriculum) [IAI Course: L1 905] This course adopts an interdisciplinary approach to the study of conservation of natural resources. It integrates environmental science and environmental economics. By examining the costs and benefits of resource consumption, we will attempt to determine the socially optimal level of resource utilization. We will look at ways in which governments attempt to achieve socially optimal resource use, and the effects of these government policies on the environment. Topics considered in the course include: solid waste, energy consumption, air pollution, agriculture and global environment change.

**ZOOL320 - Vertebrate Zoology** 320-3 Vertebrate Zoology. Evolution and diversity of fishes, amphibians, nonavian reptiles, birds, and mammals, including consideration of fossils, taxonomy, anatomy, physiology, ecology, behavior, and conservation. Prerequisite: ZOOL 220 with a grade of C or better.

**ZOOL351 - Ecological Methods** 351-3 Ecological Methods. (Same as PLB 351) Basic ecological field techniques for analysis of community structure and functional relationships. Two 3-hour laboratories per week. Prerequisite: BIOL 307. Laboratory/field trip fee: \$25.

**ZOOL360 - Introductory Biostatistics** 360-3 Introductory Biostatistics. (Same as PLB 360) Introduction to basic statistical concepts and methods as applied to biological data. Includes descriptive techniques such as measures of central tendency, variability, hypothesis testing, analysis of variance and simple linear regression and correlation. Analysis of computer generated output and report writing will be required. Prerequisite: MATH 108.

**ZOOL385 - Intro Marine Biology** 385-3 Introduction to Marine Biology. Principles of marine biology including physical and chemical characteristics of marine ecosystems, biology of important marine organisms, and descriptions of specific marine habitats ranging from coastal to pelagic and surface to deep benthic. The course will include a mandatory 5-day field trip to a coastal marine station over spring break, which will incur a cost to students of approximately \$500. Two 1-hour lectures and one 2-hour lab per week. Prerequisite: ZOOL 220 with a grade of C or better.

**ZOOL403 - Bee Identificatn Short Course** 403-2 Bee Identification Short Course. Pollinator diversity and conservation is a growing environmental concern for state and federal land managers, private industry, NGO, and municipalities. However, studies and management of pollinators are hampered by a shortage of taxonomic expertise in hyper-diverse insect taxa such as bees, which number over 800 species in the eastern U.S., over 4,000 species nationwide, and over 20,000 species worldwide. Therefore, taxonomic identification of major groups of pollinating insects is both a marketable job skill and valuable research tool. The course is designed to introduce students to the biology and identification of bees, with a focus on the bee diversity of the eastern U.S. The course will provide the necessary background in bee morphology and ecology to allow students to use traditional dichotomous keys, interactive keys, and field guides to identify common families, genera, and species of bees. Lab fee: \$50.

**ZOOL405 - Systematic Biology** 405-3 Systematic Biology. Estimation, analysis, and interpretation of phylogenetic trees; concepts, delimitation, and description of species; biological taxonomy and systems of classification; application of phylogenetics to the study of evolution. Prerequisites: BIOL 304; MATH 106 or 108 with grades of C or better.

**ZOOL407 - Parasitology** 407-4 Parasitology. Principles, collection, identification, morphology, life histories, and control measures. Two lectures and two 2-hour laboratories per week. Prerequisite: ZOOL 220 with a grade of C or better. Laboratory/Field Trip fee: \$15.

**ZOOL408 - Herpetology** 408-3 Herpetology. Taxonomic groups, identification, morphology, and natural history of amphibians and reptiles. Two lectures and one 2-hour laboratory per week. Prerequisite: ZOOL 220 with a grade of C or better. Laboratory/Field Trip fee: \$15.

**ZOOL409 - Vertebrate Histology** 409-4 Vertebrate Histology. Microscopic structure of organs and tissues with emphasis on mammalian material. Two lectures and two 2-hour labs per week. Prerequisite: ZOOL 220A,B or ZOOL 220. Laboratory/Field Trip fee: \$15.

**ZOOL410 - Conservation Biology** 410-3 Conservation Biology. An introduction to patterns of global biodiversity and threats to that diversity. Course emphasizes how principles from numerous biological disciplines are involved in conserving and managing biodiversity, and how social, economic, and political factors affect conservation strategies. Prerequisites: BIOL 307 and MATH 106 or 108 with grades of C or better.

**ZOOL411 - Environmental Risk Assessment** 411-3 Environmental Risk Assessment. Risk assessment can be defined as the process of assigning magnitudes and probabilities to the adverse effects of human activities or natural catastrophes. Prerequisites: BIOL 307 and CHEM 340 with grades of C or better.

**ZOOL413 - The Invertebrates** 413-4 The Invertebrates. Structure, phylogeny, distinguishing features and habitats of the invertebrates. Two lectures and two 2-hour laboratories per week. Prerequisite: ZOOL 220A or ZOOL 220. Laboratory/Field Trip fee: \$15.

**ZOOL414 - Freshwater Invertebrates** 414-4 Freshwater Invertebrates. Taxonomic groups, identification, distribution, and habitats of the North American freshwater invertebrate fauna. Two lectures, two 2-hour laboratories per week. Prerequisite: ZOOL 220A or ZOOL 220. Laboratory/Field Trip fee: \$15.

**ZOOL415 - Limnology** 415-3 Limnology. (Same as PLB 416) Lakes and inland waters; the organisms living in them, and the factors affecting these organisms. Two lectures and one 4-hour laboratory alternate weeks. Prerequisite: BIOL 307 with a grade of C or better. Laboratory/Field Trip fee: \$15.

**ZOOL418 - Vertebrate Anatomy Lab** 418-3 Vertebrate Anatomy Laboratory. Comparative anatomy and dissection of representative vertebrate specimens. Three 2-hour laboratories per week. Prerequisite: ZOOL 220 with a grade of C or better. Prior or concurrent registration in ZOOL 320 recommended. Laboratory fee: \$50.

**ZOOL425 - Invertebrate Paleo & Paleoecol** 425-3 Invertebrate Paleontology and Paleoecology. (Same as GEOL 425) Concepts of paleontology and paleoecology. Emphasis on functional morphology, lifestyles and habitats of fossil invertebrates and algae. The nature and evolution of marine and coastal paleocommunities. The effects of extinction events on paleocommunities and biodiversity. Laboratory. Field trips required. Prerequisite: GEOL 325 or ZOOL 220 with grade of C or better. Expense will vary in

proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$199.

**ZOOL426 - Comparative Endocrinology** 426-3 Comparative Endocrinology. (Same as ANS 426, PHSL 426) Comparison of mechanisms influencing hormone release, hormone biosynthesis, and the effects of hormones on target tissues, including mechanisms of transport, receptor kinetics, and signal transduction. Prerequisites: ANS 331 or ZOOL 220 or PHSL 310 with a grade of C. Laboratory/Field Trip fee: \$15.

**ZOOL432 - Principles of Toxicology** 432-3 Principles of Toxicology. This course will introduce students to the main topics in the field of toxicology. The emphasis will be on understanding physiological, biochemical, and molecular mechanisms of toxicity. Prerequisites: BIOL 200A and BIOL 200B; or BIOL 211, BIOL 212, and BIOL 213; with grades of C or better.

**ZOOL433 - Comparative Animal Physiology** 433-3 Comparative Animal Physiology. (Same as PHSL 433) Variations of physiological processes in animal phyla, comparison with human physiology, and physiological adaptation to environmental variation. Review of basic physiological principles and comparative aspects of mechanism and function. Prerequisites: BIOL 200A or BIOL 211; BIOL 200B or BIOL 213, or PHSL 310; with grades of C or better.

**ZOOL434 - Environmental Physiology** 434-3 Environmental Physiology. Physiological adaptations to environmental conditions in animals and humans. Lab/lecture course explores molecular, hormonal, immunological, developmental, and phenotypic processes mediating responses to factors such as stress, disease, contaminants, nutrition, and life history trade-offs. Prerequisite: BIOL 307 or PHSL 310 or ZOOL 433 with a grade of C or better. Laboratory/field trip fee: \$20.

**ZOOL435 - Pollination Ecology** 435-3 Pollination Ecology. (Same as PLB 435) This course will be an evolutionary and ecological examination of the interactions between plants and pollinators. Topics include pollination syndromes, plant breeding systems, pollinator foraging, learning, and behavior, specialized vs. generalized relationships, coevolution/cospeciation, chemical ecology, honey beekeeping & agricultural pollination, and conservation implications of pollinator relationships. Labs will provide hands-on experience in methods of investigating plant breeding systems, plant reproductive ecology, pollinator behavior and efficacy, pollen analysis, floral scent chemistry, and floral phenology. Prerequisite: BIOL 307 (General Ecology) or equivalent with a grade of C or better. For graduate students and senior undergraduates. Lab fee: \$75.

**ZOOL438 - Molecular Genetics Lab** 438-3 Plant and Animal Molecular Genetics Laboratory. (Same as PLB 438, PSAS 438, AGSE 438, CSEM 438) Arabidopsis and Drosophila model organisms, training in laboratory safety, reagent preparation, phenotype analysis, genetics, DNA and RNA analysis, PCR, cDNA construction, cloning and sequencing. Includes plant and bacterial transformation, and population level analysis of genetic variation using RAPD markers in grasses and Alu insertion in humans. Two 2-hr labs and one 1-hr lecture per week. Prerequisite: BIOL 305 or equivalent or consent of instructor. Lab fee: \$30.

**ZOOL440 - Wildlife Nutritional Ecology** 440-3 Wildlife Nutritional Ecology. This course will provide an understanding of basic nutritional principles (including foraging, digestion, absorption, metabolism, and requirements), demonstrate their application to ecological relationships of wild terrestrial vertebrates with their environment, and stimulate students to critically evaluate published literature in this field of study. Prerequisite: BIOL 307.

**ZOOL443 - Restoration Ecology** 443-3 Restoration Ecology. (Same as PLB 443) Ecological restoration tests current understanding of ecosystem assembly and function. This course applies ecological theory to restoration, with an emphasis on factors influencing plant community assembly and evaluating restoration success. Two lectures a week and one four-hour lab alternate weeks. Prerequisite: BIOL 307 or equivalent.

**ZOOL444 - Ecological Analysis Communities** 444-4 Ecological Analysis of Communities. (Same as PLB 444) Includes concepts and methods pertaining to the analysis of ecological data. Approaches will include a variety of methods for analyzing multivariate ecology, diversity, pattern, and spatial data. Laboratory will include the computer application of these concepts and methods to field situations. Two lectures and one 4 hour lab per week. Prerequisite: PLB/ZOOL 360, BIOL 307. Lab fee: \$15.

**ZOOL445 - Wetland Ecology & Mgmt** 445-3 Wetland Ecology and Management. (Same as PLB 445)  
This course provides students with experience in wetland ecology and management with an emphasis on wetland functioning, field sampling, and identification of common wetland plants. Prerequisite: either BIOL 200B or BIOL 213 or PLB 200; and BIOL 307; or consent of instructor. Two lectures and one 4-hour lab per week. Lab fee: \$25.

**ZOOL450 - Molecular Evolution** 450-3 Molecular Evolution. This course introduces the diversity of genomes and the evolutionary forces shaping them. Molecular evolution from the level of single nucleotides to whole genomes will be covered. Prerequisites: BIOL 304 and BIOL 305 with grades of C or better.

**ZOOL458 - Multiple Stressors in Ecology** 458-3 Multiple Stressors in Ecology. In this class, students will use a step-by-step approach to evaluate an environmental issue or human concern compounded by climate change. The evaluation will begin with a conceptual model of the problem, followed by planned management strategies based on collaborative decision making. The class is designed to foster quantitative reasoning, include that reasoning in research, and articulate findings in terms that foster collaborative management and outreach. Examples of potential projects include climate change impacts in concert with disease propagation, habitat quality and quantity, pollutant uptake in ectotherms, coral bleaching, changing human coastal communities, or fire incidence.

**ZOOL461 - Mammalogy** 461-3 Mammalogy. Taxonomic characteristics, identification, and natural history of mammals. Two 1-hour lectures and one 2-hour laboratory per week. Prerequisite: ZOOL 220B or ZOOL 220. Laboratory/Field Trip fee: \$10.

**ZOOL462A - Waterfowl Ecology** 462A-2 Waterfowl Ecology and Management (Lecture). This class will explore the pertinence of basic life history theory and ecological principles to waterfowl management. Lecture topics include but are not limited to waterfowl life histories (i.e., productivity and mortality), foraging ecology, nutrition, habitat use, habitat management, migration, and the influence of harvest. Prerequisites: ZOOL 220, BIOL 307 with minimum grades of C. Co-requisite: ZOOL 462B.

**ZOOL462B - Waterfowl Laboratory** 462B-1 Waterfowl Ecology and Management (Laboratory). This laboratory will meet 1 day/week for 2 hours. The primary objective will be waterfowl identification with a secondary emphasis on wetland plant identification and field techniques in waterfowl research and management. There will be 2-3 Saturday field trips. Prerequisites: none. Laboratory/field trip fee: \$20.

**ZOOL464 - Wildlife Admin & Policy** 464-3 Wildlife Administration and Policy. Responsibilities of private, state, and federal natural resources management agencies. Legal and political processes in areas of wildlife and natural resources. Three lectures per week. Special approval needed from the instructor.

**ZOOL465 - Ichthyology** 465-3 Ichthyology. Anatomy, physiology, sensory biology, behavior, taxonomy, evolution, zoogeography, and ecology of fishes. Two lectures and one 2-hour laboratory per week. Prerequisite: ZOOL 220 with a grade of C or better. Laboratory/Field Trip fee: \$10.

**ZOOL466 - Fish Management** 466-3 Fish Management. Sampling, age and growth, dynamics, habitat improvement, manipulation of fish populations, and management of freshwater and marine fish stocks. Two lectures per week and one 4-hour laboratory alternate weeks. Offered Fall term. Prerequisite: 10 hours of biological science or consent of instructor.

**ZOOL467 - Ornithology** 467-3 Ornithology. Classification and recognition of birds and the study of their songs, nests, migratory habits, and other behavior. One lecture and one four-hour laboratory per week. Prerequisite: ZOOL 220B or ZOOL 220. Laboratory/Field Trip fee: \$10.

**ZOOL468 - Wildlife Biology Principles** 468-3 Wildlife Biology Principles. Basic concepts of wildlife ecology and management. Includes lectures on ecological physiology, population dynamics, and wildlife management strategies. Prerequisite: ZOOL 220, BIOL 307.

**ZOOL469 - Wildlife Techniques** 469-3 Wildlife Techniques. Field-oriented course with instruction in techniques for management of wild species and their habitat. One 1 1/2-hour lecture and one 3-hour laboratory per week, two of which may be field trips on Saturdays. Prerequisite: ZOOL 220A,B or ZOOL 220. Laboratory/Field Trip fee: \$30.

**ZOOL471 - Entomology** 471-4 Entomology. Structure, classification, and life histories of insects. Two lectures and two 2-hour laboratories per week. Prerequisite: ZOOL 220A or ZOOL 220. Laboratory/Field Trip fee: \$10.

**ZOOL472 - Intro Systems Biology** 472-3 Introduction to Systems Biology. (Same as PLB 471) The experimental and bioinformatics analysis of large genomic and post-genomic data sets. The goal is integration of gene regulation, protein interaction, metabolite and hormonal signaling molecules into an understanding of basic cellular circuitry networks. Examine redundancy, robustness and decision making in biological systems. Prerequisite: BIOL 305 or CS 330. Lab fee: \$15.

**ZOOL477 - Aquaculture** 477-3 Aquaculture. (Same as ANS 477) Production of food, game, and bait fishes. Design of facilities, chemical and biological variables, spawning techniques, diseases and nutrition. Two lectures per week and one four-hour laboratory on alternate weeks. Prerequisites: BIOL 200A or BIOL 211 or ZOOL 118 or ANS 121 with grade of C or better.

**ZOOL478 - Animal Behavior** 478-3 Animal Behavior. Biological basis of the behavior of animals. Two lectures and one 2-hour laboratory per week. Prerequisite: One year of biological science or permission of instructor.

**ZOOL482 - Zoology Senior Seminar** 482-1 Zoology Seminar for Seniors. Each student reports on a selected topic, the class discusses using original scientific literature, and the report. The course emphasizes development of Oral and Written communication skills. One meeting per week. Not for graduate credit. Restricted to senior standing or 24 hours of life science completed.

**ZOOL485 - Special Topics in Zoology** 485-2 to 4 Special Topics in Zoology. Examination of topics of special interest not available in other departmental courses. Offered in response to student need and faculty availability. Special approval needed.

**ZOOL490 - Food Webs and Ecosystems** 490-3 Energetics, Food Webs, and Ecosystems. (Same as PLB 490) This course places conservation of particular species into the context of community and ecosystem management. Approaches to quantifying energy needs of individual species will be extended to models of trophic networks among multiple species. Food web structure and function, species interactions, and resilience to species loss species invasions, and environmental changes will be examined in light of landscape processes. Prerequisite: BIOL 307 or consent of instructor.

**ZOOL491 - Internship in Zoology** 491-1 to 6 Internship in Zoology. Supervised training in a formalized program with a zoological institution or agency. May not be used for minor in Zoology. For internships outside the department, a prospectus from the sponsoring agency with duties and duration of internship must be approved by a Zoology faculty supervisor and the Director of Undergraduate Studies before registration. No more than three hours per semester may be taken if student is on-campus. Mandatory Pass/Fail. Not for graduate credit. Prerequisite: ZOOL 220 with a grade of C or better and departmental approval. Specific internships have specific selection criteria. Of all credits that a student completes for ZOOL 491, 492, and 493, a maximum of three hours may count toward the major.

**ZOOL492 - Individual Research Zoology** 492-1 to 3 Individual Research in Zoology. Research on zoological problems. May not be used for minor in zoology. Some cost may be borne by student. A proposal describing the research project must be approved by a Zoology faculty supervisor and the Director of Undergraduate Studies before registration. Not for graduate credit. Of all credits that a student completes for ZOOL 491, 492, and 493, a maximum of three hours may count toward the major. Prerequisites: ZOOL 220 with grade of C or better, minimum of 2.75 GPA (A=4.00). Restricted to junior or senior standing. Special approval needed from the department.

**ZOOL493 - Honors Research Zoology** 493-1 to 6 Honors Research in Zoology. Individual research for honors students in zoology. May not be used for minor in Zoology. A research proposal must be approved by a Zoology faculty supervisor before registration and the Director of Undergraduate Studies. Not for graduate credit. Prerequisite: ZOOL 220 with a grade of C or better, minimum 3.0 cumulative GPA (A=4.00), participation in the University Honors Program, and departmental approval. Of all credits that a student completes for ZOOL 491, 492, and 493, a maximum of three hours may count toward the major.

**ZOOL496 - Zoology Field Studies** 496-1 to 3 Zoology Field Studies. Formal, individualized training in field zoology, including experiences that acquaint students with animals in various environments, methods

of field study, specimen collection and preservation, management and conservation, or other relevant skills. A prospectus of the training experience must be approved by a Zoology faculty supervisor before registration. Credit hours may not be counted toward a minor or major in Zoology. Not for graduate credit. Mandatory Pass/Fail. Prerequisite: ZOOL 220 with a grade of C or better.

**ZOOL497 - Zoology Lab Studies** 497-1 to 3 Zoology Laboratory Studies. Formal, individualized training in laboratory zoology, including experiences that acquaint students with dissection, microscopy, museum preparatory and curatorial techniques, biotechnology, environmental chemistry assays, or other relevant skills. A prospectus of the training experience must be approved by a Zoology faculty supervisor before registration. Credit hours may not be counted toward a minor or major in Zoology. Not for graduate credit. Mandatory Pass/Fail. Prerequisite: ZOOL 220 with a grade of C or better.

## Zoology Faculty

**Anderson, Frank E.**, Associate Professor, Ph.D., University of California, Santa Cruz, 1998.  
**Boyles, Justin G.**, Associate Professor, Ph.D., Indiana State University, 2009.  
**Brooks, Marjorie L.**, Associate Professor, Ph.D., University of Wyoming, 2003.  
**Brown, Jason L.**, Assistant Professor, Ph.D., East Carolina University, 2006.  
**Eichholz, Michael W.**, Associate Professor, Ph.D., University of Alaska, 2000.  
**Garvey, James E.**, Professor, Ph.D., Ohio State University, 1997.  
**Heist, Edward J.**, Professor, Ph.D., College of William and Mary, 1994.  
**Ibrahim, Kamal M.**, Associate Professor, Ph.D., University of Cambridge, 1989.  
**Jiminez-Ruiz, Francisco Agustin**, Associate Professor, Ph.D., University of Nebraska-Lincoln, 2004.  
**Krajewski, Carey**, Professor, Ph.D., University of Wisconsin, 1988.  
**Lovvorn, James R.**, Professor, Ph.D., University of Wisconsin, 1987.  
**Lydy, Michael J.**, Professor, Ph.D., Ohio State University, 1990.  
**Nsofor, Margaret N.**, Associate Professor of Practice, Ph.D., Mississippi State University, 1998.  
**Reeve, John D.**, Associate Professor, Ph.D., University of California Santa Barbara, 1985.  
**Warne, Robin W.**, Associate Professor, Ph.D., University of New Mexico, 2008.  
**Whitledge, Gregory W.**, Professor, Ph.D., University of Missouri, 2001.

## Emeriti Faculty

**Anthony, Terence R.**, Associate Professor, Emeritus, M.D., Ph.D., University of Chicago, 1968, 1975.  
**Brandon, Ronald A.**, Professor, Emeritus, Ph.D., University of Illinois, 1962.  
**Burr, Brooks M.**, Professor, Emeritus, Ph.D., University of Illinois, 1977.  
**Englert, DuWayne C.**, Professor, Emeritus, Ph.D., Purdue University, 1964.  
**Feldhamer, George A.**, Professor, Emeritus, Oregon State University, 1977.  
**Halbrook, Richard S.**, Associate Professor, Emeritus, Ph.D., Virginia Polytechnic Institute and State University, 1990.  
**Heidinger, Roy C.**, Professor, Emeritus, Ph.D., Southern Illinois University, 1970.  
**King, David**, Associate Professor, Emeritus, Ph.D., University of California at San Diego, 1975.  
**Kohler, Christopher C.**, Professor, Emeritus, Ph.D., Virginia Polytechnic Institute and State University, 1980.  
**McPherson, John E., Jr.**, Professor, Emeritus, Ph.D., Michigan State University, 1968.  
**Muhlach, William L.**, Associate Professor, Emeritus, Ph.D., University of Illinois at Chicago, 1986.  
**Shepherd, Benjamin A.**, Professor, Emeritus, Ph.D., Kansas State University, 1970.  
**Sparling, Donald W.**, Associate Professor, Emeritus, Ph.D., University of North Dakota, 1979.  
**Stahl, John B.**, Associate Professor, Emeritus, Ph.D., Indiana University, 1958.

**Thomas, Richard, H.**, Associate Professor, Emeritus, Ph.D., University of Arizona Tucson, 1985.

**Waring, George H.**, Professor, Emeritus, Ph.D., Colorado State University, 1966.

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**Catalog Year Statement:**

Students starting their collegiate training during the period of time covered by this catalog (see bottom of this page) are subject to the curricular requirements as specified herein. The requirements herein will extend for a seven calendar-year period from the date of entry for baccalaureate programs and three years for associate programs. Should the University change the course requirements contained herein subsequently, students are assured that necessary adjustments will be made so that no additional time is required of them.