Course name: Biology of Sharks and Rays

Summer session B

Course Number: ZOO 4926/ ZOO 6927

Credit hr : 4

Instructors: Dr. Gavin Naylor (Gnaylor@flmnh.ufl.edu) ; Dr. Dean Grubbs

Time: May 26-June 6, 2025

Location: Florida State University Coastal and Marine Laboratory
3618 Highway 98, St. Teresa, FL

Prerequisites: BSC 2011, or equivalent

Text: Recommended: Abel, D.C. and Grubbs, R.D., 2020. Shark Biology and Conservation: Essentials for Educators, Students, and Enthusiasts. Johns Hopkins University Press. Handouts and readings will be provided in class or made available over the internet.

Course Description: Biology of Sharks and Rays is an immersion course geared towards upper level undergraduates and graduate students wishing to pursue research involving sharks, skates, rays and chimaeras. Information will be disseminated through a combination of lectures, laboratory assignments, and field exercises. The course will focus on the extant diversity of elasmobranch fishes, their evolution and zoogeography. We will cover form, function, physiology, and behavior of different species of elasmobranchs emphasizing adaptations to different habitats. Toward the end of the course ,we will cover contemporary challenges associated with fisheries management of elasmobranch populations and their conservation. The course will have a strong field component, introducing students to species of elasmobranchs that inhabit the varied estuarine and marine habitats of northern Gulf of Mexico and exploring the scientific methods used to study their biology, ecology and population dynamics.

Student Learning Objectives: Students that complete this course will be able to:

1) explain the evolutionary history of chondrichthyan fishes and the forces that shaped their current diversity and biogeographic patterns,

2) assess the complex and varied life histories chondrichthyan fishes possess,
Copies of this announcement are available upon request in alternative formats for individuals with print-related
disabilities.

3) understand the physiological, behavioral and morphological adaptations necessary for survival in marine environments from estuaries to the deep sea,

4) identify and classify chondrichthyan fishes globally at the level of Order

and regionally to species,

5) apply a variety of scientific tools to surveys chondrichthyan populations and describe their movement and habitat use patterns,

6) analyze and interpret molecular datasets to answer questions related to population genetics, phylogenetics, and reproduction

7) evaluate the major anthropogenic effects on chondrichthyan fish abundances and distributions and the associated management and conservation challenges on regional to global scales.

Readings: Students will be given reading assignments which will be posted on the course website or handed out in class. The lecture presentations and outlines will be posted on the website.

Field Trips: We will sample marine and estuarine habitats over a series of field trips (weather permitting) based out of the FSU Coastal and Marine Lab

Identification: Students will be expected to be able to identify and understand the taxonomy and phylogenetic relationships among species studied in the lab.

Lab assignments: Laboratory assignments will center around two main topic areas: (1) species identification and (2) comparative anatomy. Students will carry out dissections to understand anatomy and make skeletal preps of jaws and chondrocrania that will be added to the FSUCML comparative teaching collection. Students will learn how to interpret the utility of anatomical features for studying adaptation, ontogeny, and evolutionary relationships. These are time consuming projects that will take up most of the assigned lab time during the first half of the course.

Skeletal preparations and presentations:
A comparative skeletal collection of jaws and chondrocrania is housed Zoological Collection at the FSU Coastal and Marine Lab. The skeletal preparation you carry out during the course will contribute toward this collection. You will be assigned a jaw or chondrocranium specimen for your preparation, based on availability, during the first lab. You will be expected to review the primary literature associated with the species you work on. At the end of the class, you will present your preparation to the class describing the features that are distinctive and interpret these in light of the evolutionary history, life history, ecology, physiology, and behavior of the species.
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Lab Practical: Exams: You will be given a lab practical toward the end of the class will take the format of short answer and fill in the blanks. You are expected to be able to identify any shark or ray examined in lab to species. Also, you should be able to identify selected internal and external structures and their basic functions. Questions about habitats and ecology may also be asked.
There will be one lecture exam, a final that will cover all the material covered in class. This will be administered on the last day of the class and the format will be a combination of short answer

and short essay.

Grading:
Grading component Percentage of final grade
Final Exam 30%
Laboratory Practical 30%
Skeletal Preparation and Presentation 20%
Lab Assignments 20%
Grades will be assigned on the scale below

Grade Score

A	93 – 100
A-	90 – 92
B+	87 – 89
B	83 – 86
B-	80 – 82
C+	77 – 79
C	73 – 76
C-	70 – 72
D+	67 – 69
D	63 – 66
D-	60 – 62
F	<60

Biology of Sharks. Course Topics
Lecture topics

Course Introduction. Scope of course and goals

Evolution: The Age of Fishes, Chondrichthyans Through Time

Classification and Biodiversity of Living Chondrichthyans

Anatomy, skeletal systems, integument, locomotion and functional morphology

Chondrichthyan species guilds. Association between habitat and morphology

Introduction to Fishery Independent Surveys: Longline and Gillnet

Physiology: Respiration, Circulation, Heterothermy

Homeostasis: Buoyancy, Osmoregulation, Endocrine System

Sensory Systems I: Vision, Olfaction, Mechanoreception, Taste

Sensory Systems II: Sound and Electricity: Reception and Production

Reproduction and Life Histories 1: Mating behavior and physiology

Reproduction and Life Histories 2: Modes of embryonic development

Studying shark movements and migration: tagging, telemetry, and challenges

Introduction to phylogenetic analysis, morphology and sequence data

Integrating Phylogeny with Geographic Distributions. Zoogeography

Life histories and fisheries management consequences

Fisheries management and Conservation: Regional to global case studies

Introduction to population genetics

Contrasting inferences from population genetics with tagging data

Lab & field trip topics

Introduction to Phylogenetic Diversity; dichotomous keys, specimen identification

Assignment of specimens for museum jaw or chondrocranium preparations

External Anatomy: sharks vs rays, pelagic vs benthic, coastal vs deep sea

Museum shark jaw/chondrocranium preparations

Internal Anatomy: organ systems, sensory systems, reproductive anatomy
(galeomorph shark, squalomorph shark, batoid)

Methods for tagging and telemetry

Introduction to SharksRays.org
Exercises with sharksrays.org website and associated tools

Field trip 1: FSUCML GulfSPAN Survey - Gill net / longlines (Dog Island Reef)
Field trip 2: FSUCML GulfSPAN Survey - Gill net / longlines (Turkey Point Shoal)
Field trip 3: Apalachicola Bay: Bycatch deterrent research
Field trip 4: Acoustic telemetry methods, range testing
Field trip 5: FSUCML Big Bend Survey - Gill net / shallow longlines (Waccassassa Bay/Seahorse Key) Tagging and tissue sampling of blacktip sharks
Field trip 6: FSUCML Big Bend Survey - Gill net / shallow longlines (Red Bank)

References:

Abel, D.C. and Grubbs, R.D., 2020. Shark Biology and Conservation: Essentials for Educators, Students, and Enthusiasts. Johns Hopkins University Press.
Carrier, J.C., J.A. Musick, and M.R. Heithaus. 2010. Sharks and their Relatives II: Biodiversity, Adaptive Physiology, and Conservation. CRC Press, New York, New York, USA. 596 713 pp.
Carrier, J.C., J.A. Musick, and M.R. Heithaus. 2012. Biology of Sharks and their Relatives. CRC Press, New York, New York, USA. 596 pp.
Ebert, D.A., Dando, M. and Fowler, S., 2021. A pocket guide to sharks of the world. Princeton University Press.
Ebert, D.A., Dando, M. and Fowler, S., 2021. Sharks of the World: A Complete Guide. Princeton University Press.

Evans, D.H. and J.B. Claiborne. 2006. The Physiology of Fishes, 3rd Edition. CRC Press, New York, New York, USA. 596 601 pp.
Hamlett, W.C. 2005. Reproductive Biology and Phylogeny of Chondrichthyes – Sharks, Batoids and Chimareas. Volume 3 of Series: Reproductvie Biology and Phylogeny. Cience Publishers, Inc. London, United Kingdom. 562 pp.
Hamlett, W.C. 1999. Sharks, Skates, and Rays: The Biology of Elasmobranch Fishes. The Johns Hopkins University Press, Baltimore, Maryland, USA.515 pp.
Harden-Jones FR (1968) *Fish Migrations*, London: Edward Arnold.
Hart, P.J.B. and J.D. Reynolds. 2002. Handbook of Fish Biology and Fisheries: Volume 1 Fish Biology. Blackwell Science Ltd. Malden, MA, USA. 413 pp.
Helfman, G.S., B.B. Collette, D.E. Facey, and B.W. Bowen. 2009. The Diversity of Fishes – 2nd Edition. Wiley-Blackwell, Inc. Hoboken, New jersey, USA. 720 pp
Klimley, A.P., 2013. The biology of sharks and rays. University of Chicago Press.
Last, P., Naylor, G., Séret, B., White, W., de Carvalho, M. and Stehmann, M. eds., 2016. Rays of the World. CSIRO publishing.
Pough F.H., J.B. Heiser and W.N. McFarland. 1996. Vertebrate Life, 4th Edition. Prentice Hall. Upper Saddle River, NJ. 798 pp.
Randall, D.J. and A.P. Farrell. 1997. Deep-Sea Fishes. Volume 16: Fish Physiology Series. Academic Press. San Diego, California, USA. 388 pp.
Stiassny, M.L.J., L.R. Parenti and G.D. Johnson. 1996. Interrelationships of Fishes. Academic Press San Diego, California, USA. 496 pp.
Tyus, H.M. 2012. Ecology and Conservation of Fishes. CRC Press, Boca Raton, Florida, USA. 529 pp.

University Attendance Policy
Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will
be accommodated in a way that does not arbitrarily penalize students who have a valid written excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy
The Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations.
Students are responsible for reading the Academic Honor Policy and for living up to their pledge to ". . . be honest and truthful and . . .
[to] strive for personal and institutional integrity

Americans With Disabilities Act
Students with disabilities needing academic accommodation should: (1) register with and provide documentation to the Office of Accessibility Services; and (2) request a letter from the Office of Accessibility
Services to be sent to the instructor indicating the need for accommodation and what type; and (3) meet (in
person, via phone, email, skype, zoom, etc...) with each instructor to whom a letter of accommodation was
sent to review approved accommodations. This syllabus and other class materials are available in alternative
format upon request.