

Invasion Ecology of Aquatic Animals

FAS 4932 (3 credits) Spring, 2020

Course Description

A comprehensive overview of invasion ecology, highlighting aspects related to aquatic animals, including ecological concepts and debates underlying this developing field; biology and life history of nonnative aquatic animals, including characteristics of successful invaders; risk analysis methodology; and the conservation and regulatory implications of nonnative aquatic species.

Instructor

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*Office hours: Available by email or phone; office visits available by appointment.
Note that the instructor is located about 2 hrs from main campus and will be most available for discussion in Gainesville before and after class.*

Graduate Teaching Assistant

Allison Durland Donahou
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*UF/IFAS School of Natural Resources and the Environment
Office hours: Available for meetings on campus or by email, Skype, or phone*

Student Learning Outcomes

At the end of this course, each student will:

- understand the concepts associated with species invasions
- use basic risk assessment methodology
- think critically to evaluate literature and arguments, especially when faced with uncertainty and scientific disagreement
- more effectively communicate orally and in scientific writing
- appreciate the complex relationship between science, management, and regulation

Course Meeting Times

Wednesday Periods 7-9 (1:55-4:55 pm); MCCC Goo1 (*MCCB 3086 on 1/8, 1/22, and 2/19)

Required Readings

There is no required text for the course. Some important texts that I draw heavily upon for the course are listed as “Additional References,” below. Required readings will be provided in Canvas and will include the following papers which must be read by about the date specified below as they will be discussed in class and participation is expected.

Papers	Read by:
<p>Colautti, R.I., and H.J. MacIsaac. 2004. A neutral terminology to define ‘invasive’ species. <i>Diversity and Distributions</i> 10: 135-141.</p> <p>Beck et al. 2008. Invasive species defined in a policy context: recommendations from the federal Invasive Species Advisory Committee. <i>Invasive Plant Science and Management</i> 1:414-421.</p> <p>Hill, J.E. 2008. Non-native species in aquaculture: terminology, potential impacts, and the invasion process. USDA-Southern Regional Aquaculture Center Publication No. 4303.</p>	Jan 8
<p>Velleger et al. 2011. Homogenization patterns of the world’s freshwater fish faunas. <i>Proceedings of the National Academy of Sciences</i> 108:18003–18008.</p> <p>Fitzgerald, D.B., M. Tobler, and K.O. Winemiller. 2016. From richer to poorer: successful invasion by freshwater fishes depends on species richness of donor and recipient basins. <i>Global Change Biology</i> 22:2440-2450.</p>	Jan 15
<p>Hill, J.E. 2008. Non-native species in aquaculture: terminology, potential impacts, and the invasion process. USDA-Southern Regional Aquaculture Center Publication No. 4303.</p> <p>Catford et al. 2009. Reducing redundancy in invasion ecology by integrating hypotheses into a single theoretical framework. <i>Diversity and Distributions</i> 15:22-40.</p> <p>Blackburn et al. 2011. A proposed unified framework for biological invasions. <i>Trends in Ecology and Evolution</i> 26:333-339.</p>	Jan 22
<p>Gozlan, R.E. 2008. Introduction of non-native freshwater fish: is it all bad? <i>Fish and Fisheries</i> 9: 106-115.</p> <p>Vitule, J.R., C.A. Freire, and D. Simberloff. 2009. Introduction of non-native freshwater fish can certainly be bad. <i>Fish and Fisheries</i> 10: 98-108.</p>	Jan 29
<p>Courtenay, Jr., W.R. 1997. Nonindigenous fishes. Pages 109-122 in D.S. Simberloff, D.C. Schmitz, and T.C. Brown, editors. <i>Strangers in Paradise</i>, Island Press.</p>	Feb 5

<p>Shafland, P.L. 1996. Exotic fish assessments: an alternative view. <i>Reviews in Fisheries Science</i> 4:123-132.</p> <p>Trexler, J.C., W.F. Loftus, F. Jordan, J.J. Lorenz, J.H. Chick, and R.M. Kobza. 2000. Empirical assessment of fish introductions in a subtropical wetland: an evaluation of contrasting views. <i>Biological Invasions</i> 2:265-277.</p> <p>Schofield, P.J., and W.F. Loftus. 2015. Non-native fishes in Florida freshwaters: a literature review and synthesis. <i>Reviews in Fish Biology and Fisheries</i> 25:117-145.</p>	
<p>Pimentel, D., R. Zuniga, and D. Morrison. 2005. Update on the environmental and economic costs associated with alien-invasive species in the United States. <i>Ecological Economics</i> 52: 273-288.</p> <p>Blackburn et al. 2014. A unified classification of alien species based on the magnitude of their environmental impacts. <i>PLoS Biology</i> 12(5):e1001850.</p>	Feb 12
<p>Hill, J.E. 2002. Exotic fishes in Florida. <i>LakeLines, North American Lake Management Society</i> 22(1):39-43.</p> <p>Shafland et al. 2008. Florida's exotic freshwater fishes—2007. <i>Florida Scientist</i> 71:220-245.</p>	Feb 26
<p>Hill, J.E. 2009. Risk analysis for non-native species in aquaculture. USDA-Southern Regional Aquaculture Center Publication No. 4304.</p> <p>Copp, G.H. 2013. The Fish Invasiveness Screening Kit (FISK) for non-native freshwater fishes—a summary of current applications. <i>Risk Analysis</i> 33:1394-1396.</p> <p>Roy et al. 2017. Developing a framework of minimum standards for the risk assessment of alien species. <i>Journal of Applied Ecology</i>. DOI: 10.1111/1365-2664.13025.</p>	March 18
<p>Hardin, S., and J.E. Hill. 2012. Risk analysis of Barramundi Perch <i>Lates calcarifer</i> aquaculture in Florida. <i>North American Journal of Fisheries Management</i> 32:577-585.</p> <p>Hill, J.E., and K.M. Lawson. 2015. Risk screening of Arapaima, a new species proposed for aquaculture in Florida. <i>North American Journal of Fisheries Management</i> 35:885-894.</p> <p>Neal et al. 2017. Evaluation of proposed Speckled Peacock Bass <i>Cichla temensis</i> introduction to Puerto Rico. <i>North American Journal of Fisheries Management</i> 37:1093-1106.</p>	March 25
<p>Vander Zanden, M.J., and J.D. Olden. 2008. A management framework for preventing the secondary spread of aquatic invasive species. <i>Canadian Journal of Fisheries and Aquatic Sciences</i> 65: 1512-1522.</p> <p>Kolar et al. 2010. Chapter 8. Managing undesired and invading fishes. Pages 213-259 in Hubert and Quist (editors). <i>Inland fishery management in North America</i>, 3rd ed. American Fisheries Society, Bethesda, MD.</p>	April 8
<p>DeRivera, C. E., G.M. Ruiz, A.H. Hines, and P. Jivoff. 2005. Biotic Resistance to Invasion: Native predator limits abundance and</p>	April 15

<p>distribution of an introduced crab. <i>Ecology</i> 86 (12): 3364-3376.</p> <p>Jeschke, J. 2014. General Hypotheses in Invasion Ecology. <i>Diversity and Distributions</i> 20:1229-1234.</p> <p>Henriksson, A., J. Yu, D.A. Wardle, and G. Englund. 2015. Biotic resistance in freshwater fish communities: species richness, saturation or species identity? <i>Oikos</i> 124:1058-1064.</p>	
<p>Shea, K. and P. Chesson. 2002. Community ecology theory as a framework for biological invasions. <i>Trends in Ecology and Evolution</i> 17: 170-176.</p> <p>White et al. 2006. Biotic indirect effects: a neglected concept in invasion biology. <i>Diversity and Distributions</i> 12:443-455.</p> <p>Zenni, R.D., and M.A. Nunez. 2013. The elephant in the room: the role of failed invasions in understanding invasion biology. <i>Oikos</i> 122:801-815.</p>	April 22

Additional, supplemental readings will be provided in Canvas. These supplemental readings will be provided for each lecture topic and by invited speakers.

Class Format, Policies on Attendance and Make-up Exams

The course is a classroom-based, lecture and discussion format. No specific pre-requisites are required but the class is intended for advanced undergraduates. Given the broad scope of the field of invasion ecology, the course will cover diverse topics, each requiring a base of knowledge for the course to build upon. Students should have prior coursework in biology and have an understanding of basic ecological concepts.

Attendance records will not be maintained, but it is the responsibility of the student to maintain satisfactory progress in the course and to make up all work. Late project assignments will be penalized 10% on the first day and 5% on each subsequent day. Missed quizzes cannot be taken after the scheduled date without prior written consent of the instructor except under exceptional circumstances. Cases of serious illness, bereavement, or activities covered under the Twelve-Day Rule will be considered for make-up. Appropriate documentation must be provided in all cases.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Students are expected to turn off all cell phones, messaging devices, or other communications devices during class unless specifically allowed by the instructor.

Assignments

Projects **MUST** be turned into the instructor before class ends on the due date. There will be a penalty for late projects. Make prior arrangements and expect to turn projects in early if there are conflicts with the schedule.

- *Species Synopsis* – Students will choose a non-native aquatic species of relevance to Florida and write a brief species synopsis. The species may be freshwater, estuarine, or marine and must be a non-plant taxon. Species will be chosen in consultation with the course instructor to prevent student overlap. A detailed outline of the project requirements will be provided during class. In brief, students will conduct literature and internet searches to obtain information on the occurrence, life history, ecology, effects, and regulatory status of the species and write a fact sheet summarizing this information and pointing out gaps in knowledge.
- *Risk Assessment* – Students will participate in teams to conduct a risk assessment using the Federal Aquatic Nuisance Species Task Force RAM Committee Generic Analysis method or a risk screen using the Fish Invasiveness Screening Kit (FISK or related FISK-like variant) or the U.S Fish and Wildlife Service Ecological Risk Screening Summary (ERSS) on a select group from the class species synopses. Teams will provide a copy of their completed risk assessment along with a short narrative explaining their methodology and results. More detailed information and requirements will be posted in Canvas.
- *Exams* – There will be two exams (a midterm and final). These will cover all information in lectures, readings, and from invited speakers. Species profiles and risk assessments (except what is covered in lecture), and topic reviews will not be covered on exams.

Evaluation of Student Learning (Undergraduate Student)

20% *Species Synopsis*
25% *Mid-Term exam*
20% *Risk assessment*
25% *Final exam*
10% *Discussion participation*

Grading Scale

A 94-100%; A- 90-93; B+ 86-89; B 83-85; B- 80-82; C+ 76-79; C 73-75; C- 70-72; D+ 66-69; D 63-65; D- 60-62; E <60%

<https://catalog.ufl.edu/graduate/regulations/#text>

Schedule of Class Topics

WEEK	DATE	TOPIC	ASSIGNMENTS
1	Jan 8	Introduction/Pathways of Introduction	*MCCB 3086
2	Jan 15	Biogeography/Invasion Process	
3	Jan 22	Stages of Invasion Process	Species Choice Due; *MCCB 3086
4	Jan 29	Invasion Process Theory	
5	Feb 5	Impacts	
6	Feb 12	Impacts	
7	Feb 19	Classic Case Studies	Species Profiles Due; Review/Data Set Topic Due; *MCCB 3086
8	Feb 26	Florida Case Studies /Review	
9	Mar 4	Spring Break—No Class	
10	Mar 11	Risk Analysis/Risk Assessment	Mid-Term Exam
11	March 18	Risk Assessment	
12	March 25	Risk Assessment Case Studies	
13	April 1	Management Techniques/Case Studies	
14	April 8	International, Federal, and State Management and Policy	Risk Assessment Presentation
15	April 15	Ecological Theory	
16	April 22	Ecological Theory/Review	Topic Reviews or Data Papers Due
	April 30		Final Exam (Thursday 12:30-2:30 pm)

Additional References

Davis, M.A. 2009. *Invasion Biology*. Oxford University Press.

Elton, C.E. 1958. *The Ecology of Invasions by Animals and Plants*. Revised edition (2000). The University of Chicago Press.

Lockwood, J.L., M.F. Hoopes, and M.P. Marchetti. 2007. *Invasion Ecology*. Blackwell Publishing.

Williamson, M. 1996. *Biological Invasions*. Chapman & Hall.

Online Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times

when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

Other Information

Honor Pledge

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/students/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Campus Helping Resources

- Contact information for the Counseling and Wellness Center: <https://counseling.ufl.edu/>, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.
- Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.