

Teaching Plan:

Module: Crawfish Farming - Section C

Problem Area: Reproducing and Rearing Crawfish

Estimated Time: 8-12 hours

Goal: The goal of this problem area is to develop skills in the overall production of crawfish, with emphasis on reproducing crawfish, feeding crawfish and keeping crawfish healthy

Learning Objectives: Upon completion of this problem area, students will be able to:

describe management practices to encourage crawfish reproduction
explain how feed is provided for crawfish
describe how to keep crawfish healthy
describe special considerations with soft-shell crawfish

Resources: The following instructional resources are needed to complete this problem area:

Essential:

Transparencies.

Additional:

Crawfish Production Systems (SRAC Publication No. 241).

Crawfish Culture (SRAC Publication No. 241).

Any books, bulletins, or other materials on crawfish aquaculture A few examples are listed here:

Aquaculture: The Farming and Husbandry of Freshwater and Marine Organisms, by Bardach, John E ., Ryther, John H. & McLarney, William O. John Wiley & Sons, Inc., NY, 1972.

Third Report to the Fish Farmers, by Dupree, Harry K. & Huner, Jay V., Washington: U.S. Department of the Interior, Fish and Wildlife Service, 1984.

Introduction to Aquaculture, by Landau, Matthew, John Wiley & Sons, Inc., NY, 1972.

Crustacean Farming, by Lee, Daniel O.C. & Wicking, John F, John Wily & Sons, Inc., NY, 1992.

Aquaculture: An Introduction, by Lee, Jasper S. & Newsman, Michael E ., Danielle, IL, Interstate Publishers, Inc., 1992.

Journals that include articles on crawfish farming, such as the **Water Farming Journal**, published by Carol and Associates, Inc., 3400 Neyrey Drive, Metairie, LA 70002

Content and Procedures

Preparation (Interest Approach):

To develop student interest in this module, ask students to describe what producers of cattle are most concerned with. Develop a list of these concerns on the chalkboard. Have students explain why these concerns are important. (Possible concerns include getting the cattle to produce babies, providing the right feed for the cattle, and keeping the cattle from getting disease.) Ask students why these are important. (They insure that the cattle will successfully grow.)

Ask students if they feel that there is a parallel between raising cattle and crawfish. Have them to offer comments on how cattle and crawfish may be alike and different. (One major difference is that crawfish grow in water and cattle don't.)

Presentation:

A. What management practices are used to encourage crawfish to reproduce?

Use TM C1 to presents objectives for the problem area. Use TM C2 to outline sequence of events in managing crawfish to encourage reproduction. Ask students to describe how this sequence of events could vary with climate. (Most crawfish production occurs in southern states that have mild winters and long summers.)

1. Most crawfish farmers take advantage of the natural reproduction processes of crawfish.
 - a. The cyclical nature of the process is best illustrated with the permanent pond production of crawfish.
 - b. Stock ponds in April and May.
 - c. Drain pond over a period of 2-4 weeks in May and June.
 - d. Plant vegetation in June through August.
 - e. Reflood the pond in October.
 - f. Harvest crawfish from November through late May or June.
 - g. Drain pond and repeat the cycle in May and June. (It may not be necessary to add brood crawfish.)
2. Male and female crawfish mate during all months but the peak is reached in the spring.

Use TM C3 to outline how lowering the water level is important in crawfish reproduction.

- a. The female stores sperm until eggs are laid. (Female crawfish have been observed to store sperm as long as 6 months.)
 - b. The eggs are fertilized at the time they are laid by the female.
 - c. Females usually lay eggs in burrows in the late summer or early fall.
 - d. Lowering the water level in a crawfish pond in the early summer encourages females to lay eggs.
3. Crawfish build 2 kinds of burrows based on location: levee and bottom. (Levee burrows are built in the levee of the pond, while bottom burrows are built in the pond bottom.)

Locate examples of the 2 kinds of crawfish burrows. Note any differences that appear on the outside. Observe a female with young attached. (These can be obtained from recently reflooded crawfish ponds.)

- a. Burrows are important because crawfish live in them for 2-4 months, depending on the flooding schedule used by the farmer.
 - b. In some cases, only fertilized females go into burrows, while in others male crawfish may also go into the burrow with the female.
 - c. The burrows are built near the water but not below the water level. The top is sealed to hold moisture in and provide a good place for the eggs to incubate. Burrows may be 4 feet deep to insure water during dry weather.
4. Incubation is the period of time between when an egg is fertilized and it hatches.

Determine the number of young the females stocked in a pond could produce at 300 per female. (At 10 brood crawfish per pound, half would be female. The total number of young produced per acre is calculated by multiplying the numbers of females in a pound by the number of pounds stocked on an acre. This is then multiplied by 300. In this example, 5 times 50 pounds equals 250 female crawfish in an acre. The number of young is 250 multiplied by 300, or 75,000 young crawfish. This number should produce about 2,300 lbs of .5 oz crawfish. Divide 75,000 by 32 [the number of crawfish in a pound at the weight of .5 oz].)

- a. The eggs adhere to the females body through incubation.
 - b. The female regularly moistens the eggs with the water in the burrow during the incubation period of 2 to 4 weeks. (The red crawfish incubation is shorter than that of the white river crawfish.)
 - c. The newly hatched crawfish cling to the body for a while, usually long enough to molt twice and be able to fend for themselves.
 - d. Water should be added back to the pond at hatching to insure sufficient habitat for the young.
 - e. The female typically dies after the young are on their own.
 - f. A female will produce several hundred baby crawfish.
 - g. The maximum number of eggs observed on a crawfish has been 700.
 - h. Typical females in a crawfish pond produce 300 or so eggs.
5. Young crawfish may be lost to predation by fish, cannibalism while molting, and poor quality water.
6. Four important management practices are followed in reproducing crawfish:
- a. Stock enough mature male and female crawfish in a pond in spring before water is lowered. New ponds are stocked with 50-60 lbs of brood crawfish, half of each sex. Ponds in construction will have enough crawfish left from previous year. Broodfish should be captured from source and moved to pond within 2-3 hours. Do not refrigerate or expose them to wind or sun in transport.
 - b. Gradually lower water for about 4 weeks. This will encourage females to burrow. Quickly lowering water is impractical, requires increased pump capacity, and is expensive. Gradually lowering water helps prepare crawfish for burrowing. Plant forage crops while pond is dry.
 - c. Reflood pond in early fall. This is done to coincide with the peak spawning of females in burrows. After reflooding and young emerge from burrows. If a crop is grown on field, reflooding is after crop is harvested.
 - d. Regulate harvesting schedule to allow maximum crop. Since some crawfish don't spawn until late fall or early winter, intensive harvesting should be delayed until winter.
7. Stock an adequate number of mature male and female crawfish in a pond in the spring before the water is lowered.

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Ask students to explain why brood crawfish should be protected when being moved to a pond (reduces mortality).

- a. New ponds are typically stocked with 50-60 pounds of brood crawfish, with half being of each sex.
- b. Ponds that have been in production will likely have enough crawfish left from the previous year.
- c. Brood crawfish should be captured from their source and moved to the pond within 2 or 3 hours. They should not be refrigerated or exposed to wind or sun while being transported.

8. Gradually lower the water over a period of about 4 weeks.

Make a field trip to observe the reflooding of a crawfish pond.

- a. Lowering the water will encourage the females to burrow.
- b. Quickly lowering the water is impractical and requires increased pump capacity and is expensive.
- c. Gradually lowering the water helps prepare the crawfish for burrowing.
- d. Plant forage crops while the pond is dry.

9. Reflood the pond in early fall.

- a. Reflooding is done to coincide with the peak spawning of females in the burrows.
- b. After reflooding the females and young emerge from the burrows.
- c. If a crop is grown on the field, reflooding is after the crop has been harvested.

10. Regulate the harvesting schedule to allow a maximum crop.

- a. Since some crawfish don't spawn until late fall or early winter, intensive harvesting should be delayed until winter.
- b. Harvesting should usually be completed by mid-spring.

B. How is food provided for crawfish?

Use TM C4 to outline the food needs of crawfish. Tour a crawfish farm to observe the kinds of vegetation growing in the farm.

1. Crawfish eat small plants and animals that live in the water as well as decaying organic matter.
 - a. Detritus is the decaying plant and animal material in the water.
 - b. Crawfish ponds will naturally grow small amounts of vegetation.
 - c. Most ponds do not have sufficient natural vegetation to support a large population of crawfish.
2. Rotations with certain agronomic crops are particularly beneficial, especially with rice.
 - a. Millet, soybeans, and hybrid sorghum are sometimes planted for crawfish.
 - b. Millet is not usually recommended for crawfish.
3. Rice is the preferred crop for crawfish.

Tour a farm that uses rice fields to produce crawfish. Have the owner describe important practices that are used to insure the best possible rice and crawfish crops.

- a. It can be planted for crawfish food or as a grain crop to be harvested.
- b. If harvested, the stubble and straw residue left in the field are good forage for crawfish.
- c. For crawfish, rice is planted through August at the rate of 90 to 120 lbs/acre.

- d. Pesticides should not be used to control insects in the rice. (Crawfish are very sensitive to pesticide residues. In some cases, rice can be treated when the crawfish are in burrows.)
4. Crawfish will need forage the winter and spring.

Examine crawfish from ponds with an abundance of vegetation and those from ponds with little vegetation. Compare the development of the crawfish, especially the tail muscle inside the exoskeleton.

- a. Sufficient forage must be available or the crawfish will not get enough to eat.
 - b. Crawfish may become stunted or have hollow tails due to a lack of food.
5. Most vegetation crops will need fertilizer and lime.
- a. Fertilizer and lime should be added based on soil analysis.
 - b. Fertilizer and lime should be applied at the time the crops are planted.
6. Crawfish are not usually fed commercially manufactured feed.

Indicate that crawfish nutrition is fairly well unknown. Much research is needed to determine the exact nutritional needs of crawfish.

- a. Supplemental feed may be beneficial if the forage has been consumed.
- b. Some producers use range pellets when the supply of forage has been eaten. (These are the pellets fed to cattle.)
- c. The amount of feed put into a pond depends on the population density and size of the crawfish.
- d. Research is continuing on the use of various feeds, such as catfish feed.
- e. Authorities suggest that the development of crawfish feeds may extend the production season later into the year.

C. What procedures should be followed to keep crawfish healthy?

Show TM C5 and discuss disease problems. Ask students to describe a healthy crawfish. (It is active, reproduces, grows, has all body parts, has a shell in good condition, and doesn't have external parasites attached to it.)

1. Healthy crawfish grow and reproduce more efficiently.
2. Research has been made in only a few areas of crawfish health.
3. Producers are much aware of the importance of providing a good environment for crawfish.
4. Crawfish are subject to several kinds of disease.
 - a. Environmental diseases cause more losses than other diseases.
 - b. Oxygen depletion can result in the loss of large numbers of crawfish.
 - c. Pollution in the water can cause the death of crawfish.
5. Nutritional diseases develop when crawfish do not have sufficient food.
 - a. Providing plenty of good forage can prevent many nutritional disease problems.
 - b. Any supplemental feeds should be free of contamination that would injure crawfish.

6. Crawfish are attacked by some parasites.

Ask students to explain "pathogenic disease" (a disease caused when an organism invades the body).

- a. These are living organisms that live in or on the crawfish.
 - b. The water boatman insect may lay hundreds of eggs on a crawfish giving the crawfish a fuzzy appearance. (Though unsightly, they do not apparently cause many problems.)
 - c. Crawfish may be subject to pathogenic diseases, but the occurrence of these is uncertain.
 - d. *Psorospermium haeckeli* has been found in some crawfish. (This is an organism of uncertain status.)
 - e. Additional diseases are likely to be diagnosed as crawfish increase in intensity of production.
7. Predation can cause considerable loss on a crawfish farm.

Use TM C6 to outline predation and list example of predators. Use TM C7 to outline predator control methods. Have an aquafarmer describe the kinds of predation problems on local aquafarms. Have students prepare a bulletin board or poster that illustrates the use of frightening devices to keep predators away.

- a. Predators are animals that eat other animals.
 - b. The major predators are: fish, birds, raccoons, bullfrogs, snakes, turtles, and large water beetles.
 - c. Filtering surface water to remove trash fish can help reduce some of the predation problem.
 - d. Some growers use devices that frighten predators away, such as loud noises to drive birds off.
 - e. Other approaches include trapping, destroying, and placing small mesh wire fences around ponds.
8. Crawfish are kept healthy by creating a good environment for their growth.
- a. The pond is managed so that conditions that lead to disease don't develop.
 - b. It is far easier to prevent than to try to treat diseases.
9. Cannibalism can cause losses among crawfish at certain times of the growth cycle, especially just after molting.

Ask students to explain cannibalism. (It occurs when crawfish kill and eat other crawfish.)

D. What special considerations are followed with soft-shell crawfish?

Observe a soft-shelled crawfish to note differences in the hard-shell and soft-shell forms. Use TM C8 to outline procedures in soft-shell crawfish production. Tour a soft-shell producer and observe how the crawfish are acclimated to the trays.

1. Soft-shell crawfish are fed in trays kept inside buildings at high stocking density until they molt.
2. Molting is frequent with young crawfish in warm water.
 - a. Young crawfish are selected from ponds used to grow hard-shell crawfish.
 - b. The young crawfish are hand selected when 2 inches long or larger.
 - c. They are moved from the pond to trays in a growing facility, usually a covered building.
3. Acclimating crawfish to the trays is important.

Tour a soft-shell producer and observe how the crawfish are acclimated to the trays.

- a. Moving crawfish from a pond can result in high mortality unless carefully handled.
 - b. Procedures should be followed to get the crawfish to gradually adjust to the trays.
 - c. The bottom of the tray is covered with shallow water.
 - d. Trays are about 3 feet wide, 8 feet long, and 4 or 5 inches deep.
 - e. Stocking rate in the trays varies but is 20 to 35 crawfish per square foot, depending on the size of the crawfish.
4. Crawfish are fed daily.
- a. A commercially prepared crustacean feed should be used.
 - b. Feeding should begin after acclimation at the rate of 3-5% body weight, and reduce this to 2% in a few days.

5. Remove crawfish that indicate that molting will soon occur.

Observe crawfish to note differences in color related to potential molting that may soon occur.

- a. The color of the carapace will become distinctly darker just prior to molting.
- b. The crawfish should be placed in a molting tray.
- c. Crawfish that remain in the tray and molt will be attacked by the other crawfish and destroyed.

6. Molted crawfish should be immediately removed from the molting tray and processed.

Visit a local supermarket to determine if soft-shell crawfish are available. Determine the kinds of packaging and how they are prepared.

- a. Processing should occur the same day so that the shell does not return prior to marketing.
- b. Most crawfish are frozen in bags of water because the water protects the crawfish and prevents parts from being broken off.
- c. Vacuum and shrink-wrap packaging are also being used.

Review:

Review by having students demonstrate their understanding and knowledge of the objectives for this problem area. Call on various individuals to explain parts of the objectives. The problem area can also be reviewed by asking questions about the content, during supervised practice, and during laboratory activities in crawfish aquaculture.

Application Activities:

Application can occur in the laboratory, during supervised practice, and later during work in crawfish farming.

Evaluation:

Evaluation should focus on the extent to which students have achieved the objectives for the problem area. Observations of the students during review can be most helpful. Using written and oral tests will also be helpful. Example exam questions are attached.

Objectives

- Describe management practices that encourage crawfish reproduction
- Explain how feed is provided for crawfish
- Describe how to keep crawfish healthy
- Describe special considerations with soft-shell crawfish

Crawfish Production Cycle With Permanent Ponds

- April-May:
Stock 50-60 lbs of brood crawfish per acre
- May-June:
Drain water from pond for 4 weeks
- June-August:
Plant vegetation
- October:
Reflood pond
- November:
Harvest crawfish May or June
- May-June:
Drain pond and repeat cycle

How Lowering Water Level Promotes Reproduction

- Female stores sperm from mating
- Lowering water causes burrowing
- Eggs are laid and fertilized in burrow
- Eggs are incubated in burrow

Crawfish Foods

- Small plants and animals that live in the water
- Dead plants and animals that may or may not float in the water, known as detritus
- Vegetation:
Rice is preferred
Sorghum, millet, and soybeans
Wild, native vegetation sometimes used

Disease Problems With Crawfish

- Environmental disease
- Nutritional disease
- Parasites
- Pathogenic disease

Crawfish Predators

- Predators attack and eat crawfish
- Common predators:
 - Trash fish
 - Birds
 - Raccoons
 - Bullfrogs
 - Snakes
 - Turtles
 - Large water insects, such as beetles

Predators Control Methods

- Filter water to remove trash fish
- Use frightening devices
- Destroy predators
- Trap and move predators
- Place small mesh wire fences around ponds

General Procedures With Soft-Shell Crawfish

- Young crawfish are removed from pond at a length of about 2 inches
- Crawfish are placed in large trays with shallow water on the bottom
- Acclimation process is needed
- Fed at the rate of 2-4%, depending on how much is eaten
- Monitored daily, with those near molting removed to a molting tray
- Molted crawfish are processed immediately

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Quiz for Section C

Name:

Date:

Quiz on Reproducing and Rearing Crawfish

Directions: Answer the following questions in the space provided. Be sure to spell correctly and provide the most complete information you can.

1. What are the 6 steps in the cycle of crawfish farming that take advantage of natural reproduction?
2. Provide the following information related to the reproduction of crawfish:
Time of mating:

When eggs are fertilized:

When females lay eggs :
3. What is the role of burrowing in reproduction?
4. How are burrows constructed? Why is this arrangement important?
5. What is incubation? What does the female do during incubation?
6. What are 4 important management practices in reproducing crawfish?
7. What do crawfish eat?
8. What can the farmer do to help insure that crawfish have plenty to eat?
9. What general kinds of disease may afflict crawfish? How are these related to keeping crawfish healthy?
10. What is a predator? What are the major predators of crawfish?

11. What special considerations are needed to produce soft-shell crawfish?

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Key for Quiz - Section C

1. The 6 steps in the cycle of crawfish farming that take advantage of natural reproduction are as follows:
Stock ponds in April or May.
Drain ponds over a period of 2 to 4 weeks in May and June.
Plant vegetation in the pond in June through August.
Reflood the pond in October.
Harvest the crawfish from November through May or June.
2. Time of mating: year-round but mostly in the spring.
When eggs are fertilized: when laid.
When females lay eggs: in burrows in late summer or early fall.
3. Burrowing provides a place for the female to lay eggs. Burrows protect the female and incubate the eggs.
4. Burrows are constructed on levees or pond bottoms. They are 3-4 feet deep and are sealed with mud.
5. Incubation is the time between the fertilization of an egg and when it hatches into a baby crawfish. The female keeps the eggs moist and provides a good environment for incubation.
6. Four important management practices in reproducing crawfish are as follows: Stock an adequate number of male and female brood crawfish in a pond in the spring. Gradually lower the water over a period of 4 weeks. Reflood the pond in the fall. Regulate harvesting to allow a maximum crop.
7. Crawfish eat small plants and animals that live in the water. They also eat dead plant and animal material that sometimes floats, known as detritus material.
8. The crawfish farmer can use management practices to produce forage. Vegetation can be planted in the pond when it has been drained. Feeding commercially manufactured feeds hasn't been fully tested with research.
9. The general kinds of disease that may afflict crawfish are as follows: environmental, nutritional, parasites, and pathogenic diseases. Providing an environment where these aren't problems helps keep crawfish healthy.
10. A predator is an animal that attacks and destroys other animals. The predator may use the animal for food. The common predators of crawfish are fish, birds, raccoons, bullfrogs, snakes, turtles, and large water beetles.
11. Soft-shell crawfish are young crawfish selected from ponds and grown in trays. They must be acclimated to the trays, fed and carefully monitored to remove any that are about to molt. Once molting has occurred, the crawfish should be quickly processed so that the shell doesn't return.