

# FAS 6356 Fisheries Enhancement

Course Syllabus, Summer A 2022, 2 Credits  
Online with synchronous voice discussion (Wed 8 PM EDT, starting 5/18)

## Course Description

Fisheries enhancements are a set of fisheries management approaches involving the release of cultured organisms to enhance or restore fisheries. If developed under suitable conditions and managed appropriately, enhancements can contribute effectively to fisheries management goals. On the other hand, poorly conceived and managed enhancements can be wasteful of resources, and may even exacerbate existing fisheries problems. The course aims to provide participants with the knowledge and skills required for assessing where and when enhancements can contribute to fisheries management goals, and for developing and managing such initiatives effectively. Within the framework of the 'updated responsible approach' to fisheries enhancement (Lorenzen et al., *Rev. Fish. Sci.* 18: 189-210, 2010), the course emphasizes integrative systems approaches and the key elements of population dynamics, aquaculture production, release strategies, genetic management, governance, and social and economic costs and benefits. Lectures and discussions are used to introduce students to key concepts and methods. Throughout the course, students apply those concepts and methods to an enhancement fishery case study of their choice and present results of their assessments orally and in writing.

## Course objectives

At the end of the course the participants will be able to:

1. Describe the scientific basis of fisheries enhancements
2. Determine conditions under which enhancements may contribute to fisheries and ecosystem management goals
3. Evaluate the performance of existing fisheries enhancements
4. Plan for the development of new, or the reform of existing fisheries enhancements

## Instructor

Dr. Kai Lorenzen (Professor), Fisheries and Aquatic Sciences, SFRC, 7922 71<sup>st</sup> Street, Gainesville, FL 32653; Phone 352-273 3646; Email: [klorenzen@ufl.edu](mailto:klorenzen@ufl.edu).  
Web Page: <http://fisheriessolutions.org/>

## Guest lecturers

Dr. Kenneth M. Leber (UF Courtesy Professor), Associate Vice President, Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236. Phone: 941-388-4441 x406  
Email: [KLeber@mote.org](mailto:KLeber@mote.org)

Dr. Michael D. Tringali (UF Courtesy Associate Professor), Research Scientist (Genetics), Florida Fish & Wildlife Conservation Commission, 100 Eighth Avenue S.E., St. Petersburg, FL 33701. Phone: 727- 896-8626. Email: [mike.tringali@myfwc.com](mailto:mike.tringali@myfwc.com)

## **Distance delivery**

The class will be offered fully online.

All lectures and tutorials are available as Mediasite recordings.

Students must upload a personal introduction clip and workshop presentations via the VoiceThread system and participate in a weekly online, synchronous discussion meeting that will be scheduled at the start of class.

All participants are encouraged to maintain contact and discuss questions throughout the course using a suitable means agreed upon at the start of class (e.g. Canvas chat room).

## **E-learning support**

Canvas site will be available

## **Format, Evaluation and Feedback**

Classes will consist of lectures with discussions, independent coursework, and workshops. Throughout the course, students will analyze and prepare a development plan for a fisheries enhancement of their choice. The case study enhancement may be already operational, in development, or proposed.

Grades will be allocated as: A (93 - 100 %), A- (90 - 92 %), B+ (86 - 89 %), B (82 - 85 %), B- (78 - 81 %), C+ (74 - 77 %), C (67 - 73 %), C- (63 - 66 %), D+ (59 - 62 %), D (55 - 58 %), D- (51 - 54 %), E (< 50 %).

Click here for UF grading information for students: <http://www.registrar.ufl.edu/hubstudents.html>

**Coursework with due dates:**

<b>Due Date</b>	<b>Activity</b>	<b>% of total grade</b>
5/15/2022	Discuss and confirm case study and syllabus	5
5/22//2022	System overview & governance presentation	15
5/29/2022	Quantitative assessment presentation	15
	EnhanceFish Exercise	5
6/5/2022	Genetics & aquaculture presentation	15
	Genetics Exercise	5
6/12//2022	Release strategy and ecological impacts presentation	15
6/17/2022	Summary of assessment and recommendations	15
Throughout	Participation in class	10
Total		100

Further details on course work requirements including grading criteria is provided below.

**Helping Resources**

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. Both the Counseling Center and Student Mental Health Services provide confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

University Counseling Center, 301 Peabody Hall, 392-1575, [www.counsel.ufl.edu](http://www.counsel.ufl.edu)  
Career Resource Center, CR-100 JWRU, 392-1602, [www.crc.ufl.edu/](http://www.crc.ufl.edu/)  
Student Mental Health Services, Rm. 245 SHCC, 392-1171, [www.shcc.ufl.edu/smhs/](http://www.shcc.ufl.edu/smhs/)  
Alcohol and Substance Abuse Program (ASAP); Center for Sexual Assault / Abuse Recovery & Education (CARE); Eating Disorders Program; Employee Assistance Program; Suicide Prevention Program

**UF Honor Code**

As a result of completing the registration form at the University of Florida, every student has signed the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work. I agree to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University." The instructors of this course fully support the intent of the above statement and will not tolerate academic dishonesty. We, the members of the University of Florida Community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity. Read more: <http://www.dso.ufl.edu/students.php>

## Course Schedule Overview

Date	Objectives, Lectures and Activities
Week 1	<p><i>Objectives: Learn about fisheries enhancements and the Responsible Approach; introduce yourself and your case study.</i></p> <p>Watch:            Lecture 1: Introduction to fisheries enhancements and the ‘Responsible Approach’ (K. Lorenzen)            Lecture 2: Understanding enhancement fisheries systems (K. Lorenzen)</p> <p>Do:</p> <ul style="list-style-type: none"> <li>• Upload personal introduction clip to VoiceThread</li> <li>• Select case study enhancement and collate basic information on it</li> <li>• Confirm case study selection and understanding of course requirements with instructor (telephone or Skype)</li> <li>• Upload introduction to your case study to VoiceThread</li> </ul>
Week 2	<p><i>Objectives: Learn about population dynamics of fisheries enhancements and aquaculture production; present systems overview and governance analysis for your case study.</i></p> <p>Watch:            Lecture 3: Population dynamics and quantitative assessment of stocked fisheries (K. Lorenzen)            Tutorial 1: Population dynamics and quantitative assessment of stocked fisheries (K. Lorenzen)            Lecture 4: Aquaculture production for enhancement (K. Lorenzen)</p> <p>Do:</p> <ul style="list-style-type: none"> <li>• Check out the other participant’s introduction clips</li> <li>• Provide feedback on other student’s presentation on VoiceThread and/or in chat room</li> <li>• Upload system overview &amp; governance presentation on VoiceThread</li> </ul>
Week 3	<p><i>Objectives: Learn about genetic management of fisheries enhancements and about social/economic aspects; present quantitative assessment for your case study.</i></p> <p>Watch:            Lecture 5: Genetic aspects of fisheries enhancement &amp; genetic resource management I (M.D. Tringali)            Lecture 6: Genetic aspects of fisheries enhancement &amp; genetic resource management II (M.D. Tringali)            Lecture 7: Economic and social analysis of enhancements (C.M. Adams)</p>

	<p>Do:</p> <ul style="list-style-type: none"> <li>• Provide feedback on other student’s presentation on VoiceThread and/or in chat room</li> <li>• Upload quantitative assessment presentation on VoiceThread</li> <li>• Submit EnhanceFish modeling exercise as Word Doc on Canvas</li> </ul>
Week 4	<p><i>Objectives: Learn about release strategies for fisheries enhancement; present on genetic and aquaculture production aspects of your case study.</i></p> <p>Watch:  Lecture 8: Release strategies, empirical evaluation and the use of tagging programs I (K.M. Leber)  Lecture 9: Release strategies, empirical evaluation and the use of tagging programs II (K.M. Leber)</p>
	<p>Do:</p> <ul style="list-style-type: none"> <li>• Provide feedback on other student’s presentation on VoiceThread and/or in chat room</li> <li>• Upload genetics and aquaculture presentation on VoiceThread</li> <li>• Submit genetics exercise as Word Doc on Canvas</li> </ul>
Week 5	<p><i>Objectives: Learn about the history of fisheries enhancements; present on release strategies and adaptive management for your case study and submit a draft summary.</i></p> <p>Watch:  Lecture 10: History of enhancement (K.M. Leber)</p>
	<p>Things to do:</p> <ul style="list-style-type: none"> <li>• Provide feedback on other student’s presentation on VoiceThread and/or in chat room</li> <li>• Upload release strategy and ecological impacts presentation on VoiceThread</li> <li>• Submit draft summary of assessment and recommendations as Word Doc on Canvas</li> </ul>
Week 6	<p><i>Objective: Finalize summary of your case study.</i></p>
	<p>Do:  Submit final summary of analyses and recommendations together with PowerPoint files of all your presentation by email to klorenzen@ufl.edu</p>

## Course Schedule Details and Key Readings

### Week 1

Select case study enhancement. Confirm case study selection and understanding of course requirements with instructor. Collate basic information on case study fishery and prepare initial presentation.

*Selection of case study:* You may select any fisheries enhancement, located anywhere in the world, whether proposed, in development, or fully operational. The only requirement is that you should be able to gain good information on this fishery enhancement from published material, professional contacts (e.g. fisheries or hatchery managers, scientists), or your own professional work. Different types of information will be available for different fisheries: for some proposed marine enhancements, there may quantitative assessments of the wild stock but not experimental hatchery or release data. For others, there may be experimental release data but little information on the wild stock or the fishery. It is fine if the information available for your case study fishery is unbalanced in this way (you will develop plausible scenarios and research plans for areas where the information is limited), but DO NOT select a case study for which there is very little information on anything! A Fisheries Enhancement Case Study Information Checklist is provided to help you with information collection.

#### ***Lecture 1: Introduction to fisheries enhancements and the 'Responsible Approach'*** (K. Lorenzen)

Definition and status of fisheries enhancements, typology of enhancement systems: restocking, stock enhancement, etc.; Responsible Approach.

Lorenzen, K. (2014) Understanding and managing enhancements: why fisheries scientists should care. *Journal of Fish Biology* 85: 1807-1829.

Lorenzen, K., Leber, K.M. & Blankenship, H.L. Responsible approach to marine stock enhancement: an update. *Reviews in Fisheries Science* 18: 189-210. (2010)

Paquet, P. J. Flagg, T. Appleby, A. Barr, J. Blankenship, L. Campton, D. Delarm, M. Evelyn, T. Fast, D. Gislason, J. Kline, P. Maynard, D. Mobernd, L. Nandor, G. Seidel, P. & Smith, S. (2011) Hatcheries, Conservation, and Sustainable Fisheries—Achieving Multiple Goals: Results of the Hatchery Scientific Review Group's Columbia River Basin Review. *Fisheries* 36(11): 547-561.

#### ***Lecture 2: Understanding enhancement fisheries systems*** (K. Lorenzen)

Why we need to understand enhancement fisheries systems; what can we learn from case studies?, components of enhancement fisheries system; framework for analysis; application of framework.

Lorenzen, K. (2008) Understanding and managing enhancement fisheries systems. *Reviews in Fisheries Science* 16:10-23.

## Week 2

### ***Lecture 3: Population dynamics and quantitative assessment of stocked fisheries*** (K. Lorenzen)

Fish life histories and population dynamics; a basic stock enhancement model; dynamics of ranching, stock enhancement, restocking, etc.; quantitative assessment; how to get the data: comparative studies, stock assessments, release experiments.

Lorenzen, K. (2005) Population dynamics and potential of fisheries stock enhancement: practical theory for assessment and policy analysis. *Philosophical Transactions of the Royal Society B* 360: 171-189.

Lorenzen, K. (2006) Population management in fisheries enhancement: gaining key information from release experiments through use of a size-dependent mortality model. *Fisheries Research* 80: 19-27.

### ***Tutorial 1: Population dynamics and quantitative assessment*** (K. Lorenzen)

Students use the *EnhanceFish* package to analyze the dynamics of case study fisheries.

Medley, P.A.H. & Lorenzen, K. (2006) *EnhanceFish*: A decision support tool for aquaculture-based fisheries enhancement. Open-source freeware, available from <http://fisheriessolutions.org/projects/global/enhancefish/>. (*EnhanceFish* is a Windows package, but runs on a Mac when you install a Windows emulator such as <https://www.parallels.com/products/desktop/>, available as a free trial version).

### ***Lecture 4: Aquaculture production for fisheries enhancement*** (K. Lorenzen)

Fish culture, domestication and feralization; managing domestication effects; promoting seed quality: environmental enrichment, life skills training, etc.; transport and release.

Lorenzen, K., Beveridge, M.C.M. & Mangel, M. (2012) Cultured fish: integrative biology and management of domestication and interactions with wild fish. *Biological Reviews* 87: 639-660.

Olla, B. L., M. W. Davis and C. H. Ryer. (1998) Understanding how the hatchery environment represses or promotes the development of behavioral survival skills. *Bulletin of Marine Science* 62: 531-550.

## Week 3

### ***Lectures 5 & 6: Genetic resource management for programs of stock enhancement and restocking*** (M.D. Tringali)

Evolution and genetic structure of wild and cultured fish populations; genetic impacts of transfer into aquaculture; alternative goals of management; genetic management for stock enhancement

and conservation; genetic management for culture-based fisheries and ranching; genetic impacts of releases on natural populations; overview of FL genetics policy.

Tringali, M. D., T. M. Bert, F. Cross, J. W. Dodrill, L. M. Gregg, W. G. Halstead, R. A. Krause, K. M. Leber, K. Mesner, W. Porak, D. Roberts, R. Stout and D. Yeager (2007) Genetic Policy for the Release of Finfishes in Florida. Florida Fish and Wildlife Conservation Commission, Florida.

***Lecture 7: Economic and social analysis of enhancements*** (C.M. Adams)

Economic analysis of fisheries enhancements, recreational fisheries, impacts on livelihoods

Whitmarsh, D. (2001) Economic analysis of marine ranching. CEMARE Research Paper 152, 22 pp.

Week 4

***Lectures 8 & 9: Release strategies, empirical evaluation and the use of tagging programs*** (K.M. Leber)

Historical approaches to planning release strategies; release variables: critical uncertainties; experimental assessment of release strategies; empirical generalizations about release success; challenges to implementing responsible release strategies

**Leber, K. M.**, N. P. Brennan and S. M. Arce. (1998) Recruitment patterns of juvenile, cultured Pacific threadfin, *Polydactylus sexfilis* (Polynemidae), released along sandy marine shores in Hawaii. Bulletin of Marine Science 62(2):389-408.

Leber, K. M. and H. L. Blankenship. 2011. How Advances in Tagging Technology Improved Progress in a New Science: Marine Stock Enhancement. American Fisheries Society Symposium 76:1-12.

Week 5

***Lecture 10: History of enhancement*** (K.M. Leber)

History of marine fisheries enhancements and the development of enhancement science.

Leber, K.M. (2013) Marine fisheries enhancement: Coming of age in the new millennium. In: Paul Christou et al. (eds) *Sustainable Food Production*. DOI 10.1007/978-1-4614-5797-8, Springer Science+Business Media, New York.



## **Coursework**

### Initial discussion on course requirements and choice of case study enhancement.

Discuss the course work requirements and your choice of case study enhancement with the instructor, in person or by telephone or Skype. Confirm by email that you have discussed and understood the course requirements, and your choice of case study enhancement.

Grading criteria: Comprehension of coursework requirements, consideration of criteria for selecting a case study enhancement, student is proactive in identifying a case study and seeking clarification of requirements and criteria as appropriate.

### Presentations on case study analyses

Prepare and present analyses on the following aspects of your case study enhancement:

- (1) System overview & governance
- (2) Quantitative assessment
- (3) Genetics & aquaculture
- (4) Release strategy and ecological impacts

Further guidance on the analyses will be given in the lectures and tutorials. Each analysis should be presented in a 10 minute presentation on VoiceThread.

Grading criteria: Presentations provides a good overview of analyses and results. A systematic effort to locate information on the case study enhancement and a rigorous approach to analysis are evident. The presentation is structured and presented clearly. Deadlines: Presentations must be uploaded to VoiceThread by Thursday night in week they are due.

### Review and discussion of presentations

All presentations will be reviewed and discussed by all students and the relevant instructors. Review comments can be made in VoiceThread and/or in the Canvas discussion room.

### Executive summary of assessment and recommendations

Present a succinct written summary of the analyses you have conducted on your case study enhancement during the course labs. Outline your suggestions for the further development or reform of your case study enhancement. The report will draw mostly on the material already presented orally during the course week (4 pages maximum)

Grading criteria: Synthesis provides evidence of competent application of concepts and methods learned during the course to the case study enhancement.

## **Exercises**

Submit written answers to short exercises on:

- (1) EnhanceFish modeling
- (2) Population genetics

## **Participation in Class**

Students are expected to participate actively and constructively in class.

Grading criteria: Students make regular constructive contributions by reviewing and discussing presentations and participating in the synchronous voice discussion group sessions.