



**turning them in late). Late assignments will be penalized by 10% per weekday for the first 5 weekdays—after that point, they will be worth a maximum of 50% of the original value.**

#### V. Student Disability Accommodations

If you are a student who will need accommodations in this class due to a disability or chronic health condition, I will need an accommodation letter from the Student Disability Center (SDC) before they are implemented. Please meet with me during my office hours to give me the letter and/or to further discuss your needs.

If you do not already have these letters, please contact the SDC as soon as possible to initiate the accommodation process. The SDC is located in room 121 of the TILT building. Contact them at 970-491-6385 or visit [www.disabilitycenter.colostate.edu](http://www.disabilitycenter.colostate.edu).<sup>1</sup>

#### VI. Course Goals

The goal of this course is to give students a foundation in fish culture, with an emphasis on system design and assembly, water quality measurement and management, and general culture techniques. Students will be exposed to various culture systems and techniques through term projects on culture system design and operation. By the end of the course, students should have assimilated sufficient knowledge to design a pilot fish culture operation or compete effectively for a position as a Colorado Fish Culture Technician III (entry-level hatchery position with Colorado Parks and Wildlife).

#### VII. Course Schedule – Subject to Frequent (but not random) Modification

Date	Topics (subject to change)	Readings Location
22-Jan	Basic overview of aquaculture	Ch. 1
23-Jan	Burbot research project overview (time TBD)	Wagar 132
24-Jan	Aquaculture Economics - Business plans	Ch. 2; SRAC Publication #456; NRAC – Aquaculture Success
27-Jan	Water Sources	Ch. 2
29-Jan	No class	-
30-Jan	Discussion of lab expectations; aquaculture economics	Ch. 1; Ch. 2 Wagar 132
31-Jan	Moving water in pipes - I	Ch. 2
3-Feb	Moving water in pipes - II	Ch. 2
5-Feb	Moving water with pumps	-
6-Feb	Moving water in pipes - effects of pipe size and configuration; start burbot research project PVC pipe assembly & handling	Ch. 2 FFL
7-Feb	Pipe, pump, and open channel flow calculations	Calculations

<sup>1</sup> Information provided from: <https://disabilitycenter.colostate.edu/info-for-faculty/>

10-Feb		
12-Feb	Moving water in canals, drains and other open channels	TBD
13-Feb	Moving water with pumps - effects of lift height	TBD FFL
14-Feb	Mass Balances Recirculating system & biofiltration calculations	Calculations
17-Feb	Recirculating systems: basic components; biofilters; operation; the ammonia system	Ch. 2; Ch. 3; Ch. 4
19-Feb	Raceway systems: design; components; operation	Ch. 2
20-Feb	Review Session and discussion of assigned readings	Wagar 132
21-Feb	<b>Exam 1 - Covers lectures, readings, lab exercise concepts, papers 1,2</b>	
24-Feb	Ponds: design; components; operation	Ch. 2
26-Feb	<b>No class - Colorado/Wyoming AFS Meeting (Laramie, WY)</b>	
27-Feb		
28-Feb	Alternative culture systems: cages and net pens; invertebrate culture systems	Ch. 2
2-Mar	Management of photosynthesis + primary production; plant nutrients; Pond fertilization; aquatic vegetation control measures	Ch. 3; Ch. 4
4-Mar	The Carbonate system: alkalinity, liming, hardness	Ch. 4
5-Mar	Open channel flow; data collection for burbot project	FFL
6-Mar	Carbonate system - calculations	Ch. 4
9-Mar	Gases - I	Ch. 4
11-Mar	Gases - II	Ch. 4
12-Mar	Culture system design	Wagar 132
13-Mar	Dissolved gas & aerator calculations	Calculations
16-Mar	<b>Spring Break</b>	
18-Mar		
19-Mar		
20-Mar		
23-Mar	Other water quality parameters: light; suspended solids; off-flavors	Ch. 4
25-Mar	Water temperature: thermal requirements; biological responses; thermal shock/tempering; overwintering	Ch. 4
26-Mar	Measuring aerator efficiency Field trip preparation (disinfection/practice)	FFL
27-Mar	CPW Walleye Spawning Operation (0500 - 1400 h)	-
30-Mar	Salinity: biological responses; measurement; smoltification	Ch. 4
1-Apr	Fish Feeds	Ch. 6; Ch. 7
2-Apr	Start "pond" fertilization & temp. tracking; build Artemia hatcheries	FFL
3-Apr	Fish Feeds	Ch. 7
6-Apr	Fish Feeds & Fish Feeding	Ch. 7

8-Apr	Mass balances: production terms; water quality design targets; review of papers 3,4	TBD
9-Apr	Effects of salinity on <i>Artemia</i> hatch rates (overnight); Finish growth study	FFL
10-Apr	Mass balance calculations - water quality etc.	Calculations
13-Apr	<b>Exam 2 - Covers lectures since Exam 1, readings, concepts from lab exercises, papers 3,4</b>	
15-Apr	Growth & growth calculations	Ch. 7
16-Apr	Field Trip to Aquatic Biosystems	Main Campus
17-Apr	Reproductive strategies; differentiating sexes; selective breeding; fecundity measures	Ch. 6; Ch. 7
20-Apr	Sanitation, disease treatment and prevention techniques	Ch. 5
21-Apr	Celebrate Undergraduate Research and Creativity (poster presentation on burbot project?)	-
22-Apr	Aquaculture Bashing - Jesse Trushenski	TBD
23-Apr	Fish transport and handling Grass carp tagging and measurement	FFL
24-Apr	Culture system design example - D. Cammack, Percid culture	TBD
27-Apr	Live hauling: concepts, methods, calculations	Ch. 9, calculations
29-Apr	Fish disease and aquaculture - Dr. John Drennan, CPW	
30-Apr	Public relations & animal welfare in aquaculture	Wagar 132
1-May	Role of aquaculture in conservation biology	Ch. 9, calculations
4-May	Aquatic Nuisance Species and Aquaculture	TBD
6-May	Guest lecture by Ted Smith, manager of CPW's NASRF	TBD
7-May	Culture system presentations	
8-May	Discussion of final set of papers	Papers 5,6
14-May	Final Exam - 4:10 - 6:10 PM Comprehensive, <i>except</i> papers 1 - 4	132 Wagar

### VIII. Homework & Laboratory Description

Students will be given ~ 10 homework and laboratory assignments covering key topics in aquaculture. These assignments will give students an opportunity to practice the various calculations and evaluations used in aquaculture. The assignments will generally be due 1 week after they have been given.

The majority of the laboratory exercises in FW402 will be conducted at the Foothills Fishery Laboratory, located on the CSU Foothills Campus. These exercises are designed to complement the lectures on aquaculture system design and water quality management. Students will also work together to design and conduct an experiment on the culture of some fish or mollusk of interest to aquaculture and/or fisheries management in Colorado (e.g. Common Shiner, *Luxilus cornutus*).

**IX. Term Project – Pilot Species Conservation Culture System Design**

Students will work in pairs to prepare a written report and 20 to 25-minute lecture on the biology, pilot culture system, and culture techniques used to raise a fish or aquatic invertebrate species of conservation concern. These presentations and reports will be delivered to the class. You will receive more information on the projects early in the semester. Note: If you have previously written a report on fish culture for another course, you *will not* be allowed to re-use that report for this course.

**X. Prerequisites**

FW300 (Ichthyology)

**XI. Course Home Page**

A number of course files (readings, data sets, laboratory handouts) will be posted on the course Canvas website – you will need to login here: <http://help.canvas.colostate.edu/login.aspx>.

**XII. Academic Integrity<sup>2</sup>**

We take academic integrity seriously. At minimum, academic integrity means that no one will use another's work as their own. The CSU writing center defines plagiarism this way:

Plagiarism is the unauthorized or unacknowledged use of another person's academic or scholarly work. Done on purpose, it is cheating. Done accidentally, it is no less serious. Regardless of how it occurs, plagiarism is a theft of intellectual property and a violation of an ironclad rule demanding "credit be given where credit is due."

**Source:** (Writing Guides: Understanding Plagiarism.

<http://writing.colostate.edu/guides/researchsources/understandingplagiarism/plagiarismoverview.cfm>.

If you plagiarize in your work you could lose credit for the plagiarized work, fail the assignment, or fail the course. Plagiarism could result in expulsion from the university. Each instance of plagiarism, classroom cheating, and other types of academic dishonesty will be addressed according to the principles published in the CSU General Catalog (see page seven, column two:

<http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf>).

Of course, academic integrity means more than just avoiding plagiarism. It also involves doing your own reading and studying. It includes regular class attendance, careful consideration of all class materials, and engagement with the class and your fellow students. Academic integrity lies at the core of our common goal: to create an intellectually honest and rigorous community. Because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, we will ask to you sign the CSU Honor Pledge as part of completing the species culture project. **While you will not**

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<sup>2</sup> Dr. Greg Dickinson, CSU, developed the Academic Integrity statement used here and gives permission for other CSU instructors to use parts or all of this statement in their own syllabi.

**be required to sign the honor pledge, we will ask each of you to write and sign the following statement on your term paper project and your take-home exams.**

***"I have not given, received, or used any unauthorized assistance."***

### In-Class Behavior

Dr. Myrick, the guest lecturers, and his graduate students work hard to provide you with a high-quality educational experience. In-class disturbances, such as ringing cell phones, detract from that experience and we consider them highly disruptive and disrespectful. Therefore, you are asked to **turn off** your cell phone before the start of any lecture or laboratory session. If your phone does ring during class, you will be asked to leave the room for the remainder of that class period. Any other in-class behavior that is deemed unacceptable or distracting to your fellow students will also result in your being asked to leave the class for the remainder of that period.

### **XIII. Assigned Readings**

Students will be expected to complete a set of readings over the course of the semester. Readings are considered testable material for the indicated exam. All readings are available through the CSU Library.

<b>References</b>	<b>Paper Discussion</b>
<b>Students are responsible for securing their own copy of the readings. They are all available through the CSU Library.</b>	
Wocher, H., A. Harsanyi, and F. J. Schwarz. 2011. Husbandry conditions in burbot ( <i>Lota lota</i> L.): Impact of shelter availability and stocking density on growth and behaviour. <i>Aquaculture</i> 315(3-4):340-347.	#1
Sun, G., M. Li, J. Wang, and Y. Liu. 2016. Effects of flow rate on growth performance and welfare of juvenile turbot ( <i>Scophthalmus maximus</i> L.) in recirculating aquaculture systems. <i>Aquaculture Research</i> 47(4):1341-1352.	#1
Blanco Gonzalez, E., and F. de Boer. 2017. The development of the Norwegian wrasse fishery and the use of wrasses as cleaner fish in the salmon aquaculture industry. <i>Fisheries Science</i> 83(5):661-670.	#2
Imsland, A. K., P. Reynolds, T. A. Hangstad, D. B. J. Ólöf, T. Noble, M. Wilson, J. A. Mackie, T. A. Elvegård, T. C. Urskog, and B. Mikalsen. 2018. Feeding behaviour and growth of lumpfish ( <i>Cyclopterus lumpus</i> L.) fed with feed blocks. <i>Aquaculture Research</i> 49(5):2006-2012.	#2
Velasco-Blanco, G., A. D. Re, F. Díaz, L. Ibarra-Castro, P. Maria Isabel Abdo-de la, L. E. Rodríguez-Ibarra, and C. Rosas. 2019. Thermal preference, tolerance, and thermal aerobic scope in clownfish <i>Amphiprion ocellaris</i> (Cuvier, 1830) predict its aquaculture potential across tropical regions. <i>International Aquatic Research</i> 11(2):187-197.	#3
Burg, G. C., J. Johnson, S. Spataro, O. K. Amelia, N. Urbina, G. Puentedura, M. Heuton, S. Harris, S. D. Hillyard, and B. Frank van. 2019. Care and propagation of captive pupfish from the genus <i>Cyprinodon</i> : insight into conservation. <i>Environmental Biology of Fishes</i> 102(8):1015-1024.	#3