UNIVERSITY OF FLORIDA and FLORIDA STATE UNIVERSITY

SEAHORSE KEY MARINE LAB, NATURE COAST BIOLOGICAL STATION,
552 1ST STREET, CEDAR KEY, FL 32625
MAIN PHONE: (352) 325-6078
&
FLORIDA STATE UNIVERSITY COASTAL AND MARINE LABORATORY
3618 HIGHWAY 98, ST TERESA, FL 32358-2702
MAIN PHONE: 850-6120; FAX: 850-697-4822

Course title: **Biology of Sharks**
Summer Semester, 4 hr credits, June 2nd-15th, 2019

Instructors: Dr. Dean Grubbs, FSU
FSUCML, Office 121, 850-697-2067; dgrubbs@bio.fsu.edu
Dr. Gavin Naylor, FLMH, UF
Dickinson Hall, Office 278, 352-273-1954; gnaylor@flmnh.ufl.edu

Time: 08:00-18:00

Place: **June 2-8** FSUCML, auditorium (lectures) and building 408 (laboratory).
June 9-15 Seahorse Key Marine Lab

Prerequisites: 4000 level: Core courses in biology, 5000 level: graduate students.

Text: No text. All handouts and readings will be provided in class or made available over the web

Introduction: Biology of Sharks 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 some of the species of elasmobranchs that inhabit the varied estuarine, marine, and freshwater habitats of northern Gulf of Mexico

Class Goals: Students that complete this course will gain an understanding of (1) The evolutionary history of sharks and rays (2) The forces that have shaped their diversity and biogeographic patterns, (3) The variation in life histories that is exhibited across the group (4) The physiological, behavioral and

morphological adaptations that have allowed elasmobranchs to colonize different habitats. At the conclusion of the course, students will be able to identify the species that occur in NW Florida waters, become familiar with a variety of sampling and tagging methods that are used to study their biology, and explain major environmental and historical influences that have shaped species abundances and distributions.

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 Marine Lab (June 2-8) and Sea Horse Key (days 9-15). Representative samples of species collected from different habitats will be fixed in 10% formalin, preserved in 70% ETOH

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 that will be added to Dr. Grubbs' 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 (at FSU Marine Lab)

Osteological presentations:

Dr. Grubbs is building an comparative skeletal collection of jaws to be housed at the FSU Coastal and Marine Lab. The work you carry out during the course will contribute toward this effort. You will be assigned a species for your preparation, based on availability, during the first evening's lab. Time is built into the schedule to complete the assignment though it will require work after hours. 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

Lab Practical: Lab practical format will be 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.

Exams: There will be one lecture exam, a final that will cover all the material covered in the two-week period.

Grading: Grading will be based on the final exam score (30 pts), lab practical (30 pts), osteological presentation (20 pts), and lab assignments (20 pts).

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

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 excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy: The University of Florida's Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge (UF Academic Honor Policy can found at https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/)

Americans With Disabilities Act: Students with disabilities needing academic accommodation should: (1) register with and provide documentation to the Student Disability Resource Center; and (2) bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class.

This syllabus and other class materials are available in alternative format upon request.
For more information about services available to FSU students with disabilities, contact the:
Student Disability Resource Center (https://disability.ufl.edu)

Syllabus Change Policy
Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

Biology of Sharks. Course Outline

3 June, Mon.	
Lecture 1	Course Introduction. Scope of course and goals
Lecture 2	Classification and Biodiversity of Living Chondrichthyans
Field trip 1	Coastal/Estuarine sampling I: Gill net inshore / shallow long lines
Lab 1	Introduction to dichotomous keys, specimen identification and preservation Selection of specimens for skeletal preparations
4 June, Tues.	
Lecture 3	Anatomy, skeletal systems, integument, locomotion
Lecture 4	Feeding modes and biomechanics
Field trip 2	Long lining off bottom (targetting *Dasyatis* & *Rhizoprionodon* for course dissections)
Lab 2	External Anatomy/Phylogenetic diversity Survey: sharks vs rays, pelagic vs benthic
5 June, Wed.	
Lecture 5	Physiology: Respiration, Circulation, Heterothermy
Lecture 6	Homeostasis I: Buoyancy and Osmoregulation
Lecture 7	Homeostasis II: Endocrine systems ***NO FIELD TRIP***
Lab 3	Dissection. Internal Anatomy: organ systems. (7 teams of paired students, 1 shark, 1 ray, 1 skate per student pair)
6 June, Thursday.	
Lecture 8	Sensory Systems I: Vision, Olfaction, Mechanoreception, Taste
Lecture 9	Sensory Systems II: Sound and Electricity: Reception and Production, Bioluminescence
Field trip 3	Longlining /Tagging
Lab 4	**E**ach group to continue with anatomy and skeletal preps of their 3 specimens

Copies of this announcement are available upon request in alternative formats for individuals with print-related disabilities.

7 June, Friday.	
Lecture 10	Reproduction and Life History
Lecture 11	Life History and Ecology
Field trip 4	Longlining /Tagging
Lab 5	Work on jaw preparations
8 June, Saturday.	
Lecture 12	Species assemblages
Lecture 13	Trophic Guilds
Lecture 14	Movement, Migration, tagging technologies and challenges
	NO FIELD TRIP
Lab 6	Finish jaw preparations and presentations
9 June, Sunday.	
	DRIVE TO SEAHORSE KEY. SET UP IN DORMS ETC.
10 June, Monday.	
Lecture 15	Chondrichthyans through time, Paleozoic, Mesozoic and Cenozoic
Lecture 16	Intro to phylogenetic analysis using morphology and sequence data
Field trip 5	Tagging and tissue sampling of black tips off Seahorse Key
Lab 7	Computer Lab: Introduction to Phylogenetic Estimation using MacClade and PAUP
11 June, Tuesday.	
Lecture17	Phylogenetic relationships among modern elasmobranch taxa.
Lecture 18	Zoogeography and Diversity - Challenges reconstructing the deep past from extant distributions
Field trip 6	Tagging and tissue sampling off Seahorse Key
Lab 8	DNA extraction of collected tissue samples. PCR amplification

12 June, Wednesday

Lecture 19	Introduction to SharksRays.org
Lecture 20	Integrating Life History with phylogeny and Zoogeography
	NO PLANNED FIELD TRIP
Lab 9	Become familiar with sharksrays.org website and associated tools

13 June, Thursday

Lecture 21	Movement, Migration and its effects on population structure
Lecture 22	Contrasting inferences from population genetics with tagging data
Field trip 7	Sampling to reinforce association between habitat and species occurrence
Lab 10	Exercises with sharksrays.org website

14 June, Friday

Lecture 23	Course wrap up. Pulling it all together. Life History, phylogeny, movement and biogeography
	STUDENT PRESENTATIONS (IN AFTERNOON)

15 June, Saturday

FINAL EXAM 2 hours (AM)

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References:

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. 2004. Biology of Sharks and their Relatives. CRC Press, New York, New York, USA. 596 pp.

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..

Jennings, S. M.J. Kaiser, and J.D. Reynolds. 2001. Marine Fisheries Ecology. Blackwell Publishing. 417 pp.

Moyle, P.B. and J.J. Cech. 1996. Fishes: and Introduction to Ichthyology. Prentice Hall. Saddle River, NJ.

Nelson, J.S. 2006. Fishes of the World. 4th Edition. Joh Wilsy & Sons. Hoboken, NJ. 601 pp.

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 PressSan Diego, California, USA. 496 pp.

Tyus, H.M. 2012. Ecology and Conservation of Fishes. CRC Press, Boca Raton, Florida, USA. 529 pp.

Wootton, R.J., 1998: Ecology of teleost fishes. Kluwer Academic Publishers, Dordrecht, the Netherlands.
