

 FLORIDA ATLANTIC UNIVERSITY	NEW COURSE PROPOSAL Graduate Programs		UGPC Approval _____ UFS Approval _____ SCNS Submittal _____ Confirmed _____ Banner Posted _____ Catalog _____
	Department BIOLOGICAL SCIENCE College College of Science <small>(To obtain a course number, contact erudolph@fau.edu)</small>		
Prefix OCE Number 6059	<small>(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)</small> Lab Code	Type of Course Lecture	Course Title Ecology of Infectious Marine Diseases
Credits <small>(Review Provost Memorandum)</small> 3	Grading <small>(Select One Option)</small> Regular <input checked="" type="radio"/> Sat/UnSat <input type="radio"/>	Course Description <small>(Syllabus must be attached; see Guidelines)</small> Marine wildlife disease ecology takes a holistic approach to examining multi-parasite and multi-host systems across diverse marine habitats and geographic regions. This course covers a wide range of marine phyla, and examines the multifaceted role of the environment in the ecology and epidemiology of infectious marine disease.	
Effective Date <small>(TERM & YEAR)</small> Fall 2020	Prerequisites Required: Graduate standing; Aquatic Animal Health (ZOO 6556). Recommended: Ecology (equal to ZOO 6556)		
Prerequisites Required: Graduate standing; Aquatic Animal Health (ZOO 6556). Recommended: Ecology (equal to ZOO 6556)		Corequisites None	Registration Controls <small>(Major, College, Level)</small> Graduate Level
Prerequisites, Corequisites and Registration Controls are enforced for all sections of course			
Minimum qualifications needed to teach course: Member of the FAU graduate faculty and has a terminal degree in the subject area (or a closely related field.)		List textbook information in syllabus or here No textbook required. Recommended: The Ecology of Wildlife Diseases by Hudson PJ, Rizzoli A, Grenfell BT, Heesterbeek H, and Dobson AP (eds.). 2001. Oxford University Press.	
Faculty Contact/Email/Phone Dr. Annie Page-Karjian cpagekarjian@fau.edu 772-242-2453		List/Attach comments from departments affected by new course	

Approved by Department Chair <u>Joseph L. Patton</u> College Curriculum Chair <u>Christopher Beecher</u> 2020.02.10 09:36:26 -05'00' College Dean <u>Walter DeKalos</u> UGPC Chair _____ UGC Chair _____ Graduate College Dean _____ UFS President _____ Provost _____	Date <u>10-25-19</u> <u>2/10/2020</u> _____ _____ _____ _____
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Email this form and syllabus to UGPC@fau.edu one week before the UGPC meeting.

Course Syllabus
Ecology of Infectious Marine Diseases – OCE-6059-001-xxxxx, 3 credits

Lead Instructor: Annie Page-Karjian, DVM, PhD; FAU Harbor Branch, Lab I Building, Room 140
Phone: (772) 242-2453 Email: cpagekarjian@fau.edu

Effective Date: Fall 2020

Office hours: MF 11:00 am – 12:00 pm; also available in the classroom 15 minutes before and after each class and by appointment

TA Contact Information: None

Course Location: FAU Harbor Branch, Room TBD
Course Day/Time: Wednesdays @ 12:00 pm – 2:50pm

Prerequisites:

Required: Graduate standing; Aquatic Animal Health (ZOO 6556)
Recommended: Ecology (equal to PCB 4043)

Course Description: Marine wildlife disease ecology takes a holistic approach to examining multi-parasite and multi-host systems across diverse marine habitats and geographic regions. This course covers a wide range of marine phyla, and examines the multifaceted role of the environment in the ecology and epidemiology of infectious marine disease.

Course Objectives/Student Learning Outcomes: This course aims to introduce students to the field of infectious disease ecology, particularly regarding marine organisms, and to expose students to contemporary techniques used by wildlife disease ecologists in the collection and modeling of data.

Recommended Text/Supplementary Readings: Reading material for this course is based on journal articles and books chapters. Lectures will often refer to ideas and results from assigned readings.

- *The Ecology of Wildlife Diseases* by Hudson PJ, Rizzoli A, Grenfell BT, Heesterbeek H, and Dobson AP (eds.). 2001. Oxford University Press.
- Anderson. 1991. Populations and infectious diseases: ecology or epidemiology? *Journal of Animal Ecology* 60: 1-50.
- Fish medicine, 1993, M.K. Stoskopf
- Principal Diseases of Marine Fish and Shellfish, 1990, C.J. Sinderman
- Reptile Medicine and Surgery, 2006, D.R. Mader
- CRC Handbook of Marine Mammal Medicine, 2003, L.A. Dierauf & F.M.D. Gulland
- Infectious Diseases and Pathology of Reptiles, 2007, E.R. Jacobson

Course Calendar:

First class: August 2020

No class:

Last class: December 2020

*Tentative Dates of Exams:***Course Policies and Procedures****Course Evaluation Methods**

Final grades will be determined by averaging grades for four activities:

Short Class Tests (4 each @ 50 points = 200 points)	25%
Mid-Term Exam (200 points)	25%
Final Exam (200 points)	25%
Student Presentations (200 points)	25%

Course Grading Scale

Percentage Score:	Grade:	Percentage Score:	Grade:
92% - 100%	A	72% - 77%	C
90% - 91%	A-	70% - 71%	C-
88% - 89%	B+	68% - 69%	D+
82% - 87%	B	62% - 67%	D
80% - 81%	B-	60% - 61%	D-
78% - 79%	C+	0% - 59%	F

Incomplete Grade: A grade of Incomplete ("I") is reserved for students who are passing a course but have not completed all the required work because of exceptional circumstances. A grade of "I" will only be given under certain conditions and in accordance with the academic policies and regulations put forward in FAU's University Catalog. The student must show exceptional circumstances why requirements cannot be met. A request for an incomplete grade has to be made in writing with supporting documentation, where appropriate. As per university policy, an incomplete grade will only be given to a student who fulfills all of the following criteria:

1. Misses multiple exams or the final examination due to a legitimately documented emergency as defined by the FAU Academic Policies and Regulations:
http://www.fau.edu/academic/registrar/09-10_catalog/academics.html
2. Has a grade of C or better
3. Submits evidence of the emergency and signs an incomplete agreement.

Attendance Policy: Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance. Students are responsible for arranging to make up

work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

Classroom Etiquette Policy: University policy on the use of electronic devices states: "In order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular telephones and pagers, are to be disabled in class sessions." You may be asked to leave the class session for noncompliance.

Student Honor Policy: Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty, including cheating and plagiarism, is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high-quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at http://www.fau.edu/ctl/4.001_Code_of_Academic_Integrity.pdf

Cheating is a serious offense. If you are caught cheating, you will receive an F in the course. In addition, you will be referred to the Dean of Student Services and charged with an academic crime. Test procedures and rules will be stated at the beginning of each exam.

Disabilities Statement: In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

Counseling and Psychological Services (CAPS) Center: Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to <http://www.fau.edu/counseling/>

Code of Academic Integrity Policy: Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high-quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001. If your college has particular policies relating to cheating and plagiarism, state so here or provide a link to the full policy—but be sure the college policy does not conflict with the University Regulation.

Important Dates: The following dates are based upon the current university academic calendar. Changes to these critical dates have occurred in the past and you are responsible for checking the academic calendar on the university website for any changes during the academic term.

Academic calendar: <http://www.fau.edu/registrar/pdf/acadcal1718.pdf>

Last day to withdraw w/o receiving a "W" – September 4th

Labor day Closed: September 7th

Veteran Day Closed: November 11th

Thanking Break closed: November 26th and November 27th

Last day to withdraw w/o receiving an "F" – October 16

University Final exam Schedule: <http://www.fau.edu/registrar/courses/final-exams.php>

Course Topical Outline (subject to modification)

Note: For each lecture, students will be assigned selected readings from texts and/or peer-reviewed publications. Powerpoint presentations of class lectures will also be provided as PDFs.

Week I: Course introduction

1. Disease ecology principles
2. Microparasites vs. macroparasites
3. *Reading Assignment(s):*
 - a. Cunningham et al. 2012. Disease invasion: impacts on biodiversity and human health. *Philosophical Transactions of the Royal Society of Biological Sciences* 367: 2804-2806.
 - b. Holt et al. 2003. Parasite establishment in host communities. *Ecology Letters* 6: 837-842.
 - c. Gaydos et al. 2008. Top 10 principles for designing healthy coastal ecosystems like the Salish Sea. *EcoHealth* 5: 460-471.

Week II: Overview of infectious marine diseases

1. Plants (sea grass, macroalgae)
2. Invertebrates (corals, sea urchins, sea stars, abalones, oysters, crustaceans)
3. Vertebrates (fish, marine mammals, sea turtles, marine birds)

4. *Reading Assignment(s)*:
 - a. Lafferty & Harvell. 2014. Chapter 5: The role of infectious diseases in marine communities. In: Bertness et al. (eds) *Marine Community Ecology and Conservation*. Sinauer Associates, Inc.
 - b. Harvell et al. 2004. The rising tide of ocean diseases: unsolved problems and future priorities. *Frontiers in Ecology and the Environment* 2(7): 375-382.
 - c. Ward & Lafferty 2004. The elusive baseline for marine disease: Are diseases in ocean ecosystems increasing? *PLoS Biology* 2(4): 0542-0547.

Week III: Overview of infectious marine diseases

1. Vertebrates (fish, marine mammals, sea turtles, marine birds)
2. *Reading Assignment(s)*:
 - a. Select readings from Stoskopf's text: Chapters 24, 67, 78, Bacteria; Chapters 26, 69, 80, 88, Viruses; Chapters 25, 28, 68, 71, 79, 82, 90, Fungus; Chapters 27, 70, 81, 89, Protozoans
 - b. Select readings from Mader's text (Chapters 75, 76, Appendices A, B)
 - c. Select readings from Dierauf & Gulland text (Chapters 1, 2)
 - d. Select reading from Merck Veterinary Manual: Marine Mammals.
<http://www.merckvetmanual.com/exotic-and-laboratory-animals/marine-mammals>
 - e. Newman et al. 2007. Aquatic bird disease and mortality as an indicator of changing ecosystem health. *Marine Ecology Progress Series* 352: 299-309.

Week IV: Host immunity Part 1

1. Host immunology
2. *Reading Assignment(s)*:
 - a. Sadd & Schmid-Hempel. 2009. Principles of ecological immunology. *Evolutionary Applications* 2(1): 113-121.
 - b. Kennedy-Stoskopf. 1993. Immunology, Part 1, Chapter 11, in Stoskopf's *Fish Medicine* p 149-159.
 - c. Ellis et al. 2011. Immunological function in marine invertebrates. Responses to environmental perturbation. *Fish and Shellfish Immunology* 30 (6):1209-1222.
 - d. Select reading from Jacobson text (Chapter 2)
 - a. Select reading from Dierauf & Gulland text (Chapter 12)

Week V: EXAM 1

1. Paper topics DUE

Week VI: Host immunity Part 2

1. Evolution of host resistance
2. Parasites and host behavior
3. *Reading Assignment(s)*:

- a. Sadd & Schmid-Hempel. 2009. Principles of ecological immunology. *Evolutionary Applications* 2(1): 113-121.
- b. Baucom & de Roode. 2011. Ecological immunology and tolerance in plants and animals. *Functional Ecology* 25: 18-28.
- c. Gorter et al. 2015. Parasite host range and the evolution of host resistance. *Journal of Evolutionary Biology* 28(5): 1119-1130.
- d. Godfrey. 2013. Networks and the ecology of parasite transmission: a framework for wildlife parasitology. *International Journal for Parasitology: Parasites and Wildlife* 2: 235-245.

Week VII: Collection and analysis of pathogen data Part 1

1. Diagnostic techniques
2. *Reading Assignment(s)*:
 - a. Burge et al. 2016. Complementary approaches to diagnosing marine diseases: a union of the modern and the classic. *Philosophical Transactions of the Royal Society B* 371: 20150207.
 - b. Lafferty & Hoffman. 2016. Marine disease impacts, diagnosis, forecasting, management and policy. *Philosophical Transactions of the Royal Society B* 371: 20150200.

Week VIII: Collection and analysis of pathogen data Part 2

1. Study design and sample sizes
2. Aquatic animal health assessments
3. Prevalence data
4. *Reading Assignment(s)*:
 - a. O'Brien et al. 2009. Making reliable decisions in the study of wildlife diseases: using hypothesis tests, statistical power, and observed effects. *Journal of Wildlife Diseases* 45(3): 700-712.
 - b. Burge et al. 2016. Complementary approaches to diagnosing marine diseases: a union of the modern and the classic. *Philosophical Transactions of the Royal Society B* 371: 20150207.
 - c. Lafferty & Hoffman. 2016. Marine disease impacts, diagnosis, forecasting, management and policy. *Philosophical Transactions of the Royal Society B* 371: 20150200.
 - d. Halliday et al. 2012. Bringing together emerging and endemic zoonoses surveillance: shared challenges and a common solution. *Philosophical Transactions of the Royal Society of Biological Sciences* 367: 2872-2880.

Week IX. Pathogen factors

1. Evolution of virulence
2. Coinfections
3. Disease transmission dynamics
4. Temporal and spatial patterns of disease
5. *Reading Assignment(s)*:

- a. de Roode et al. 2008. Virulence-transmission trade-offs and population divergence in virulence in a naturally occurring butterfly parasite. *Proceedings of the National Academy of Sciences* 105(21): 7489-7494.
- b. Keesing et al. 2006. Effects of species diversity on disease risk. *Ecology Letters* 9: 485-498.
- c. Bordes & Morand. 2011. The impact of multiple infections on wild animal hosts: a review. *Infection Ecology and Epidemiology* 1: 7346.
- d. Graham. 2008. Ecological rules governing helminth-microparasite coinfection. *Proceedings of the National Academy of Sciences* 105(2): 566-570.
- e. Johnson & Hoverman. 2012. Parasite diversity and coinfection determine pathogen infection success and host fitness. *Proceedings of the National Academy of Sciences* 109(23): 9006-9011.

Week X. EXAM 2

Week XI. Effects of the changing environment on marine disease ecology Part 1

1. Climate change
2. Ocean acidification
3. *Reading Assignment(s)*:
 - a. Harvell et al. 1999. Emerging marine diseases- climate links and anthropogenic factors. *Science* 285: 1505-1510.
 - b. Harvell et al. 2002. Climate warming and disease risks for terrestrial and marine biota. *Science* 296(5576): 2158-2162.
 - c. Lafferty. 2009. The ecology of climate change and infectious diseases. *Ecology* 90(4): 888-900.
 - d. Burek et al. 2008. Effects of climate change in Arctic marine mammal health. *Ecological Applications* 18(2): S126-S134.
 - e. Burge et al. 2014. Climate change influences on marine infectious diseases: implications for management and society. *Annual Review of Marine Science* 6: 249-277.

Week XII. Effects of the changing environment on marine disease ecology Part 2

1. Anthropogenic pollution
2. *Reading Assignment(s)*:
 - a. White et al. 2018. Ingested micronizing plastic particle compositions and size distributions within stranded post-hatchling sea turtles. *Environmental Science and Technology* 52: 10307-10316.

Week XIII. Introduction to infectious disease modeling

1. Basic reproductive number (R_0)
2. *Reading Assignment(s)*:
 - a. Lloyd-Smith et al. 2005. Should we expect population thresholds for wildlife disease? *Trends in Ecology and Evolution* 20(9): S11-S19.

- b. Nelms et al. 2018. Investigating microplastic tropic transfer in marine top predators. *Environmental Pollution* 238: 999–1007.
- c. Southall et al. 2019. Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects. *Aquatic Mammals* 45(2): 125–232.

Week XIV. Infectious disease modeling Part 1

- 1. Compartmental (SIR) models
- 2. *Reading Assignment(s)*:
 - a. Kilpatrick & Altizer. 2010. Disease ecology. *Nature Education Knowledge* 3(10): 55. <https://www.nature.com/scitable/knowledge/library/disease-ecology-15947677>
 - b. Handel. 2017. Learning infectious disease epidemiology in a modern framework. *PLOS Computational Biology*
<https://doi.org/10.1371/journal.pcbi.1005642>

Week XV. Infectious disease modeling Part 2

- 1. Compartmental (SIR) models
- 2. *Reading Assignment(s)*:
 - a. Handel. 2017. Learning infectious disease epidemiology in a modern framework. *PLOS Computational Biology*
<https://doi.org/10.1371/journal.pcbi.1005642>

Week XVI. FINAL EXAM

- 1. Papers DUE