

INSTRUCTOR INTRODUCTION AND COURSE ORIENTATION

Introduction to Aquaculture

Course Outline

Welcome to Aquaculture! This continuing education course introduces the basic principles of fish and shellfish production. Topics during the first eight weeks of the course include site selection; water quality; nutrition and feeding; management of diseases and parasites; genetics and breeding; and harvest, transport and aquaculture economics. Upon completion, students should be able to describe the natural conditions and management practices necessary to produce a crop of fish or shellfish. The last eight weeks of the course covers the specific culture techniques used in the production of a variety of aquatic species, including channel catfish, African catfish, tilapia, hybrid striped bass, rainbow trout, yellow perch, freshwater and marine shrimp, clams, and oysters, and others. Upon completion, students should be able to describe the various culture methods and prepare a production plan for each of the species covered.

Week 1: Introduction, History, and Culture Systems I - This week we will introduce the course, go over a brief history of aquaculture, and begin a discussion of ponds and other culture systems used in various types of fish and shellfish farming.

Week 2: Culture Systems II - This week we will discuss single pass or flow-through systems used in aquaculture, followed by a look at the emerging use of RAS (recirculating aquaculture systems) for the commercial production of aquatic organisms.

Week 3: Water Quality I - This week we will begin our discussion of water quality in aquaculture. There is also a link to a site that introduces basic chemistry, for those of you that have no chemistry background.

Week 4: Water Quality II - This week we will complete our discussion of water quality in aquaculture. The second lesson this week deals with the unique water quality requirements of crustaceans and mollusks, and with strategies for selecting sites for bottom culture of mollusks in natural waters.

Week 5: Nutrition and Feeding - This week's lessons deal with the nutrition and feeding of various species of cultured fish. There is also information on fish feed ingredients and the formulation of feeds for commercial fish production.

Week 6: Diseases - This week's lessons deal with the causes and possible treatments of various diseases of fish and shellfish. Many of the most common diseases of aquatic organisms are described and discussed.

Week 7: Predation & Cannibalism; Genetics & Breeding - The first lesson this week covers the problems of wild predators that eat cultured fish and shellfish, and cannibalism among some species of cultured aquatic organisms. The second lesson is a discussion of the fascinating field of fish genetics, fish breeding and biotechnology.

Week 8: Harvest & Haul; Economics & Business Planning - The first lesson this week deals with methods used for harvesting ponds, cages, tanks and raceways, and with the transport of live fish between facilities and to processing plants and other markets. The second lesson covers aquaculture economics and business planning. This completes our coverage of general topics in our introduction to aquaculture. The next eight weeks will be devoted to specific culture techniques for species of interest to the class.

Week 9: Channel Catfish - The second half of this course will cover specific culture techniques used for a variety of species. It is appropriate that we begin with the culture techniques used for the species that forms the largest aquaculture industry in the US: Channel Catfish. There has been more than 70 years of government and university research and practical experience by fish farmers that has resulted in the great mass of knowledge and well developed technology in use in the production of channel catfish. With appropriate modification, many of these same techniques may be applied to the production of virtually any warmwater species of fish in ponds.

Week 10: Rainbow Trout - Another widely cultured fish that has been produced on commercial farms for a very long time (since the 1800s in some areas) is rainbow trout. Rainbow trout is a coldwater species that is most often grown in flow-through raceways. The techniques for rainbow trout culture in raceways are very well established, and as such it is an excellent example of this type of fish production. This is why I have chosen it as the second species for our discussion. Again, if you understand the methods for trout production in raceways, these methods may be applied with appropriate modifications to the culture of other species.

Week 11: Tilapia and Hybrid Striped Bass - This week we will cover tilapia and hybrid striped bass. These species are interesting in that they may be cultured in a variety of different ways, depending on local circumstances. Tilapia is actually a group of tropical species, which may be grown in ponds year-round in tropical regions. In temperate regions such as in most of the US, tilapia are produced primarily in RAS systems. There are a dozen or so RAS tilapia farms in North Carolina, and all are profitable. Tilapia is very tolerant of poor water quality and frequent handling, does not stress easily, and is relatively easy to produce. The largest hybrid striped bass farm in the US utilizes raceways and is located in southern California. In North Carolina, hybrid striped bass are grown in ponds. HSB is a "coolwater" species, is susceptible to stress in poor water quality conditions, cannot be handled in warm weather, and requires much skill to produce. HSB farms are generally highly profitable.

Week 12: African Catfish and Yellow Perch - This week we will cover African Catfish (also known as North African Catfish, *Clarius gariepinus*), and Yellow Perch. The African Catfish has received much attention in recent years, and is now widely cultured in Africa, Europe, and South America. It is a very hardy fish, an air-breather, and an ideal culture fish in a variety of different culture systems in many parts of the world. I do not cover African Catfish in my curriculum courses, and do not have course notes for this species. I have, however, included two excellent publications for your reading. Yellow Perch is cultured in the Great Lakes region, and also in North Carolina, where it is native to coastal rivers. The culture of yellow perch has had varying degrees of success, but it is a species with much market potential in the upper midwestern US, and particularly in the Great Lakes states. This week's self-test is short, and only covers the lesson on Yellow Perch.

Week 13: Oysters and Clams - This week we will cover the culture of oysters and clams. While several species of oysters are covered, the lesson on clams deals with the hard clam *Mercenaria mercenaria*, which is widely cultured along the Atlantic and Gulf coasts of the US. The two lessons this week cover the grow-out phase of production, with additional posts on hatchery production. The Self-Test includes questions taken from the two weekly lessons, as well as the sections on oyster and clam hatcheries. I have also included some excellent articles for further reading, for those who have a particular interest in this subject!

Week 14: Blue Mussels; Algae Culture for Shellfish Production - This week's lessons cover the culture of blue mussels, and include a huge amount of information on algae culture. The principle lesson this week is blue mussel culture, and the self-test this week is quite short, with only 8 questions on the culture of mussels. A couple of people in the class requested information on algae culture, and since this is not my area of expertise, I asked Michelle Sabaoun if I could use selected materials from the algae culture course she teaches here at BCC. I left out the portions on algae taxonomy, as well as the portions of the course that are not pertinent to aquaculture, but this still leaves a lot of material! Feel free to spend as much or as little time on algae culture as you wish. The material may also be downloaded and saved for future reading. Algae culture is very important in shellfish hatcheries where it is used to feed the seed organisms, and diatom culture is used in marine shrimp hatcheries to feed larval shrimp. The culture of macroalgae is itself a large aquaculture industry in many parts of the world. Algae are also being heavily researched as a source of biofuels. The information here covers sterile technique, the isolation and small-scale culture of algae, as well as large-scale production in ponds.

Week 15: Marine Shrimp - This week we will discuss marine shrimp culture, with an emphasis on *Litopenaeus vannamei*, the Pacific white shrimp, which is the most important culture species throughout the world. Marine shrimp culture is an enormous industry that now exceeds \$10 billion in value, providing the majority of shrimp consumed in the US, Europe, and Japan. Most of the shrimp we eat in local restaurants in NC is farm-raised, and most comes from Latin America (a significant portion is

produced in Ecuador, which was a pioneer of shrimp farming in the 1970s). The discussion wiki this week centers around environmental concerns and solutions in shrimp farming. The self-test consists of 16 questions on the Week 15 Lesson, with additional study materials for those particularly interested in marine shrimp farming (the additional study materials are not included in the self-test).

Week 16: Freshwater Prawns - Our final lessons this week will cover freshwater prawns, *Macrobrachium rosenbergii*. This is a highly lucrative culture species in North Carolina (and many other places as well), and is of particular interest to small-scale farmers because of the high prices and excellent profitability that may be realized with just a few acres of production. In the discussion wiki for this week, I am asking for your input on the course, as well as encouraging you to ask any questions you may have about this week's lessons as well as any final questions about any of the topics covered in the course. Thank you for your participation and I hope you have enjoyed it as much as I have!

1. Instructor information

Name: *Dr. Doug Holland, Director, Center for Aquaculture and Biotechnology*

Contact information – phone, email, office location:

Phone: (910)755-7432 email: hollandd@brunswickcc.edu

Office: H105 (room 105 in the Aquaculture Building)

2. Communication information

How to ask "personal" questions: *The best way to contact me is by email, but also by phone.*

Turnaround time for responses:

I check email and phone messages several times each day Monday-Thursday.

I also check email messages from home at night and on weekends.

How to request an appointment: *By phone or email.*

If an email is sent, what should the subject line contain? *Question from: (your name).*

3. Office hours

Monday 3-5pm, Tuesday 12noon-2pm, Wednesday 10am-12noon

4. What to do if there is:

An emergency: *Contact me by email; that is what I check most often!*

A problem with an assignment or test: *Post on “Course Questions” or in the wiki.*

5. General overview of how the course will operate:

This continuing education course is designed to be fully online, and take about 6 hours each week. There are two or more lessons each week, posted under “Study Materials”, composed of written notes with embedded web links that will direct you to sites with further information on subjects of particular interest. You may study these notes and web links at your leisure, as the course is self-paced. Approximate time for each lesson is 2.5 hours (assuming you also visit several web links), for a total of 5 hours of study time each week.

Once you have read over the lessons each week, you may click on the weekly wiki discussion post. The instructor will begin the discussion with a question related to the week’s subject matter. After that, the discussion may go anywhere the class wants to take it. The wiki is also an opportunity to ask questions of the instructor and other class members about the weekly lessons. Approximate time for the wiki discussions is 0.5 hour each week (although you may spend more time discussing the material and asking questions if you wish).

When you feel confident that you understand the subject matter for the week, try taking the self-test. These tests will help you determine how well you have learned the material posted each week. You may take as long as you like on the test, and you may take the test as many times as you wish. Approximate time for completion of each weekly test is 0.5 hour.

This is a non-credit course. However, Brunswick Community College will issue a Certificate of Successful Completion to each student who completes at least 60% of the course.

Completion of 60% of the course is defined as either:

A. Participation in 60% of the weekly wiki discussions (at least 10 out of 16 weeks) and at least 1 attempt on 10 of the weekly self-tests (regardless of test score).

-or-

B. A cumulative score of 60% on weekly self-tests (960 out of 1600 possible points). This may be achieved in several ways. For example, completion of all 16 weekly self-tests with an average score of 60%, or completion of 10 weekly self-tests with an average score of 96%.

To receive the certificate, you only have to complete either A or B, not both.

After successful completion of this course, students may petition for proficiency credit for two curriculum courses offered in our Certificate, 1-year Diploma, and 2-year Degree programs in Aquaculture Technology at BCC. These courses are AQU 111 – Aquaculture I, and AQU 112 – Aquaculture II. To receive credit, you must be enrolled at BCC, take a 200-question Proficiency Examination for each course (the test questions are the same questions used in this course) and attain a score of 80% on that test to receive credit as a “CR” (credit for record). Credit by Proficiency usually does not transfer, but will count towards up to 25% of a Certificate, Diploma or 2-year Degree in Aquaculture at BCC. There is a \$25 exam fee for each course.

Always be sure to check the "Latest News" (upper right-hand column) whenever you log on for any important announcements. News announcements will also be sent to your e-mail address.

6. How to submit assignments

Weekly wiki discussions are posted and submitted under "Items to Submit"

Self-Tests are also posted, taken, and submitted under "Items to Submit"

7. Any special requirements -

Microsoft Word or a comparable word processing program is required to read the course notes (lessons) under "Study Materials".

Additional posts may require Adobe Acrobat Reader.

8. What's next?

Go to Week 1, read the Study Materials, visit any of the embedded web links on subjects of particular interest, and then begin your first week's assignments under “Items to Submit”. The weekly self-tests are based on the course notes given in the lessons, and not on the web links or wiki discussions.