

# SANTA CRUZ COUNTY REGIONAL OCCUPATIONAL PROGRAM

## AQUACULTURE TWO

CBEDS Title: ROP will supply

CBEDS Number: ROP will supply

Career Path: Agricultural & Natural Resources

**Course Description:** A hands-on applied math and science application of aquaculture. Students will apply math and science to a project-based curriculum with real world applications. The course includes aquatic careers, an overview of the different types of aquaculture, water-quality, monitoring, aquatic ecology, equipment, organism life cycles and culturing techniques, feeds and nutrition and business practice. Students will culture various aquatic organisms in the laboratory and participate in field trips to local aquaculture facilities. Business partners will mentor and offer job shadowing and internship opportunities to the students. Students will volunteer 20 hours of service learning hours for the year.

<u>Job Title</u>	<u>O*NET-SOC codes</u>
Farmers and Ranchers	11-9012.00
Fish Hatchery Managers	11-9011.03
Farmworkers, Farm and Ranch Animals	45-2093.00
Agricultural Crop Farm Managers	11-9011.02
Biologists	19-1020-01
Agricultural Technicians	19-4011.01
Forest and Conservation Technicians	19-4093.00
Landscaping and Groundskeeping Workers	37-3011.00
First-Line Supervisors and Manager/Supervisors- Agricultural Crop Workers	45-1011.01
First-Line Supervisors and Manager/Supervisors- Horticultural Workers	45-1011.04
Animal Breeders	45-2021.00
Agricultural Equipment Operators	45-2091.00
Nursery Workers	45-2092.01
General Farmworkers	45-2092.02
Fishers and Related Fishing Workers	45-3011.00
Forest and Conservation Workers	45-4011.00

Prerequisites: Aquaculture One

## COURSE OUTLINE

Upon successful completion of this course, students will be able to demonstrate the following skills necessary for employment or further education and training:

	<u>Hours</u> Classroom	<u>Hours</u> Intern
<p>I. Career Preparation Standards (Note: additional hours for Career Preparation Standards are integrated into instruction in content area standards).</p> <p>A. Understand how personal skill development--including positive attitude, honesty, self-confidence, time management, and other positive traits--affect employability.</p> <ol style="list-style-type: none"> <li>1. Demonstrate an understanding of classroom policies and procedures.</li> <li>2. Define business ethics and explain the importance of ethical standards in the business environment.</li> <li>3. Discuss the laws that apply to sexual harassment and discuss tactics for handling harassment situations.</li> <li>4. Discuss importance of personal skills in a business environment i.e. positive attitude, self-confidence, honesty, perseverance, self-discipline.</li> <li>5. Define personal hygiene and identify acceptable business attire for the industry.</li> <li>6. Prioritize tasks and meet deadlines.</li> </ol> <p>B. Understand principles of effective interpersonal skills, conflict resolution and negotiation.</p> <ol style="list-style-type: none"> <li>1. Discuss and demonstrate the dynamics of conflict resolution and negotiation and their importance within the business environment.</li> <li>2. Work cooperatively, share responsibilities, accept supervision and assume leadership roles.</li> <li>3. Demonstrate cooperative working relationships and prepare etiquette across gender and cultural groups.</li> </ol> <p>C. Understand the importance of good academic skills, critical thinking and problem-solving skills in the workplace.</p> <ol style="list-style-type: none"> <li>1. Recognize the importance of good reading, writing, math, and keyboarding skills in the business environment and implement a plan for self-improvement as needed.</li> <li>2. Apply estimation, measurement and calculation</li> </ol>	<p>20</p>	

- skills to business applications, including whole number math, decimals and fractions, counting and monetary function and use of tables as appropriate to industry.
3. Read, write and give directions.
  4. Exhibit critical and creative thinking skills and logical reasoning skills.
  5. Recognize problem situations; identify, locate and organize needed information or data; and propose, evaluate and select from alternative solutions.
- D. Understand principles of effective communication.
1. Read and implement written instructions, technical manuals, written communication and reference books.
  2. Present a positive image through verbal and nonverbal communication through use of appropriate methods.
  3. Demonstrate proper etiquette in business communications, including an awareness of requisites for international communications (i.e. customs, time zones)
  4. Demonstrate writing/editing skills i.e. write, proofread, and edit business correspondence, use correct grammar, punctuation, capitalization, vocabulary and spelling and select appropriate forms of technology for communication.
- E. Understand occupational safety issues, including avoidance of physical hazards
1. Discuss and implement good safety practices, including avoidance and reporting of physical hazards in the work environment, safe operation of equipment and proper handling of hazardous material.
  2. Apply sound ergonomic principles in organizing one's workspace.
- F. Understand career paths and strategies for obtaining employment
1. Explore career opportunities and projected trends, investigate required education, training and experience, and develop an individual education plan.
  2. Identify steps for setting goals and writing personal goals and objectives.
  3. Examine aptitudes related to career options; relate personal characteristics and interests to educational and occupational opportunities.
  4. Develop job acquisition documents, including job

- application, resume, appropriate cover and follow-up correspondence and portfolio.
- 5. Identify and demonstrate effective interviewing techniques.
- G. Understand and adapt to changing technology.
  - 1. Identify and demonstrate use of computer hardware and peripherals.
  - 2. Identify and explain use of computer software.
  - 3. Identify and use operating systems.
  - 4. Input and retrieve information.
  - 5. Understand the importance of lifelong learning in adapting to changing technology.

## II. Aquaculture Two

### A. Aquaculture Basics and History

#### Student Outcomes:

1. Explain the development of aquaculture as a part of agriculture.
2. Name three civilizations practicing aquaculture more than 200 years ago
3. Define aquaculture
4. Compare traditional farming to aquaculture
5. Discuss why aquaculture evolved from fishing practices
6. Discuss how the catfish industry developed and why Mississippi leads in catfish production
7. Explain why Idaho leads in trout production
8. List five main activities that are a part of aquaculture but often become a separate industry
9. Identify significant scientific events of people that contributed to the development of aquaculture
10. Explain the National Sea Grant Program and its role in scientific research
11. Discuss the role of science and technology the development of aquaculture
12. Indicate the role of scientific research in the future of aquaculture

### B. Aquatic Plants and Animals

#### Student outcomes:

1. Name the major aquatic species in the United States
2. Name five aquatic animals that hold potential for aquaculture in the US.
3. Explain why aquatic crops may be more productive than terrestrial crops
4. Briefly describe the general water and feeding characteristics of five aquatic animals
5. List three aquatic plants that potentially could be cultured in the US

6. List three other uses for aquatic plants besides human food
7. Give examples of aquatic animals and plants that could be used in polyculture
8. Recognize the scientific names for some common aquatic species
9. List and describe important biological characteristics in selecting a species for aquaculture
10. Explain how aquatic species save energy when compared to terrestrial species
11. List and describe the major characteristics of aquatic plants and animals
12. Discuss the morphology, anatomy and physiology of common aquatic animals
13. Name and describe the nine body systems of aquatic animals
14. Identify and describe the internal and external anatomy of a fish
15. Identify and describe the basic structure and internal anatomy of crustaceans
16. Identify and describe the basic structure and internal anatomy of an oyster or mussel
17. Describe the basic morphology of aquatic plants

### C. Marketing Aquaculture

Student outcomes:

1. Define marketing
2. Describe the process of marketing aquaculture
3. Explain the elements in developing a marketing strategy
4. Explain the importance of developing a marketing plan
5. Identify possible market outlets for aquaculture products
6. Select an appropriate market
7. Explain costs in marketing
8. Describe the process of market promotion in aquaculture
9. Identify terms related to marketing with their correct definitions
10. Discuss quality control
11. Describe some scientific-skill required to maintain the quality fish and fish products
12. Recognize that development of a marketing plan and strategy requires research
13. Describe processing
14. Describe the grading process
15. List factors to consider when exploring marketing alternatives
16. Identify food fish processing cuts and forms with their correct descriptions

#### D. Aquatic Management Practices

Student outcomes:

1. Describe the purpose and functions of a hatchery
2. Describe the spawning facilities used in aquaculture
3. Define harvesting
4. Describe harvesting methods
5. Define terms related to commercial catfish production with their definitions
6. Arrange in order the phases of fingerling production
7. Describe stocking rates for various stages of production and various species
8. List guidelines for obtaining fingerlings for food-fish production
9. Describe trout culture
10. Identify the types of trout farming enterprises
11. List the phases of trout production
12. Explain broodfish management
13. Discuss egg management after fertilization
14. Describe fry and fingerling management
15. List general management guidelines for different species
16. Define terms associated with commercial baitfish production
17. Describe the baitfish industry
18. Distinguish between descriptions and uses of common and Chinese carps
19. Describe hobby fish production and management
20. Explain the methods of pond preparation and fertilization for different species
21. List control techniques for predators
22. List guidelines for transporting fish to long-distance markets
23. Define terms associated with commercial crayfish production
24. Describe the commercial culture of tilapia
25. List methods of managing tilapia to control overpopulation
26. Discuss common production concerns for different species
27. Describe different production systems used by various species
28. Define terms related to commercial trout production
29. Define terms related to harvesting and hauling
30. Compare total and partial harvest
31. Describe ways seeds are produced for different species
32. Explain how sex is determined in fish
33. Discuss methods of controlling reproduction in fish

34. Describe procedures in reproducing aquatic animals
35. Describe the sexual reproduction processes of aquatic animals
36. List salmonids that could be or are cultured
37. Describe the reproduction and life cycle of crayfish
38. Describe the reproduction and life cycle of a shrimp
39. Distinguish between red swamp and white river crayfish
40. Describe the commercial production of hybrid striped bass
41. Identify popular baitfish species
42. Describe aquatic species and their current culture or potential for culture
43. Demonstrate a familiarity with the scientific names of different aquatic animals
44. Describe breeding systems and their purposes

#### E. Fundamentals of Nutrition in Aquaculture

Student outcomes:

1. Find the protein, energy, vitamin, and mineral requirements for fish
2. Understand the role of nonnutritive factors in feed
3. Know what toxic substances to watch for in fish feed
4. Identify methods for preparing and feeding fish
5. Identify potential ingredients for fish diets
6. List the information required by a least-cost ration program
7. Explain the importance of winter feeding catfish
8. Explain different feeding practices for different species
9. Calculate the amount of feed required
10. Calculate the feed conversion ratio (FCR)
11. Identify the parts of the digestive system
12. Explain the role of the digestive system in absorption
13. Explain how anatomy and behavior affect feeding
14. List factors that influence energy requirements
15. List three sources of energy
16. Identify factors that affect the digestibility of fat
17. Explain the role of essential fatty acids and essential amino acids
18. Name ten essential amino acids
19. Name two essential fatty acids
20. List the fat-soluble and water-soluble vitamins
21. Describe ten effects of vitamin and the microminerals
22. List ten functions of minerals

#### F. Health of Aquatic Animals

Student outcomes:

1. Outline fish health management

2. List behavioral signs of sick fish
3. List common physical signs of sick fish
4. List common stressors of fish
5. Outline general management measures for preventing disease outbreaks
6. List and compare treatment methods
7. Complete a list of general guidelines for treatment of fish diseases
8. Calculate treatments for fish ponds
9. Define terms associated with disease conditions
10. Discuss disease resistance
11. Define terms associated with severity of disease or condition
12. Discuss the role of stress in fish diseases
13. Discuss common diseases caused by pathogenic viruses
14. Discuss common diseases caused by pathogenic bacteria
15. Describe a fungal infection
16. Name and describe a common pathogenic protozoan parasite
17. Name and describe a common pathogenic crustacean parasite
18. Describe a grub or fluke infection
19. Name and describe a common pathogenic worm parasite
20. List noninfectious diseases and give examples
21. Describe an infection of lice

## G. Water Requirements for Aquaculture

### Student outcomes:

1. Explain why water is important in aquaculture
2. Explain the quality features of water for aquaculture
3. Define terms related to water quality management with their definitions
4. Calculate
5. Water needs and filling time
6. List causes of dissolved oxygen loss
7. List signs of dissolved oxygen efficiency
8. Select facts about the prevention of oxygen depletion
9. List methods of correcting dissolved oxygen deficiency
10. Know what causes turbidity
11. List the purposes of liming
12. Discuss aquatic plant control methods with their descriptions
13. List ways to dispose of wastewater
14. Describe the properties of water
15. List cations and anions found in water
16. Describe why and how aquatic solutions change
17. Explain how changes in water affect aquatic life

18. Match compounds and elements with their chemical formulas and symbols
19. Discuss the importance of oxygen in water quality management
20. Discuss the role of temperature in oxygen management
21. List chemicals, compounds and elements that are detrimental to water quality
22. Understand the importance of nitrogen compounds in water quality management
23. Complete statements about pH and water quality
24. Select from a list methods of managing the pH cycle
25. Select general guidelines for water chemistry management

#### H. Aquatic Structures and Equipment

Student outcomes:

1. Distinguish between four types of ponds
2. Identify factors in pond site selection
3. Explain important pond construction requirements
4. Define tank and raceway culture
5. List advantages and disadvantages of tank and raceway culture
6. Define cage culture
7. List advantages and disadvantages of cage culture
8. Describe cage design requirements
9. Identify site-specific factors that determine costs
10. List factors to consider when planning pond size
11. Identify layout and design considerations
12. List advantages of small versus large ponds
13. Identify four types of aerators
14. Describe the seines used on ponds
15. Describe a live-car or sock
16. Identify the need for boats, tractors, trucks, and pumps
17. Identify species for pond, cage, raceway, tank or silo culture
18. List steps in determining a site's water quality
19. Determine whether soil is suitable for pond construction
20. Describe the biological concerns in a recirculating or closed system
21. Compare some of the biological concerns with cages and closed systems

#### I. Aquaculture Business

Student outcomes:

1. Define terms related to aquacultural business management
2. List reasons for keeping records
3. Distinguish between basic kinds of records
4. List guidelines for building and maintaining a good credit standing

5. List factors that a lender looks for in a borrower
6. List factors that a borrower looks for in a lender
7. Identify indicators of good loan repayment ability
8. List sources of credit for aquacultural enterprises
9. List the essential components of all budgets
10. Select budgeting principles from a list
11. Define related management terms
12. Describe functions in the management process
13. Identify management considerations in planning an aquabusiness
14. Explain important skills of managers
15. Describe the importance of records and reports
16. Explain important human relations skills

#### J. Federal, State and International Agencies and Regulations

Student outcomes:

1. List six agencies of the U.S. Department of Agriculture involved in aquaculture
2. Name six agencies concerned with the production of food
3. Identify acronyms used frequently by agencies
4. Name the service that provides diagnostic assistance to aquaculture producers
5. Name two sources of operation capital or star-up capital for aquaculture businesses
6. Describe the role of the Soil Conservation Service in planning an aquaculture facility
7. Indicate the government act that gives the Army Corps of Engineers authority
8. Describe the role of the National Sea Grant College Program
9. Describe the role of the FDA in aquaculture
10. Describe the role of the U.S. Fish and Wildlife Service in aquaculture
11. Explain the role of the EPA in aquaculture
12. List three programs of the Tennessee Valley Authority Centers
13. Cite two international laws that preceded the Laws of the Sea
14. List four individual responsibilities when starting or changing an aquaculture operation
15. Identify agencies that support scientific research in aquaculture
16. Provide examples of research conducted by government agencies
17. Give the location of the aquaculture research programs
18. Name four programs and agencies that provide research information and data to aquaculture
19. Name five environmental issues addressed by the EPA

## K. Career Opportunities in Aquaculture

Student outcomes:

1. List the basic skills and knowledge needed for successful employment and job advancement
2. Describe the thinking skills needed for the workplace of today
3. Identify the traits of an entrepreneur
4. List six occupational areas of aquaculture
5. Describe the general duties of the occupations in six areas of aquaculture
6. Describe the education and experience needed to enter six areas of aquaculture
7. List six general competencies needed in the workplace
8. Describe five ways to identify potential jobs
9. List eight guidelines for choosing a job
10. List ten guidelines for filling out an application form
11. Describe a letter of inquiry or application
12. List the elements of a resume or data sheet
13. Describe ten reasons an interview may fail
14. Identify the careers that require a science background
15. Discuss what research studies indicate about basic skills and thinking skills for the workplace

Maximum hours of instruction: Classroom\_\_\_\_\_

Internship \_\_\_\_\_

**Note:** Internship or work based learning hours will vary in number and area of concentration within the scope of the course outline, depending upon community training site, interest and skill level of each student.

**Instructional Strategies:** Lecture, simulations, guest speakers, field trips, role play, demonstration, lab, applied practice.

**Instructional Materials:** Aquaculture Science, Rick Parker, Delmar Publishers 1995,  
Aquaculture Science Lab Manual, Rick Parker, Rosemary Vaughn, Terry Patterson,  
BSCS Biology An Ecological Approach Kendall/Hunt Publishing Company 1998  
Calculus Concepts and Applications Steve Rasmussen 1998

**Articulation:**

**UC A-G:** This class is approved for \_\_\_\_\_ credit at \_\_\_\_\_ High School/s.

**Academic Credit:** SCIENCE

Industry/licensing requirement met:

Certificates: Course completion certificate attached. Competencies should match major sections of the course outline.

Revised: {06/11/04}