

Advanced Aquaculture - FAS 6932

1 Overview

Advanced aquaculture will build upon the foundations of the Introduction to Aquaculture course (FAS6932). Students will be exposed to more advanced concepts including aquaculture engineering and system design; broodstock management; live feeds and algae production; economics and marketing; as well as biosecurity. Application of principles and concepts presented in this class will be emphasized. At the conclusion of this course students should have a firm grasp of critical concepts in aquaculture and be better prepared for careers in private, state, and federal organizations as well as academia.

- 3 Credits
- Spring Semester
- 100% online, asynchronous
- <http://elearning.ufl.edu/>

Course Prerequisites: Introduction to Aquaculture (FAS6932) is required unless permission is granted by the instructor. A strong foundation in biology, chemistry, marine science, and fish biology/ichthyology is recommended but not required.

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- Please use the Canvas message/Inbox feature for fastest response.
- Office hours: available by email or phone; office visits available by appointment.

Textbook(s) and/or readings: There is no required text for the course. Online readings will be provided for each learning topic.

2 Learning Outcomes

At the end of this course, each student will be able to:

- Design and engineer aquaculture systems for a wide variety of commercially important species.
- Explain the complex relationships between the animal and its culture environment and how these interactions influence growth, disease, survival, and reproduction.
- Describe the role of aquaculture in stock enhancement and restoration efforts.
- Formulate a comprehensive biosecurity plan for an aquaculture production site using risk identification and management strategies.
- Apply principles and concepts from this course to solve problems that may be encountered in aquaculture research and commercial production.

3 Course Logistics

This course is entirely web-based and students may access lectures, readings, and supporting materials as they become available each week.

To ensure satisfactory progress in the course, it is the responsibility of the student to access on-line lectures, readings, quizzes, and exams in a timely manner. All quizzes, assignments, and exams must be submitted by 11:59pm of the posted due date.

Technology Requirements:

- A computer or mobile device with high-speed internet connection.
- A headset and/or microphone and speakers; a web cam is suggested.
- Latest version of web browser. Canvas supports only the two most recent versions of any given browser. [What browser am I using?](#)
- Voicethread: <http://ufl.voicethread.com> (more instructions will be provided)

3.1 Assignments & Deliverables

Quizzes & Exams

A total of 14 quizzes will be administered online over the course of the semester covering material presented from that week. Quizzes will be multiple choice and questions will come from lecture, readings, and other supplementary materials provided by the instructor. Students will only be allowed to access quizzes once.

The mid-term exam will cover all material presented from weeks 1 through 8. The exam format may include multiple choice, short answer, and essay questions and will be administered online.

The final exam will be cumulative and cover all material presented from weeks 1 through 15. The exam format may include multiple choice, short answer, and essay questions and will be administered online.

Project/Writing Assignment

A broad range of topics have been covered in the Introduction to Aquaculture and Advanced Aquaculture classes, but we have barely scratched the surface. This assignment gives students the opportunity to become the instructor. All students will be required to develop a 20 minute PowerPoint lecture on an aquaculture topic of their choice. The lecture should be developed as if it were an additional module for this class. Lectures should be narrated using the VoiceThread tool. Students will also be required to develop a short 5 question quiz that tests the knowledge of someone who has viewed the lecture. *More details on this assignment are provided in Canvas.*

3.2 Grades & Grading Scale

42 points Quizzes (14 @ 3 points each)

20 points Mid-term exam

13 points Voicethread assignment

25 points Final exam

100 points total

Grading Scale (%)

A 90-100

B+ 85-89.99

B 80-84.99

C+ 75-79.99

C 70-74.99

D+ 65-69.99

D 60-64.99

E < 60

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

4 Course Content

Learning Modules

Week	Date	Topic	Assignment	Due Date
1	Jan 4 - 7	Aquaculture overview; Water quality/chemistry (ponds and RAS)	Quiz 1	Jan 8
2	Jan 9 - 14	Aquaculture engineering	Quiz 2	Jan 15
3	Jan 17 - 21	Recirculating system design and considerations	Quiz 3	Jan 22
4	Jan 23 - 28	Broodstock management	Quiz 4	Jan 29
5	Jan 30 - Feb 4	Induced spawning and captive reproduction of fishes	Quiz 5	Feb 5
6	Feb 6 - 11	Larval systems/production	Quiz 6	Feb 12
7	Feb 13 - 18	Protozoan and metazoan parasites in aquacultured fishes	Quiz 7	Feb 19
8	Feb 20 - 25	Bacterial diseases and viruses in aquacultured fishes	Mid-Term Exam	Feb 26
9	Feb 27 - Mar 3	Stock enhancement; Restoration aquaculture	Quiz 8	Mar 3
10	Mar 13 - 18	Aquaculture economics	Quiz 9	Mar 19
11	Mar 20 - 25	Live feeds culture	Quiz 10	Mar 26
12	Mar 27 - Apr 1	Molluscan biology and aquaculture	Quiz 11	Apr 2
13	Apr 3 - 8	Comprehensive and integrated aquaculture health planning	Quiz 12	Apr 9
14	Apr 10 - 15	Algae culture and aquaponics	Quiz 13	Apr 16
15	Apr 17 - 19	Applied physiology for aquaculture; Biotechnology in aquaculture	Quiz 14	Apr 19
16	Apr 24 - 28	NO LECTURE	Final Exam	Apr 28

Reading List

(See section #7 below)

5 Policies and Requirements

This syllabus represents current plans and objectives for this course. As the semester progresses, changes may need to be made to accommodate for timing, logistics, or to enhance learning. Such changes, communicated clearly, are not unusual and should be expected. Students are expected to regularly visit the course website for course communications.

5.1 Late Submissions & Make-up Requests

It is the responsibility of the student to access on-line lectures, readings, quizzes, and exams and to maintain satisfactory progress in the course.

All assignments, quizzes and exams are to be submitted by stated deadlines. Late submissions will not be accepted without the prior written consent of the instructor and will receive a grade of “0”.

Computer or other hardware failures, except failure of the UF e-Learning system, will not excuse students for missing assignments. Any late submissions due to technical issues **MUST** be accompanied by the ticket number received from the Helpdesk when the problem was reported to them. The ticket number will document the time and date of the problem. You **MUST** e-mail your instructor within 24 hours of the technical difficulty if you wish to request consideration.

For computer, software compatibility, or access problems call the HELP DESK phone number—352-392-HELP = 352- 392-4357 (option 2).

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

5.2 Semester Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning.

At approximately the mid-point of the semester, the School of Forest Resources & Conservation will request anonymous feedback on student satisfaction on various aspects of this course. These surveys will be sent out through Canvas and are not required, but encouraged. This is not the UF Faculty Evaluation!

At the end of the semester, students are expected to provide UF with feedback on the quality of instruction in this course using a standard set of university and college criteria (UF Faculty Evaluations). These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

5.3 Netiquette: Communication Courtesy

All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. Failure to do so may result in loss of participation points and/or referral to the Dean of Students' Office. <http://teach.ufl.edu/docs/NetiquetteGuideforOnlineCourses.pdf>

5.4 Academic Honesty Policy

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."*

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit 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."*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct or appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated.

Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see:

<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

5.5 University Policy on Accommodating Students with Disabilities:

Students requesting accommodation for disabilities must first register with the Dean of Students Office (<http://www.dso.ufl.edu/drc/>). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams.

Accommodations are not retroactive, therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

5.6 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.

6 Getting Help

For issues with technical difficulties for e-learning in Canvas, please post your question to the Technical Help Discussion in your course, or contact the UF Help Desk at:

- Learning-support@ufl.edu | (352) 392-HELP - select option 2 | <http://elearning.ufl.edu>
- Library Help Desk support <http://cms.uflib.ufl.edu/ask>
- SFRC Academic Hub <https://ufl.instructure.com/courses/303721>

6.1 Student Life, Wellness, and Counseling Help

- Counseling and Wellness resources <http://www.counseling.ufl.edu/cwc/>
- U Matter, We Care <http://www.umatter.ufl.edu/>
- Career Resource Center <http://www.crc.ufl.edu/>
- Other resources are available at <http://www.distance.ufl.edu/getting-help> for online students.

6.2 Student Complaint Process

The School of Forest Resources & Conservation cares about your experience and we will make every effort to address course concerns. We request that all of our online students complete a course satisfaction survey each semester, which is a time for you to voice your thoughts on how your course is being delivered.

If you have a more urgent concern, your first point of contact should be the SFRC Academic Coordinator or the Graduate/Undergraduate Coordinator for the program offering the course. You may also submit a complaint directly to UF administration:

- Students in online courses: <http://www.distance.ufl.edu/student-complaint-process>
- Students in face-to-face courses: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf

7 Reading List

Module 1

Wurts, W. and Durborow, R. 1992. Interactions of pH, Carbon Dioxide, Alkalinity and Hardness in Fish Ponds. SRAC Publication No. 464

Boyd, C. 1998. Water Quality for Pond Aquaculture. Alabama Agricultural Experiment Station Research and Development Series No. 43.

Wilson, P.C. 2010. Water Quality Notes: Alkalinity and Hardness. University of Florida EDIS SL332.

Wilson, P.C. 2009. Water Quality Notes: Dissolved Oxygen. University of Florida EDIS SL313.

Wilson, P.C. 2010. Water Quality Notes: pH. University of Florida EDIS SL328.

Module 2

Oakes, P.L., Gullet, K., and Bobowick, T. 2011. Aeration of ponds used in aquaculture. Agricultural Engineering Technical Note No. AEN-3.

Masser, M.P. and Lazur, A. 1997. In-Pond Raceways. SRAC Publication No. 170.

Managing Flow-Through Systems – BMP No. 20. 2004. Alabama Aquaculture Best Management Practice (BMP). Auburn University and USDA-Natural Resources Conservation Service.

Brune, D.E., Schwartz, G., Eversole, A.G., Collier, J.A., and Schwedler, T.E. 2004. Partitioned Aquaculture Systems. SRAC Publication No. 4500.

Tucker, C. 2005. Pond Aeration. SRAC Publication No. 3700.

Module 3

Malone, R. 2013. Recirculating Aquaculture Tank Production Systems A Review of Current Design Practice. SRAC Publication No. 453.

Bankston, J.D. and Baker, F.E. 1994. Selecting the Proper Pump. SRAC Publication No. 372.

Summerfelt, S.T. and Hochheimer, J.N. 1997. Review of Ozone Processes and Applications As an Oxidizing Agent in Aquaculture. *The Progressive Fish-Culturist* 59:94-105.

Module 4

Coyle, S.D., Durborow, R.M., and Tidwell, J.H. 2004. Anesthetics in Aquaculture. SRAC Publication No. 3900.

Abernathy, J.W., Peatman, E., and Liu, Z. 2010. Basic Aquaculture Genetics. SRAC Publication No. 5001.

Rottmann, R.W., Shireman, J.V., and Chapman, F.A. 1991. Capturing, Holding, Handling, Transporting, Injecting and Brood Fish for Induced Spawning. SRAC Publication No. 422.

Neiffer, D.L., and Stamper, M.A. 2009. Fish Sedation, Anesthesia, Analgesia, and Euthanasia: Considerations, Methods, and Types of Drugs. *ILAR J.* 50(4):343-60.

Rottmann, R.W., Francis-Floyd, R. and Durborow, R. 1992. The Role of Stress in Fish Disease. SRAC Publication No. 474.

Module 5

Mylonas, C.C. and Zohar, Y. 2001. Use of GnRHa-delivery systems for the control of reproduction in fish. *Reviews in Fish Biology and Fisheries* 10: 463–491.

Lubzens, E., Young, G., Bobe, J. and Cerdà, J. 2010. Oogenesis in teleosts: How fish eggs are formed. *General and Comparative Endocrinology* 165:367–389.

Schulz, R.W., de França, L.R., Lareyre, J.J., LeGac, F., Chiarini-Garcia, H., Nobrega, R.H., and Miura, T. 2010. Spermatogenesis in fish. *General and Comparative Endocrinology* 165:390–411.

Module 6

Watson, C.A., Chapman, F.A. 1996. Artificial Incubation of Fish Eggs. University of Florida EDIS FA-32.

Rønnestad, I., Yu'fera, M., Ueberscha, B., Ribeiro, L., Sæle, Ø. and Boglione, C. 2013. Feeding behaviour and digestive physiology in larval fish: current knowledge, and gaps and bottlenecks in research. *Reviews in Aquaculture* 5 (Suppl. 1), S59–S98.

Ludwig, G.M., Stone, N.M., and Collins, C. 1998. Fertilization of Fish Fry Ponds. SRAC Publication No. 469.

Woolley, L.D. and Qin, J.G. 2010. Swimbladder inflation and its implication to the culture of marine finfish larvae. *Reviews in Aquaculture* 2:181–190.

Module 7

Francis-Floyd, R. and Yanong, R.P.E. 1994. Spironucleus Infestations (Spironucleosis) in Freshwater Aquarium Fish. University of Florida EDIS VM67.

Yanong, R.P.E. 2009. Cryptocaryon irritans Infections (Marine White Spot Disease) in Fish. University of Florida EDIS FA164.

Yanong, R.P.E. 2003. Fish Health Management Considerations in Recirculating Aquaculture Systems—Part 1: Introduction and General Principles. University of Florida EDIS Cir 120.

Klinger, R.E. and Francis-Floyd, R. 2001. Submission of Fish for Diagnostic Evaluation. University of Florida EDIS FA55.

Module 8

Yanong, R.P.E. 2003. Use of Antibiotics in Ornamental Fish Aquaculture. University of Florida EDIS Cir84.

Yanong, R.P.E. and Waltzek, T.B. 2010. Megalocytivirus Infections in Fish, with Emphasis on Ornamental Species. University of Florida EDIS FA182.

Francis-Floyd, R. 2011. Mycobacterial Infections of Fish. SRAC Publication No. 4706.

Kelly, A.M. 2013. Medicated Feed for Food Fish. SRAC Publication No. 473.

Module 9

Lorenzen, K., Beveridge, M.C.M., and Mangel, M. 2012. Cultured fish: integrative biology and management of domestication and interactions with wild fish. *Biol. Rev.* 87: 639–660.

Lorenzen, K., Leber, K.M. and Blankenship, H.L. 2010. Responsible Approach to Marine Stock Enhancement: An Update. *Reviews in Fisheries Science* 18(2):189–210.

Module 10

None

Module 11

Støttrup, J.G. 2006. Review on the Status and Progress in Rearing Copepods for Marine Larviculture. Advantages and Disadvantages. Among Calanoid, Harpacticoid and Cyclopoid Copepods. En: Editores: L. Elizabeth Cruz Suárez, Denis Ricque Marie, Mireya Tapia Salazar, Martha G. Nieto López, David A. Villarreal Cavazos, Ana C. Puello Cruz y Armando García Ortega. *Avances en Nutrición Acuícola VIII*. VIII Simposium Internacional de Nutrición Acuícola. 15 - 17 Noviembre. Universidad Autónoma de Nuevo León, Monterrey, Nuevo León, México. ISBN 970-694-333-5.

Treece, G.D. 2000. Artemia Production for Marine Larval Fish Culture. Artemia Production for Marine Larval Fish Culture. SRAC Publication No. 702.

Ohs, C.L., Cassiano, E.J., and Rhodes, A. 2009. Choosing an Appropriate Live Feed for Larviculture of Marine Fish. University of Florida EDIS FA 167.

Treece, G.D. and Davis, D.A. 2000. Culture of Small Zooplankters for the Feeding of Larval Fish. SRAC Publication No. 701.

Module 12

TBA

Module 13

Yanong, R.P.E. and Erlacher-Reid, C. 2012. Biosecurity in Aquaculture, Part 1: An Overview. SRAC Publication No. 4707.

Yanong, R.P.E. 2012. Biosecurity in Aquaculture, Part 2: Recirculating Aquaculture Systems. SRAC Publication No. 4708.

Yanong, R.P.E. 2013. Biosecurity in Aquaculture, Part 3: Ponds. SRAC Publication No. 4712.

Module 14

Tyson, R. and Simonne, E. 2014. A Practical Guide for Aquaponics as an Alternative Enterprise. University of Florida EDIS HS1252.

Rakocy J.E., Masser, M.P. and Losordo, T.M. 2006. Recirculating Aquaculture Tank Production Systems: Aquaponics—Integrating Fish and Plant Culture. SRAC Publication No. 454.

Engle, C.R. 2015. Economics of Aquaponics. SRAC Publication No. 5006.

Creswell, L. 2010. Phytoplankton Culture for Aquaculture Feed. SRAC Publication No. 5004.

Module 15

TBA