

## Lesson C3–1

---

# Exploring the Aquaculture Industry

---

**Unit C.** Animal Wildlife Management

**Problem Area 3.** Fish Management

**Lesson 1.** Exploring the Aquaculture Industry

### **New Mexico Content Standard:**

**Pathway Strand:** Natural Resources and Environmental Systems

**Standard:** III: Apply scientific principles to natural resource management activities.

**Benchmark:** III-B: Examine biological and physical characteristics to identify and classify natural resources.

**Performance Standard:** 4. Identify fish species.

**Student Learning Objectives.** Instruction in this lesson should result in students achieving the following objectives:

1. Discuss terms used for aquaculture and fish anatomy.
2. Identify major species used in aquaculture.
3. List management and nutrient requirements of aquaculture.
4. Describe freshwater and saltwater aquaculture production systems.
5. Explain harvesting and marketing of aquaculture products.

**List of Resources.** The following resources may be useful in teaching this lesson:

Cooper, Elmer L., Burton, DeVere L., *Agriscience Fundamentals and Applications*. Albany, New York: Delmar. 2002 (Textbook Unit 12)

Ensminger, M. E. *Animal Science*. Danville, Illinois: Interstate Publishers, Inc. 1991

**Recommended Resources.** One of the following resources should be selected to accompany the lesson:

Lee, Jasper S. *Introduction to Livestock and Companion Animals 2nd Edition*. Danville, Illinois: Interstate Publishers, Inc. 2000 (Textbook and Activity Manual Chapter 12)

**Other Resources.** The following resources will be useful to students and teachers:

Internet keywords: aquaculture, hatchery, aqua crop, spawning, and fish production.

## List of Equipment, Tools, Supplies, and Facilities

Writing surface  
Overhead projector  
Transparencies from attached masters  
Copies of student lab sheet

**Terms.** The following terms are presented in this lesson (shown in bold italics):

Alligators  
Aqua crop  
Aquaculture  
Bluegill  
Fish  
Freshwater  
Fry  
Hatchery  
Lobsters  
Prawn  
Production cycle  
Raceways  
Saltwater  
Shrimp  
Spring water  
Surface runoff  
Tilapia

Water facility  
Water quality  
Well water

**Interest Approach.** Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

*Take students on a field trip to a hatchery or have a guest speaker come into the classroom to discuss working in aquaculture. Have student write down five questions they could ask at the hatchery before they go. The same may be done with the guest speaker.*

## Summary of Content and Teaching Strategies

**Objective 1:** Discuss terms used for aquaculture and fish anatomy.

**Anticipated Problem:** What are terms used in aquaculture?

- I. In order to discuss aquaculture, some important terms must be known.
  - A. **Aquaculture** is the production of aquatic vegetation and animals. An **aqua crop** refers to commercially produced water species.
  - B. There are two types of water. **Freshwater** is water that contains little or no salt. **Saltwater** is water containing over 16.5 parts per thousand of salt.
  - C. **Fish** are animals that have gills instead of lungs and are vertebrates—they have backbones. Other creatures used in aquaculture include crustaceans and mollusks.
  - D. A **hatchery** is a facility where eggs are incubated and hatched by artificial means. A **fry** is a newly hatched fish.
  - E. **Water quality** is used to describe how suitable water is to a specific use. Depending on the use, many sources of water are used. Sources include surface runoff, well water, and spring water. **Surface runoff** is the water that is not absorbed by the soil from rain. **Well water** is water drawn up by wells from underground aquifers. **Spring water** comes from natural openings in the earth and the quality is similar to well water.
  - F. Fish anatomy and physiology includes fins, gills, swim bladders, and other parts specific to fish.

Use TM: C3–1A to discuss anatomy and physiology of fish.

**Objective 2:** Identify major species used in aquaculture.

**Anticipated Problem:** What major species are used in aquaculture?

- II. Many species are raised for profit in aquaculture. Here are a few examples:
- A. **Tilapia** are fish well suited for aquaculture and were originally found in Africa. They are used because they grow and reproduce very quickly. Tilapia are sensitive to cold temperatures and are sometimes used to control vegetation in ponds and lakes.
  - B. **Shrimp** is the name used to describe approximately 2,000 species of crustaceans. They are mainly bottom dwellers and scavengers that feed slowly on both plant and animal organisms. **Prawn** is the term used to describe any large shrimp.
  - C. **Lobsters** are crustaceans with hard shells that live in saltwater areas. They are usually found on the bottom of the ocean under rocks and in holes. They eat other lobsters, crabs, snails, and small fish.
  - D. **Alligators** are large reptiles that are used for their meat and hides. Alligator farms are found in the southern states including Mississippi and Louisiana.
  - E. The legs of bullfrogs are used for meat and are in great demand. Frogs are also used for research, but are hard to raise commercially because of their complex life cycle.
  - F. Eel production is used for food, especially in Japan. Elvers are raised in ponds and caught by fisherman in their natural environments.
  - G. The **Bluegill** is a sunfish that has a deep compressed head and a small mouth. They are fairly easy to produce and are well adapted to various climates.

Use TM: C3–1B to list various species to raise.

**Objective 3:** List management and nutrient requirements of aquaculture.

**Anticipated Problem:** How do you manage and feed aquaculture species?

- III. A **production cycle** describes the complete production of a crop from seed stock to market size. Since water environments can be complex, careful feeding and management is required for a profitable business.
- A. Aquatic animals will become diseased and inefficient if they are malnourished. The proper amount of protein, fat, minerals, carbohydrates, and vitamins must be fed according to what type of animal you are producing.
  - B. There are natural foods or foods that grow naturally, like plankton, that can be harvested and fed to aqua crops. There are also man-made feeds that are produced according to the needs of the animal it is intended to feed. Manufactured feed can come in a variety of forms including pellets and meal.
  - C. Management of species in general includes monitoring facilities, equipment and maintaining water quality.

Use LS: C3–1A to research the life cycle of aquaculture species.

**Objective 4:** Describe freshwater and saltwater aquaculture production systems.

**Anticipated Problem:** What are freshwater and saltwater production systems like?

- IV. The aquatic environment you create for your species will depend on what is necessary for the species to survive. A **water facility** is the environment or structure in which your aqua crop species is raised.
- A. Ponds are water structures made by humans or created by nature. They vary in size and cannot have flowing water. Ponds need to be designed for easy harvesting and are usually freshwater facilities. Ponds are usually only 3 to 5 feet deep and need to be monitored for water quality and excess vegetation.
  - B. **Raceways** are water structures that are human-made and use flowing water. They are normally long, narrow, and 3 to 4 feet deep. The advantages of raceways include having more oxygen and carrying waste away. The disadvantages include having to use pumps and more water.
  - C. Tanks made of metal, concrete, and other materials are used to raise some species. They come in various shapes and sizes and can be managed easier because of their smaller size.
  - D. Pens and cages are materials that confine species to a small area in a very large body of water. They are used to make harvesting and managing aqua crops easier.

Use TM: C3–1C to discuss water facilities.

**Objective 5:** Explain harvesting and marketing of aquaculture products.

**Anticipated Problem:** How do you harvest and market aqua crops?

- V. Harvesting and marketing of aqua crops vary with species and production systems, but there are a couple general concepts.
- A. Harvesting is the capturing of fish used for partial or complete consumption. Fish raised in tanks are easy to harvest because of the size of facility. Dip nets are used to harvest tanks out of tanks. A seine is used to harvest out of raceways. Ponds are more complicated to harvest because they may have to be drained.
  - B. Marketing of fish, aquatic products, and species can be simple or direct to the consumer or complex or changed and then sold to others who will sell the products to consumers. Marketing is only as good as the market for the product. Always make sure you have a dependable buyer for your products before you invest the money to grow them.

Use TM: C3–1D as an overhead to have the class come up with as many products as they can. Examples include: Catfish, Carp, Trout, Lobster, Eel, etc.

**Review/Summary.** Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used to

determine which objectives need to be reviewed or retaught with a different approach. Questions provided in the recommended textbooks may also be used to help review.

**Application.** Application can involve student activity with the provided labs.

**Evaluation.** Evaluation should focus on student achievement of the objectives for each lesson. Various techniques can be used, such as performance on the application activities. A sample written test is attached.

## **Answers to Sample Test:**

### **Part One: Matching**

1 = h, 2 = b, 3 = e, 4 = f, 5 = a, 6 = d, 7 = g, 8 = c

### **Part Two: Completion**

1. aqua crop
2. Aquaculture
3. Saltwater
4. water facility
5. Water quality
6. production cycle

### **Part Three: Short Answer**

Any of the following answers are correct:

Lobsters  
Prawn  
Alligators  
Bluegill  
Shrimp  
Tilapia  
Eel  
Bullfrog

---

# Test

---

## Lesson C3–1: Exploring the Aquaculture Industry

### Part One: Matching

*Instructions.* Match the term with the correct response. Write the letter of the term by the definition.

- |                 |                   |               |
|-----------------|-------------------|---------------|
| a. Fish         | d. Freshwater     | g. Fry        |
| b. Hatchery     | e. Raceways       | h. Well water |
| c. Spring water | f. Surface runoff |               |

- \_\_\_\_\_ 1. Water drawn up by wells from underground aquifers.
- \_\_\_\_\_ 2. Where eggs are incubated and hatched by artificial means.
- \_\_\_\_\_ 3. Water structures that are human-made and use flowing water.
- \_\_\_\_\_ 4. The water that is not absorbed by the soil from rain.
- \_\_\_\_\_ 5. Animals that have gills instead of lungs and are vertebrates—they have backbones.
- \_\_\_\_\_ 6. Water that contains little or no salt.
- \_\_\_\_\_ 7. A newly hatched fish.
- \_\_\_\_\_ 8. Comes from natural openings in the earth and the quality is similar to well water.

### Part Two: Completion

*Instructions.* Provide the word or words to complete the following statements.

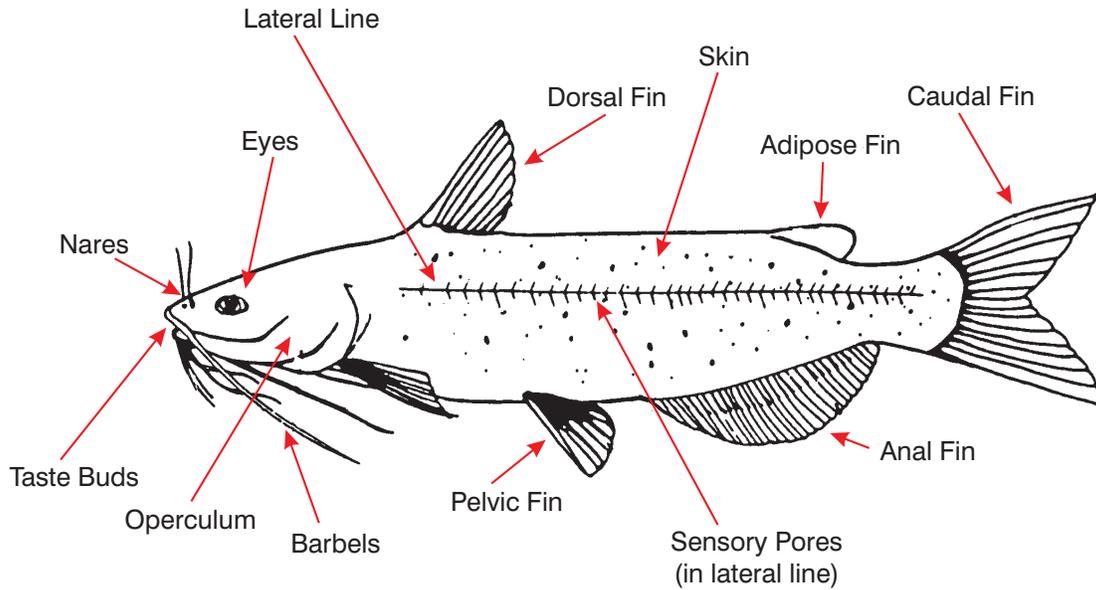
1. An \_\_\_\_\_ refers to commercially produced water species.
2. \_\_\_\_\_ is the production of aquatic vegetation and animals.
3. \_\_\_\_\_ is water containing over 16.5 parts per thousand of salt.
4. A \_\_\_\_\_ is the environment or structure in which your aqua crop species is raised.
5. \_\_\_\_\_ is used to describe how suitable water is to a specific use.
6. A \_\_\_\_\_ describes the complete production of a crop from seed stock to market size.

### Part Three: Short Answer

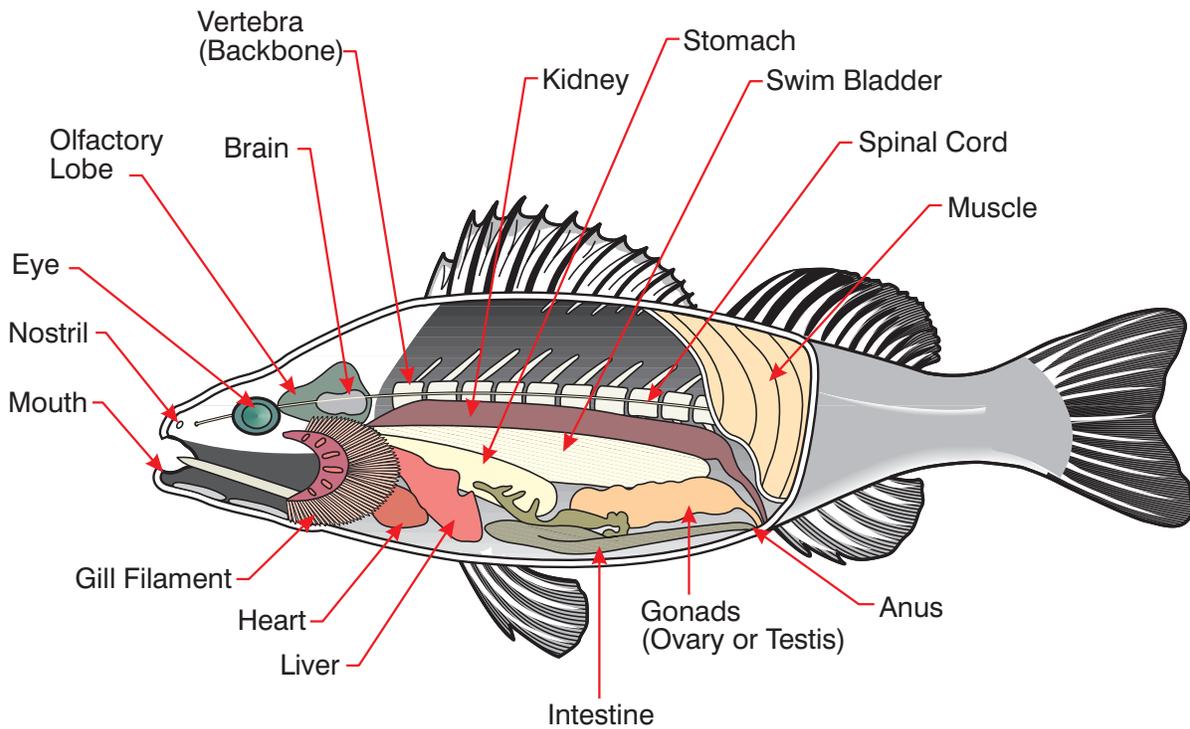
*Instructions.* Provide information to answer the following questions.

What are five major species of aqua crops raised?

# FISH ANATOMY



# FISH PHYSIOLOGY



# AQUACULTURE SPECIES USED IN PRODUCTION

**Shrimp**

**Prawn**

**Lobsters**

**Alligators**

**Bullfrogs**

**Elvers**

**Bluegill**

# TYPES OF WATER FACILITIES USED IN AQUA CROPS

- ◆ **A water facility is the environment or structure in which your aqua crop species is raised.**
- ◆ **Ponds are water structures made by humans or created by nature. They vary in size and cannot have flowing water. Ponds need to be designed for easy harvesting and are usually freshwater facilities. Ponds are usually only 3–5 feet deep and need to be monitored for water quality and excess vegetation.**
- ◆ **Raceways are water structures that are man-made and use flowing water. They are normally long, narrow, and 3–4 feet deep. The advantages of raceways include having more oxygen and carrying waste away. The disadvantages include having to use pumps and more water.**
- ◆ **Tanks made of metal, concrete, and other materials are used to raise some species. They come in various shapes and sizes and can be managed easier because of their smaller size.**
- ◆ **Pens and cages are materials that confine species to a small area in a very large body of water. They are used to make harvesting and managing aqua crops easier.**

**TM: C3-ID**

**How many types of products or species can you list that deal with aqua crops?**

---

# Lab Sheet

---

**Purpose:**

A production cycle describes the complete production of a crop from seed stock to market size. The purpose of this lab is to draw the complete life cycle of a species used in aquaculture.

**Directions:**

Draw the complete life cycle of your species and label each stage with the correct name and any other facts about it.

**Materials:**

Drawing paper  
Drawing utensils  
Research information