

FISHERIES AND WILDLIFE DEPARTMENT

Fisheries and wildlife prepares students for professional careers in fisheries and wildlife as research scientists, biologists, managers, educators, and administrators. Oregon State University is strategically located for the study of fisheries and wildlife, surrounded by diverse ecosystems including the Pacific Ocean and coastal estuaries, many small and large rivers, lowland valleys, mountains and the high desert. Courses include traditional classroom experiences and laboratories, often enriched by field trips to nearby state fish hatcheries, national forests and wildlife refuges. We also offer experiential learning opportunities at the Hatfield Marine Science Center on the coast in Newport. In addition to our full-time faculty, FW students benefit from courses and mentoring provided by scientists with the Oregon Cooperative Fish and Wildlife Research Unit, Oregon Department of Fish and Wildlife, and several federal research centers.

The undergraduate curriculum is designed to develop a solid background in biology and ecology for our students as the basis for careers in resource science, conservation and management. However, FW is not simply a biological discipline. Professionals must weigh social considerations when formulating conservation and management strategies and policies. Consequently, biological, social, economic, and political science courses are integrated into the curriculum. The undergraduate curriculum is composed of core courses and a specialization. The core represents the educational foundation for fish and wildlife conservation while the specialization provides each student with an opportunity to build a curriculum to meet specific goals. Our capstone courses emphasize critical thinking in natural resource science and management, as well as science communication and outreach. Students planning to transfer to FW should focus on courses in general biology, general chemistry, physical science, and mathematics during their freshman and sophomore years.

Transfer Students

Because of the technical and professional nature of the college's curricula, the college reserves the right to determine whether courses taken at another institution satisfy the college's curricular requirements. In general, equivalent college-level courses successfully completed at an accredited college or university are accepted. OSU students requesting a transfer to the College of Agricultural Sciences' Department of Fisheries and Wildlife must be a student in good academic standing at the university. Please contact the departmental head advisor at 541-737-1941 for additional information.

Graduate Program

Graduate programs leading to the PSM, MS, or PhD (and participation in the MAIS degree program) permit intensive study in special areas of interest under the guidance of nationally known scientists. Advanced study in fisheries science may be pursued in stream ecology, aquaculture, population dynamics in response to exploitation, ecology of marine and freshwater fishes, taxonomy and systematics, genetics, toxicology, and parasites and diseases of fish. Advanced study in wildlife science can involve almost any invertebrate or vertebrate species, biotic community or habitat. Research emphasis may be placed on population dynamics and utilization, life history and ecology, conservation biology, habitats,

nutrition, physiology, behavior, and organization of animal communities. Opportunities exist for work in terrestrial, marine and aquatic systems.

Undergraduate Programs

Major

- Fisheries and Wildlife Sciences (BS, CRED, HBS) (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/fisheries-wildlife-sciences-bs-hbs>)

Minor

- Fisheries and Wildlife Sciences (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/fisheries-wildlife-sciences-minor>)
- Marine Conservation and Management (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/marine-conservation-management-minor>)

Graduate Programs

Majors

- Fisheries and Wildlife Administration (PSM) (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/fisheries-wildlife-administration-psm>)
- Fisheries Science (MAIS, MS, PhD) (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/fisheries-science-ms-phd-mais>)
- Wildlife Science (MAIS, MS, PhD) (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/wildlife-science-ms-phd-mais>)

Minors

- Fisheries Science (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/fisheries-science-graduate-minor>)
- Wildlife Science (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/wildlife-science-graduate-minor>)

Graduate Certificate

- Fisheries Management (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/fisheries-management-graduate-certificate>)
- Wildlife Management (<http://catalog.oregonstate.edu/college-departments/agricultural-sciences/fisheries-wildlife/wildlife-management-graduate-certificate>)

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Faculty

Emeritus Coblentz, Gregory, Hall, Horton, Kennedy, Markle, Mate

Professors Baker, Banks, Bartholomew, Brandt, Edge, Se. Heppell, Langdon, Noakes, Robinson, Sampson

Professors, Senior Research Kauffman, Hughes

Associate Professors B. Dugger, DeBano, Epps, Garcia, Giannico, Sc. Heppell, Miller, O'Malley, Sanchez, Sidlauskas, Wooster

Associate Professors, Senior Research Hagen

Assistant Professors Armstrong, Arismendi, Biedenweg, Hutchinson, Levi, Torres, Warren, White

Assistant Professors, Senior Research Ellsworth, Gladics, Janousek, Orben, Palacios, Rivers,

Senior Instructors Duplaix, Hanschumaker, Paoletti, Reese, Shinderman

Instructors Albertson, Allen, Arbuckle, Campbell, Cheung, Diebel, Donaghy-Cannon, S. Dunham, Finley, Jarkowsky, Kelly, Konstantinidis, Moore, Painter

Courtesy Faculty

Professors Haig, Lackey, Power, Roby, Schreck

Professors, Senior Research Herlihy

Associate Professors K. Dugger, Friedlaender, Horning, Kaufmann, Peterson, Rosenberg, Stein, Thompson

Assistant Professors Antolos, Bisbal, Bottom, Boyer, Brodeur, Carraway, Chestnut, Church, Dumbauld, J. Dunham, Eagle-Smith, Ebersole, Fitzpatrick, Ford, Forsman, Gervais, Glenn, Greenberg, Hagar, Hughes, Huntington, Hurst, Johnson, Jordan, Lesmeister, H. Li, J. Li, Lyons, Munakata, Penaluna, Reeves, Ryer, Schumaker, Sumich, Suryan Swearingen, Tomas Nash, Van Sickle, Weitkamp

Assistant Professors, Senior Research Chapman

Adjunct Faculty

Professors Kent (Microbiology), McComb (Graduate School), Smith (Anthropology), Sylvia (Applied Economics), Rempel (OSU Library)

Associate Professor Betts (Forest Ecosystems and Society)

Assistant Professor Brander (Environmental and Molecular Toxicology)

Departmental Faculty Page: <http://fw.oregonstate.edu/fisheries-and-wildlife/directory/faculty>

Fisheries and Wildlife

FW 107. ORIENTATION TO FISHERIES AND WILDLIFE. (1 Credit)

Information relevant to academic pathways and career planning in the fields of fisheries and wildlife. Graded P/N.

FW 112. SCIENCE OF FLY FISHING TROUT. (1 Credit)

Uses fly fishing as a window into the larger world of science, art, and conservation, and more specifically into the structure and function of freshwater ecosystems. This class requires students to be concurrently registered for The Literature of Fly Fishing for Trout through English (ENG 225), and the Art of Fly Fishing through Physical Activity Courses (PAC 331).

Corequisites: ENG 225, PAC 331

FW 113. INTRODUCTION TO MARINE LIFE IN THE SEA-MARINE BIRDS AND MAMMALS. (1 Credit)

Introduces first- and second-year undergraduates, teachers and non-degree students to the breadth of marine science course offerings and research at Oregon State University's Hatfield Marine Science Center located in Newport, Oregon. Using an experiential based format, students collect field data to better understand marine mammals (whales, dolphins and porpoises), seabirds, and their interactions with their environment. Lec/lab. Graded P/N.

FW 199. SPECIAL STUDIES. (1-16 Credits)

Graded P/N.

Equivalent to: FW 199H

This course is repeatable for 16 credits.

FW 199H. SPECIAL STUDIES. (1-16 Credits)

Graded P/N.

Attributes: HNRS – Honors Course Designator

Equivalent to: FW 199

This course is repeatable for 16 credits.

FW 209. CAREER SKILLS IN FISHERIES AND WILDLIFE SCIENCES. (1 Credit)

A foundation for life-long career development in fisheries and wildlife sciences. Practice the skills needed to search, apply, and attain internships and jobs. Graded P/N.

Prerequisites: FW 107 with P or better

FW 251. PRINCIPLES OF FISH AND WILDLIFE CONSERVATION. (3 Credits)

History of conservation and natural resource use; ecological principles, and social and economic limitations of conservation; principles and practices of wildlife and fisheries management; role of research in management.

FW 255. FIELD SAMPLING OF FISH AND WILDLIFE. (3 Credits)

Introduction to sampling populations and communities of vertebrate animals emphasizing sampling design, collection and management of data, and communication of results.

FW 289. COMMUNICATION SKILLS FOR FISHERIES AND WILDLIFE PROFESSIONALS. (4 Credits)

Introduces students to the theoretical and practical dimensions of interpersonal and public communication in a natural resource management field. Lec/rec.

FW 301. FIELD TECHNIQUES FOR MARINE MAMMAL CONSERVATION. (1 Credit)

A laboratory and hands-on experience covering field techniques, computer software for data organization and analyses, and understanding the practical management conservation application for students who are taking or have taken FW/BI 302, Biology and Conservation of Marine Mammals. Taught summer term at HMSC, Newport, OR.

Prerequisites: BI 302 (may be taken concurrently) with D- or better or FW 302 (may be taken concurrently) with D- or better

FW 302. BIOLOGY AND CONSERVATION OF MARINE MAMMALS. (4 Credits)

An examination of the biology of whales, pinnipeds, and other marine mammals, including general adaptations to a marine existence; systematics and biogeography; reproduction; diving physiology; communication and echolocation; feeding and migratory behavior; and marine mammal/human interactions; including conservation issues. CROSSLISTED as BI 302. Taught at Hatfield Marine Science Center OR online through Ecampus.

Equivalent to: BI 302

FW 303. SURVEY OF GEOGRAPHIC INFORMATION SYSTEMS IN NATURAL RESOURCE. (3 Credits)

Concepts underlying geographic information systems, global positioning system, and remote sensing; application to management and research, data quality issues, and case studies. Not a lab/skills class.

FW 307. SPECIALIZATION DEVELOPMENT. (1 Credit)

Students will examine career alternatives, develop career goals, learn what knowledge, skills, and abilities are important for diverse careers in fisheries and wildlife conservation, and develop an academic and lifelong plan for achieving their career goals. This course is intended to assist students in developing a specialization in fisheries and wildlife sciences. Graded P/N.

FW 311. ORNITHOLOGY. (3 Credits)

Survey of the adaptations of birds to a diverse array of habitats. Topics include origins, anatomy, reproductive strategies, migration, flight, behavior, physiology, nutrition, and conservation.

FW 312. SYSTEMATICS OF BIRDS. (2 Credits)

External anatomy, classification of birds of the world, and field identification of birds by sight and song. Field trips required.

FW 315. ICHTHYOLOGY. (3 Credits)

A survey of the diversity of biological adaptations of fishes. Topics include physiological and zoogeographical adaptations, reproduction, evolution, cladogenesis, morphology, behavior, and genetics.

FW 316. SYSTEMATICS OF FISHES. (3 Credits)

Phylogenetic diversity, evolution, relationships and identification of the world's fishes, with particular focus on Oregon fishes. Includes identification, anatomy, use of keys, introduction to the comparative method, systematic theory, taxonomy, field collection and specimen curation. Lec/lab.

Prerequisites: (BI 211 with D- or better or BI 211H with D- or better or BI 204 with D- or better) and (BI 212 [D-] or BI 212H [D-] or BI 205 [D-]) and (BI 213 [D-] or BI 213H [D-] or BI 206 [D-])

FW 317. MAMMALOLOGY. (3 Credits)

A survey of the origins, evolution, diversity, and adaptations of mammals to diverse environments. Topics include taxonomy, reproduction, sensory perception, herbivory, population cycles and behavior.

FW 318. SYSTEMATICS OF MAMMALS. (2 Credits)

A survey of the phylogenetic diversity of the mammals in Oregon from a habitat/community perspective. Identifying, using keys, and measuring specimens will be stressed.

FW 320. INTRODUCTORY POPULATION DYNAMICS. (4 Credits)

Principles and concepts of population dynamics related to fish and wildlife populations; methods of estimating abundance, mortality, sustainable harvest levels and extinction risk; hands-on introduction to models for population analysis. Lec/lab.

Prerequisites: BI 370 (may be taken concurrently) with D- or better or BI 370H (may be taken concurrently) with D- or better or BI 371 (may be taken concurrently) with D- or better

FW 321. APPLIED COMMUNITY AND ECOSYSTEM ECOLOGY. (3 Credits)

Perspectives in community and ecosystem ecology, and their use in management of fisheries and wildlife resource systems.

Prerequisites: FW 320 (may be taken concurrently) with D- or better

FW 323. MANAGEMENT PRINCIPLES OF PACIFIC SALMON IN THE NORTHWEST. (3 Credits)

Explores the nature of the salmon problem in the Northwest. Experts from diverse disciplines describe principles of salmon biology, habitat ecology and management, socioeconomics of direct and indirect users, and government policies.

FW 324. *FOOD FROM THE SEA. (3 Credits)

Where does seafood come from, and how does seafood arrive on a plate? How productive are the world's oceans, and can the oceans continue to produce enough to feed (and employ) the masses? How do different cultures, ethnicities, and regions of the world rely upon food from the sea for daily meals? Food from the Sea is an exploration of the cultural, societal, economic, practical, and environmental features of the protein that feeds billions. (Bacc Core Course)

Attributes: CSGI – Core, Synth, Global Issues

FW 325. *GLOBAL CRISES IN RESOURCE ECOLOGY. (3 Credits)

Historical and contemporary implications of the impacts of burgeoning human populations on rates and patterns of global ecological change. Changes in ecosystem processes and crises of species extinction in the context of cultural and political institutions. (Bacc Core Course).

Attributes: CSGI – Core, Synth, Global Issues

FW 326. INTEGRATED WATERSHED MANAGEMENT. (3 Credits)

A comprehensive approach to watershed management, one that includes biophysical, socioeconomic, planning and education related topics. Intended for students interested in the sustainable management of natural resources.

FW 328. WILDLIFE CAPTURE AND IMMOBILIZATION. (2 Credits)

Manual and chemical restraint methods are covered with an emphasis on darting equipment, animal and human safety, drug pharmacology and species specific recommendations. CROSSLISTED as VMB 328. Lec/lab.

Equivalent to: VMB 328

This course is repeatable for 4 credits.

FW 331. ECOLOGY OF MARINE AND ESTUARINE BIRDS. (4 Credits)

Focusing on how marine and estuarine birds are adapted for life at sea. Topics include morphology, physiology, foraging ecology, and biogeography as well as introductory oceanography. Field trips.

FW 340. *MULTICULTURAL PERSPECTIVES IN NATURAL RESOURCES. (3 Credits)

Explores multicultural influences on development of natural resources in the American West. Effects of diverse social values on changes in the physical landscape and biodiversity. (Bacc Core Course)

Attributes: CPDP – Core, Perspective, Difference/Power/Discrimination

FW 341. FISH AND WILDLIFE LAW ENFORCEMENT. (2 Credits)

Introduction to the philosophy, purposes, and methods of enforcing natural resource laws, emphasizing fish and wildlife laws.

FW 345. *GLOBAL CHANGE BIOLOGY. (3 Credits)

Global Change Biology is the study of the impact of climate change on natural systems and actions to mitigate (slow) or adapt to climate change. Global climate change is having dramatic effects on natural resources including fish and wildlife populations and their habitats. Students will gain an understanding of the role that natural ecosystems (oceans, forests, wetlands, grasslands etc.) play in regulating the climate; how land use affects the earth's climate; how climate change will affect fish, wildlife and their habitats; and the role that managers and researchers can play in mitigating and adapting to climate change. (Bacc Core Course)

Attributes: CSGI – Core, Synth, Global Issues

FW 350. *ENDANGERED SPECIES, SOCIETY AND SUSTAINABILITY. (3 Credits)

Provides a general background to endangered species biology, and the social and economic implications of the legislation enacted to conserve endangered species (Endangered Species Act, CITES Treaty). (Bacc Core Course)

Attributes: CSST – Core, Synthesis, Science/Technology/Society

FW 356. *CITIZEN SCIENCE. (3 Credits)

Citizen science involves non-specialists in scientific studies addressing large challenges best solved through collaboration. Citizens contribute data scientists may not otherwise be able to obtain, while improving their understanding of the scientific process, integrating technology into the learning process, and generating new knowledge for society. (Bacc Core Course)

Attributes: CSST – Core, Synthesis, Science/Technology/Society

FW 360. *ORIGINS OF F&W MANAGEMENT-EVOLUTION, GENETICS, AND ECOLOGY. (3 Credits)

Examines genetics and human interactions with fisheries and wildlife from an ecological and evolutionary perspective. Basic principles of environmental interactions, and how humans interact with other species and their environments in the disciplines commonly recognized as fisheries, wildlife and conservation sciences. (Baccalaureate Core Course)

Attributes: CSST – Core, Synthesis, Science/Technology/Society

FW 366. ENVIRONMENTAL CONTAMINANTS IN FISH AND WILDLIFE. (3 Credits)

Environmental contamination is an important threat to many fish and wildlife populations and the habitats and prey upon which they rely. The field of ecotoxicology links the ecology of fish and wildlife with toxicology of environmental contaminants, and so spans political, scientific, and public relations realms. Through the pairing of introductory concepts with key case studies, this course provides students with a preparatory framework for understanding toxicological issues of importance for those focused on studying, managing or conserving fish and wildlife populations.

Prerequisites: (BI 204 with D- or better or BI 211 with D- or better or BI 211H with D- or better) and (BI 205 [D-] or BI 212 [D-] or BI 212H [D-])

FW 370. CONSERVATION GENETICS. (4 Credits)

A foundational course in preparation for a degree in Fisheries and Wildlife or other degrees focused on conservation of natural resources. Covers a broad range of topics associated with issues surrounding genetics that working professionals in the biological sciences should be conversant about. One of the most important aspects of the course is the development of problem-solving and critical-thinking skills.

Prerequisites: (BI 211 with D- or better or BI 204 with D- or better) and (BI 212 [D-] or BI 205 [D-]) and (BI 213 [D-] or BI 206 [D-])

FW 401. RESEARCH. (1-16 Credits)

This course is repeatable for 16 credits.

FW 403. THESIS. (1-16 Credits)

This course is repeatable for 32 credits.

FW 405. READING AND CONFERENCE. (1-16 Credits)

This course is repeatable for 16 credits.

FW 407. SEMINAR. (1-16 Credits)

Graded P/N. Taught at Hatfield Marine Science Center.

Equivalent to: FW 407H

This course is repeatable for 16 credits.

FW 407H. SEMINAR. (1-16 Credits)

Graded P/N. Taught at Hatfield Marine Science Center.

Attributes: HNRS – Honors Course Designator

Equivalent to: FW 407

This course is repeatable for 16 credits.

FW 408. WORKSHOP. (1-16 Credits)

This course is repeatable for 16 credits.

FW 410. INTERNSHIP. (1-6 Credits)

This course is repeatable for 99 credits.

FW 415. FISHERIES AND WILDLIFE LAW AND POLICY. (3 Credits)

Provides students with an understanding of the key legal frameworks within which they will work to conserve fish and wildlife resources. Examines federal law and policy relating to allocation and conservation of fish and wildlife resources.

FW 419. THE NATURAL HISTORY OF WHALES AND WHALING. (3 Credits)

Addresses the natural history of whales as a unique example of adaptation in an evolutionary lineage, and the history of whaling as a general example of the failings of international resource management.

FW 421. AQUATIC BIOLOGICAL INVASIONS. (4 Credits)

An overview of the background, theory, evolution, ecology, politics and conservation of invasions by introduced species in aquatic environments. CROSSLISTED as BI 421. Taught at Hatfield Marine Science Center OR online through Ecampus.

Equivalent to: BI 421

FW 422. INTRODUCTION TO OCEAN LAW. (3 Credits)

Examination of US law and primary international law focused on fisheries management with coverage of regulation of other ocean resources including energy, marine mammals, endangered species, pollution, and protected areas. Final project is intended to provide students with hands-on exposure to real-world fisheries and ocean management issues.

FW 426. COASTAL ECOLOGY AND RESOURCE MANAGEMENT. (5 Credits)

Study of the ecology and management of coastal marine and freshwater ecosystems as well as natural resources, emphasizing experimental (participatory) learning in a field station setting. Lec/lab.

FW 427. PRINCIPLES OF WILDLIFE DISEASES. (4 Credits)

Ecological aspects of important diseases affecting North American wildlife will be discussed. Demonstrations will mainly cover migratory birds, carnivores and ruminants. Lec/lab. Ecampus sections do not use lab demonstrations.

FW 434. ESTUARINE ECOLOGY. (4 Credits)

Integrated and synthetic training in the ecological processes of estuarine environments, with emphases on ecological interactions among organisms and the biogeochemical cycling of carbon and nitrogen. Topics include geomorphology, estuarine physics and chemistry, primary and secondary producers, ecosystem metabolism, element cycling, food webs, fisheries, restoration, management, and impacts of climate. Field trip required, transportation fee charged. CROSSLISTED as OC 434/OC 534.

Equivalent to: OC 434

FW 435. ^WILDLIFE IN AGRICULTURAL ECOSYSTEMS. (3 Credits)

Examines the relationships between agricultural production and fish and wildlife populations and communities. Explores the impacts of agricultural practices on fish and wildlife. Field trips required; transportation fee charged. OSU Ecampus students are not required to attend field trips. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

FW 439. ^HUMAN DIMENSIONS OF FISHERIES AND WILDLIFE MANAGEMENT. (3 Credits)

Students build an understanding and appreciation for the role of human dimensions (HD) in fisheries and wildlife management. Students work both independently and in groups on assignments with an HD focus. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

FW 445. ECOLOGICAL RESTORATION. (4 Credits)

Fundamentals of restoring and reclaiming disturbed landscapes and ecosystems. Topics to be covered include types and assessment of site conditions; determining restoration goals and feasibility; hydrologic, biotic, and soil functions and their importance in restoration; and measures of successful restoration. Lec/lab/rec. CROSSLISTED as FES 445.

Equivalent to: FES 445

FW 451. AVIAN CONSERVATION AND MANAGEMENT. (3 Credits)

Identification, classification, life history strategies, ecology and management of upland and migratory birds.

FW 452. BIODIVERSITY CONSERVATION IN MANAGED FORESTS. (3 Credits)

Designed for students in forestry, wildlife, fisheries and related fields. Introduces the concepts of, and approaches to, managing forest stands, landscapes and regions to achieve desired habitat conditions for indicator species and conservation of biological diversity. CROSSLISTED as FES 452.

Equivalent to: FES 452

FW 454. ^FISHERY BIOLOGY. (4 Credits)

Principles and methods used in studying the biology of fishes; ecological requirements of freshwater and anadromous fishes; principles and practices in sport fishery management. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

Prerequisites: FW 315 with D- or better and FW 320 [D-]

FW 456. FRESHWATER ECOLOGY AND CONSERVATION. (5 Credits)

Physical, chemical, biological, and environmental concepts in continental aquatic systems. Includes techniques related to assessing aquatic resources their management and conservation. Lec/lab.

Prerequisites: BI 370 with D- or better or BI 371 with D- or better

FW 458. MAMMAL CONSERVATION AND MANAGEMENT. (4 Credits)

A thorough understanding of the management, conservation, and ecology of mammals in North America; includes population dynamics, harvest management, techniques to determine abundance, diets, reproduction, and the cultural and political variables that contribute to formulation of management programs.

FW 462. ECOSYSTEM SERVICES. (3 Credits)

Introduces students to the ecological, economic, and social/ethical issues involved in the study of ecosystem services, with a major focus on biological components involved in ecosystem services. Topics covered include: 1) an introduction to the roles that living organisms play in the provision of ecosystem services, 2) the relationship of ecosystem functions and services, 3) the societal factors that influence this relationship, 4) general categories of ecosystem services, 5) identification of potential ecosystem services in terrestrial and aquatic systems, 6) an overview of the methods of valuation, and 7) translating ecosystems functions to services. Case studies will be used to illustrate key concepts and relationships within different ecological and social contexts.

FW 464. MARINE CONSERVATION BIOLOGY. (3 Credits)

Lectures, group library research, and class debates on current issues regarding the conservation of biodiversity in the sea. Topics include overfishing, invasive species, eutrophication, marine pollution, and global warming, as well as means of addressing these threats.

Prerequisites: BI 370 with D- or better or BI 370H with D- or better

Equivalent to: BI 464

FW 465. MARINE FISHERIES. (4 Credits)

A global perspective on commercial fish and shellfish harvesting with emphasis on fishing technology and policy issues. Offered fall term in odd years.

FW 467. ANTARCTIC SCIENCE AND CONSERVATION. (4 Credits)

Explores the history, geology, climate, and ecosystems of Antarctica, with special emphasis on current conservation issues.

FW 469. METHODS IN PHYSIOLOGY AND BEHAVIOR OF MARINE MEGAFUNA. (3 Credits)

An in-depth study of marine megafauna (mammals, birds, turtles) with an emphasis on methods and analyses of behavior and physiology for conservation. Lab and field exercises include investigations into the behavior–physiology nexus of diving, migration, thermoregulation, energy expenditure, and mating systems. Research techniques to be explored will include, for example, tracking and remote biotelemetry monitoring technologies, respirometry, genetics, and direct field study observation. Theoretical approaches, field techniques and statistical analyses will help prepare students for a career in fisheries or wildlife science. Lec/lab. Taught at HMSC.

FW 470. *ECOLOGY AND HISTORY: LANDSCAPES OF THE COLUMBIA BASIN. (3 Credits)

Integrates environmental history and landscape ecology of the Columbia River Basin from geologic origins to the present, to create an understanding of change caused by natural processes and human activities. (Bacc Core Course)

Attributes: CSST – Core, Synthesis, Science/Technology/Society

FW 471. ENVIRONMENTAL PHYSIOLOGY OF FISHES. (4 Credits)

Principles of the functional biology of fishes with emphasis on environmental interactions and management implications.

FW 473. FISH ECOLOGY. (4 Credits)

Behavior of fishes as a mode of accommodation to various ecological and evolutionary constraints. Importance of heritable and learned patterns to population and community dynamics. Application of behavioral studies to the solution of management problems. Lec/lab/rec.

Prerequisites: (BI 370 with D- or better or BI 370H with D- or better) and FW 315 [D-]

FW 474. EARLY LIFE HISTORY OF FISHES. (4 Credits)

Overview of diversity of development patterns in fishes; emphasis on morphology, life history, and evolution. Offered alternate years.

FW 475. WILDLIFE BEHAVIOR. (4 Credits)

Adaptive significance of egocentric and social behavior of wildlife species. Implications of behavior in sound management practice.

FW 476. FISH PHYSIOLOGY. (4 Credits)

Physiological specializations and adaptations of major groups of fishes.

Prerequisites: FW 315 with D- or better

FW 477. AGE AND GROWTH OF FISH. (3 Credits)

An overview of the terminology, theory, assumptions, limitations, error, and processing and ageing techniques for different types of calcified structures used to age fishes.

Prerequisites: FW 454 with D- or better

FW 479. WETLANDS AND RIPARIAN ECOLOGY. (3 Credits)

Ecology of riparian freshwater and estuarine wetlands of the Pacific Northwest. Effects of land use on ecosystem structure, function, biodiversity, and restoration will be explored.

FW 481. WILDLIFE ECOLOGY. (3 Credits)

Interrelationships of wildlife, environmental change. Predicting and measuring responses of wildlife to altered habitat conditions .

Prerequisites: BI 370 with D- or better or BI 370H with D- or better or BI 371 with D- or better

FW 488. PROBLEM SOLVING IN FISHERIES AND WILDLIFE SCIENCE. (3 Credits)

A capstone course designed to introduce students to the synthesis of scientific information on species, habitats and ecosystems and the use of such data in shaping fisheries and wildlife conservation, management and policy. Includes a group problem-solving project and case studies. For FW majors in their senior year.

Prerequisites: FW 320 with D- or better and FW 321 (may be taken concurrently) [D-]

FW 489. EFFECTIVE COMMUNICATIONS IN FISHERIES AND WILDLIFE SCIENCE. (3 Credits)

Centers on the synthesis and interpretation of data and effective communication of that information in written and oral communication to diverse audiences including scientists, managers, administrators and the general public.

FW 491. FISH DISEASES IN CONSERVATION BIOLOGY AND AQUACULTURE. (3 Credits)

Introduction to diseases of fish including pathogens important to aquaculture and ornamental industries as well as to wild fish populations and conservation programs. CROSSLISTED as MB 491/MB 591.

Equivalent to: MB 491

FW 493. FIELD METHODS FOR MARINE RESEARCH. (3 Credits)

The primary focus is providing hands-on experience in a small class exploring various field sampling methodologies, research planning logistics, and field operations in estuary and nearshore environments. Topics covered include measurement and collection methods, animal handling techniques, equipment care and handling, sampling strategy, experimental design, data management planning and, if possible, small boat work.

FW 496. FISH DISEASES IN CONSERVATION BIOLOGY AND AQUACULTURE LAB. (2 Credits)

This laboratory complements lectures in FW/MB 491/591, with students learning basic necropsy techniques; identification of bacterial, viral and metazoan pathogens; and molecular identification methods. CROSSLISTED as MB 496/MB 596.

Equivalent to: MB 496

FW 497. ^AQUACULTURE. (3 Credits)

Principles and practices for the aquaculture of fish, shellfish, and algae. (Writing Intensive Course.)

Attributes: CWIC – Core, Skills, WIC

FW 498. AQUACULTURE LABORATORY. (3 Credits)

Biology and culture requirements of fish, shellfish, and algae. Emphasis on laboratory culture techniques and practical experience in handling organisms. Taught at Hatfield Marine Science Center.

FW 499. SPECIAL TOPICS IN FISHERIES AND WILDLIFE. (0-16 Credits)

Various topics in fisheries science and wildlife science. Taught at Hatfield Marine Science Center and Corvallis campus.

Equivalent to: ENT 499

This course is repeatable for 16 credits.

FW 501. RESEARCH. (1-16 Credits)

This course is repeatable for 16 credits.

FW 502. TEACHING METHODS IN FISHERIES AND WILDLIFE. (1 Credit)

This is a discussion course designed to help new GTAs and instructors who are learning the trials and tribulations of university-level teaching in our department. This is a great course for students who are interested in hearing more about teaching approaches, grading and assessment, student communication, problem students, and development of teaching Graded P/N.

FW 503. THESIS. (1-16 Credits)

This course is repeatable for 999 credits.

FW 505. READING AND CONFERENCE. (1-16 Credits)

This course is repeatable for 16 credits.

FW 506. PROJECTS. (1-6 Credits)

Projects are synthesis papers or outreach products that are developed with a mentor from campus, a natural resource agency, or the student's place of employment. The purpose of your project is to contribute to the field of study with a product that reflects the principles and applications learned in your classes.

This course is repeatable for 12 credits.

FW 507. SEMINAR. (1-16 Credits)

Selected Topics. Taught at Hatfield Marine Science Center and Corvallis campus.

This course is repeatable for 16 credits.

FW 508. WORKSHOP. (1-16 Credits)

This course is repeatable for 16 credits.

FW 510. PROFESSIONAL INTERNSHIP. (1-16 Credits)

This course is repeatable for 10 credits.

FW 514. PROFESSIONAL DEVELOPMENT: MEETING COMMUNICATIONS. (1 Credit)

Fisheries and wildlife professionals use meetings of scientists, managers and stakeholders to communicate key findings and develop consensus recommendations for policy. This 1-credit experiential learning course will expose students to a scientific or management meeting in their chosen field (fisheries, wildlife, ecology, or conservation biology) and get them to think about how meetings function as well as their content.

This course is repeatable for 3 credits.

FW 515. FISHERIES AND WILDLIFE LAW AND POLICY. (3 Credits)

Provides students with an understanding of the key legal frameworks within which they will work to conserve fish and wildlife resources. Examines federal law and policy relating to allocation and conservation of fish and wildlife resources.

FW 519. THE NATURAL HISTORY OF WHALES AND WHALING. (3 Credits)
Addresses the natural history of whales as a unique example of adaptation in an evolutionary lineage, and the history of whaling as a general example of the failings of international resource management.

FW 521. AQUATIC BIOLOGICAL INVASIONS. (4 Credits)
An overview of the background, theory, evolution, ecology, politics and conservation of invasions by introduced species in aquatic environments. Taught at Hatfield Marine Science Center OR online through Ecampus.

FW 522. INTRODUCTION TO OCEAN LAW. (3 Credits)
Examination of US law and primary international law focused on fisheries management with coverage of regulation of other ocean resources including energy, marine mammals, endangered species, pollution, and protected areas. Final project is intended to provide students with hands-on exposure to real-world fisheries and ocean management issues.

FW 523. MONITORING WILDLIFE POPULATIONS AND THEIR HABITATS. (3 Credits)
An overview of monitoring plan design and the conceptual background needed to understand and critique monitoring plans, and have the basic skills to develop and implement a monitoring program as part of an interdisciplinary team.

FW 524. INTRODUCTION TO FISHERIES ASSESSMENT. (3 Credits)
Fisheries management strategies rely on models that predict a population's responses to exploitation. This course introduces approaches commonly used to assess and evaluate the dynamics and status of a population. Provides an overview of the terminology, data requirements, underlying rationale, assumptions, limitations and uncertainty associated with stock assessments.

FW 526. COASTAL ECOLOGY AND RESOURCE MANAGEMENT. (5 Credits)
Study of the ecology and management of coastal marine and freshwater ecosystems as well as natural resources, emphasizing experimental (participatory) learning in a field station setting. Lec/lab.

FW 527. PRINCIPLES OF WILDLIFE DISEASES. (4 Credits)
Ecological aspects of important diseases affecting North American wildlife will be discussed. Demonstrations will mainly cover migratory birds, carnivores and ruminants. Lec/lab. Ecampus sections do not use lab demonstrations.

FW 528. DIVERSITY AND IDENTIFICATION OF LARVAL FISHES. (3 Credits)
Research on early life history stages of fishes has increased considerably in recent years, due to its importance in many research fields, such as fisheries science and oceanography, species conservation, systematics and morphology. Simultaneously, the ability to identify ichthyoplankton has decreased. This course is intended to provide students with an understanding of the evolutionary diversity of ichthyoplankton of the world.

FW 529. ICHTHYOPLANKTON IDENTIFICATION LABORATORY. (2 Credits)
Larval fishes are important in many research fields, and are part of many natural history collections. However, often museums are unable to provide the curatorial needs due to the lack of trained personnel. The lab will provide students with the necessary practical skills to identify larval fishes. Distinctive from the course 528, where students learn about the diversity and evolution of larval fish characters, the laboratory is designed to the identification of larvae from a real collection. Students are encouraged to bring unidentified ichthyoplankton samples or mixed species lots to the course to help with their identification.

FW 534. ESTUARINE ECOLOGY. (4 Credits)
Integrated and synthetic training in the ecological processes of estuarine environments, with emphases on ecological interactions among organisms and the biogeochemical cycling of carbon and nitrogen. Topics include geomorphology, estuarine physics and chemistry, primary and secondary producers, ecosystem metabolism, element cycling, food webs, fisheries, restoration, management, and impacts of climate. Field trip required, transportation fee charged. CROSSLISTED as OC 434/OC 534.

Equivalent to: OC 534

FW 535. WILDLIFE IN AGRICULTURAL ECOSYSTEMS. (3 Credits)
Examines the relationships between agricultural production and fish and wildlife populations and communities. Explores the impacts of agricultural practices on fish and wildlife. Field trips required; transportation fee charged. OSU Ecampus students are not required to attend field trips.

FW 537. STRUCTURED DECISION MAKING IN NATURAL RESOURCE MANAGEMENT. (2 Credits)
Structured decision making (SDM) is used for making natural resource management and policy decisions. It is an ideal framework for interdisciplinary teams to cooperate and identify the most effective management strategies. Graduate students from diverse backgrounds (natural resources, political science, others) are provided with an understanding of the SDM process.

FW 538. STRUCTURED DECISION MAKING IN NATURAL RESOURCE MANAGEMENT LAB. (2 Credits)
Students who are taking or have taken FW 537 are provided with the understanding of and ability to employ the techniques needed to build models that are used during the structured decision-making process. The laboratory emphasizes the use of graphical models and basic statistical techniques for building decision-making models. Lec/lab.
Prerequisites: FW 537 (may be taken concurrently) with D- or better

FW 540. VERTEBRATE POPULATION DYNAMICS. (4 Credits)
Concepts in population ecology and quantitative approaches to managing wildlife populations; methods of parameter estimation, model structure, assumptions, and analysis, applications to common management issues.

FW 544. QUANTITATIVE DECISION ANALYSIS FOR FISH AND WILDLIFE MANAGEMENT. (4 Credits)
Decision analysis allows decision makers to examine the expected effects of different strategies before implementation; incorporate multiple objectives and values of stakeholders; determine the relative influence of various sources of uncertainty; and estimate the value of collecting additional data. Quantitatively oriented graduate students in natural resources are provided with an in-depth overview of decision analysis and adaptive management, emphasizing animal population management. Lec/lab.

FW 545. ECOLOGICAL RESTORATION. (4 Credits)
Fundamentals of restoring and reclaiming disturbed landscapes and ecosystems. Topics to be covered include types and assessment of site conditions; determining restoration goals and feasibility; hydrologic, biotic, and soil functions and their importance in restoration; and measures of successful restoration. CROSSLISTED as FES 545.
Equivalent to: FES 545

FW 549. HISTORY OF FISHERIES SCIENCE. (3 Credits)
Surveys the development of fisheries science, professionalization of the discipline, patronage, and the political, economic, and social context in which fisheries science operates.

FW 550. TROPHIC CASCADES. (2-3 Credits)

Theory and empirical analysis of terrestrial carnivore effects on plants and ecosystems as mediated through herbivores. Emphasis on large carnivores, frequency/strength of trophic cascades, implications for ecosystem function, management, and restoration. Lectures, current literature, discussions, field exercise, term paper, and student presentations. CROSSLISTED as FES 550.

Equivalent to: FES 550

This course is repeatable for 3 credits.

FW 551. AVIAN CONSERVATION AND MANAGEMENT. (3 Credits)

Identification, classification, life history strategies, ecology and management of upland and migratory birds.

FW 552. FOREST WILDLIFE HABITAT MANAGEMENT. (4 Credits)

Management of terrestrial vertebrates in forest ecosystems. Effects on silvicultural practices and landscape pattern on habitats and populations. CROSSLISTED as FES 552.

Equivalent to: FES 552

FW 554. FISHERY BIOLOGY. (4 Credits)

Principles and methods used in studying the biology of fishes; ecological requirements of freshwater and anadromous fishes; principles and practices in sport fishery management.

FW 556. FRESHWATER ECOLOGY AND CONSERVATION. (5 Credits)

Physical, chemical, biological, and environmental concepts in continental aquatic systems. Includes techniques related to assessing aquatic resources their management and conservation. Lec/lab.

FW 558. MAMMAL CONSERVATION AND MANAGEMENT. (4 Credits)

A thorough understanding of the management, conservation, and ecology of mammals in North America; includes population dynamics, harvest management, techniques to determine abundance, diets, reproduction, and the cultural and political variables that contribute to formulation of management programs.

FW 560. PSYCHOLOGY OF ENVIRONMENTAL DECISIONS. (3 Credits)

Natural resource management and conservation programs have one thing in common: to be effective, they must consider how and why humans make decisions. This course approaches this topic from a psychological lens and will cover the psychological processes associated with making individual and group decisions, common biases and heuristics in our decision-making, and how these apply to diverse natural resource management and conservation issues. Students will learn how to take these aspects of human decision making into consideration when participating in or facilitating collaborative environmental programs.

FW 562. ECOSYSTEM SERVICES. (3 Credits)

Introduces students to the ecological, economic, and social/ethical issues involved in the study of ecosystem services, with a major focus on biological components involved in ecosystem services. Topics covered include: 1) an introduction to the roles that living organisms play in the provision of ecosystem services, 2) the relationship of ecosystem functions and services, 3) the societal factors that influence this relationship, 4) general categories of ecosystem services, 5) identification of potential ecosystem services in terrestrial and aquatic systems, 6) an overview of the methods of valuation, and 7) translating ecosystems functions to services. Case studies will be used to illustrate key concepts and relationships within different ecological and social contexts.

FW 563. CONSERVATION BIOLOGY OF WILDLIFE. (3 Credits)

Overview of the field of conservation biology with emphasis on the relationship to conservation and management of wildlife.

FW 564. MARINE CONSERVATION BIOLOGY. (3 Credits)

Lectures, group library research, and class debates on current issues regarding the conservation of biodiversity in the sea. Topics include overfishing, invasive species, eutrophication, marine pollution, and global warming, as well as means of addressing these threats.

Equivalent to: BI 564

FW 565. MARINE FISHERIES. (4 Credits)

A global perspective on commercial fish and shellfish harvesting with emphasis on fishing technology and policy issues. Offered fall term in odd years.

FW 569. BEHAVIOR AND PHYSIOLOGY OF MARINE MEGAFUNA. (3 Credits)

An in-depth study of marine megafauna (mammals, birds, turtles) with an emphasis on methods and analyses of behavior and physiology for conservation. Lab and field exercises include investigations into the behavior-physiology nexus of diving, migration, thermoregulation, energy expenditure, and mating systems. Research techniques to be explored will include, for example, tracking and remote biotelemetry monitoring technologies, respirometry, genetics, and direct field study observation. Theoretical approaches, field techniques and statistical analyses will help prepare students for a career in fisheries or wildlife science. Lec/lab. Taught at HMSC.

FW 570. ECOLOGY AND HISTORY: LANDSCAPES OF THE COLUMBIA BASIN. (3 Credits)

Integrates environmental history and landscape ecology of the Columbia River Basin from geologic origins to the present, to create an understanding of change caused by natural processes and human activities. CROSSLISTED as HSTS 470/HSTS 570.

Equivalent to: HSTS 570

FW 571. ENVIRONMENTAL PHYSIOLOGY OF FISHES. (4 Credits)

Principles of the functional biology of fishes with emphasis on environmental interactions and management implications.

FW 573. FISH ECOLOGY AND CONSERVATION. (4 Credits)

Behavior of fishes as a mode of accommodation to various ecological and evolutionary constraints. Importance of heritable and learned patterns to population and community dynamics. Application of behavioral studies to the solution of management problems.

FW 574. EARLY LIFE HISTORY OF FISHES. (4 Credits)

Overview of diversity of development patterns in fishes; emphasis on morphology, life history, and evolution. Offered alternate years. CROSSLISTED as OC 574.

Equivalent to: OC 574

FW 575. WILDLIFE BEHAVIOR. (4 Credits)

Adaptive significance of egocentric and social behavior of wildlife species. Implications of behavior in sound management practice.

FW 576. FISH PHYSIOLOGY. (4 Credits)

Physiological specializations and adaptations of major groups of fishes.

FW 579. WETLANDS AND RIPARIAN ECOLOGY. (3 Credits)

Ecology of riparian freshwater and estuarine wetlands of the Pacific Northwest. Effects of land use on ecosystem structure, function, biodiversity, and restoration will be explored.

FW 580. STREAM ECOLOGY. (3 Credits)

Structure and function of stream ecosystems, with emphasis on biological processes; physical and chemical relations; riparian influences and landscape perspectives.

FW 581. WILDLIFE ECOLOGY. (3 Credits)

Interrelationships of wildlife, environment and humans. Evaluation of properties and habitats of wildlife populations.

FW 583. SPECIES RECOVERY PLANNING AND RESTORATION. (3 Credits)

The importance of communication in science is stressed and a broad knowledge of endangered species-related information is provided. Students develop the ability to critically evaluate published information in scientific literature and to present and summarize it as part of the collaborative species recovery planning process with a varied audience of stakeholders.

FW 591. FISH DISEASES IN CONSERVATION BIOLOGY AND AQUACULTURE. (3 Credits)

Introduction to diseases of fish including pathogens important to aquaculture and ornamental industries as well as to wild fish populations and conservation programs. CROSSLISTED as MB 491/MB 591.

Equivalent to: MB 591

FW 596. FISH DISEASES IN CONSERVATION BIOLOGY AND AQUACULTURE LAB. (2 Credits)

This laboratory complements lectures in FW/MB 491/591, with students learning basic necropsy techniques; identification of bacterial, viral and metazoan pathogens; and molecular identification methods. CROSSLISTED as MB 496/MB 596.

Equivalent to: MB 596

FW 597. AQUACULTURE. (3 Credits)

Principles and practices for the aquaculture of fish, shellfish, and algae.

FW 598. AQUACULTURE LABORATORY. (3 Credits)

Biology and culture requirements of fish, shellfish, and algae. Emphasis on laboratory culture techniques and practical experience in handling organisms. Taught at Hatfield Marine Science Center.

FW 599. SPECIAL TOPICS IN FISHERIES AND WILDLIFE. (0-16 Credits)

Various topics in fisheries science and wildlife science. Taught at Hatfield Marine Science Center and Corvallis campus.

Equivalent to: ENT 499

This course is repeatable for 99 credits.

FW 601. RESEARCH. (1-16 Credits)

This course is repeatable for 16 credits.

FW 603. THESIS. (1-16 Credits)

This course is repeatable for 999 credits.

FW 605. READING AND CONFERENCE. (1-16 Credits)

This course is repeatable for 16 credits.

FW 606. PROJECTS. (1-16 Credits)

This course is repeatable for 16 credits.

FW 607. SEMINAR. (1-16 Credits)

This course is repeatable for 16 credits.

FW 620. ECOLOGICAL POLICY. (3 Credits)

Policy issues associated with ecosystem management, risk assessment, biological diversity, ecosystem health, sustainability, invasive species, bioregionalism, globalization and transnational factors, and rights, ethics, and morals.

FW 661. ANALYSIS OF ANIMAL POPULATIONS. (5 Credits)

Quantitative methods for estimating parameters (abundance, survival, population stability) of animal populations. Emphasis is on vertebrate animals and statistical methods of hypothesis testing, parameter estimation, and inference testing. Offered odd-numbered years.

FW 699. SPECIAL TOPICS IN FISHERIES AND WILDLIFE. (1-4 Credits)

Various topics in fisheries science and wildlife science. Taught at Hatfield Marine Science Center and Corvallis campus.

This course is repeatable for 8 credits.

FW 808. WORKSHOP. (1-16 Credits)