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Transparency Masters

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T IV-G-5 Methods of Harvesting
T IV-G-6 Storing Aquacrops
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Module IV-G — Farming in Water

**Problem Area:** Harvesting the Crop

**Estimated Time:** 4-8 hours

**Purpose/Goal:** This problem area develops fundamental competencies in harvesting aquacrops. This will be achieved by providing instruction in the meaning of harvesting, kinds of harvests and methods to use.

**Instructional Objectives:** Upon completing this problem area, students will be able to:
- Define harvesting;
- Describe types of harvests;
- Explain harvesting methods;
- Describe how to store aquacrops.

**Instructional Resources:**

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

**Essential**
- Transparencies made from the masters attached to this teaching plan.
- Copies of the handout H IV-G-1, Basic Seining Procedures.

**Additional:**

*Third Report to the Fish Farmers,* by Dupree and Huner.

*Introduction to Aquaculture,* by Landau.

*Commercial Catfish Farming,* by Lee.


*Aquaculture Training Manual,* by Swift.

*Catfish Farmer’s Handbook,* by Wellborn.
Preparation
(Interest Approach):

The interest approach prepares students for studying the aquacrops harvesting. The strategy compares rounding up cattle for shipment to a sale to the harvesting of aquacrops.

The procedure to use follows:

1. **Ask why ranchers** round up cattle. One of the reasons they round them up is to ship them to a sale. Examples: include to administer medications, brand or move to a new location.

2. **Explain ranch employees** need particular skills in how to herd cattle. If not, the cattle will tend to run wild and never be corralled. Ask students to name some of the skills cowboys or ranch employees need. Examples: how to ride a horse, understanding of cattle behavior, and how rounding up cattle can cause injury.

3. **Point out cattle** running loose in the pasture provide no returns at the time of marketing. Ranchers want to pen the whole herd when they have a roundup. Emphasize the same is true with fish. Fish in the pond are valuable, but the grower can’t get money until they are “rounded up” and sold. (Note: The same principle applies to grain left in a field or any other crop.)

4. **Lead from the interest approach** into listing the problem area objectives.
## Presentation

<table>
<thead>
<tr>
<th>Key Questions/Summary of Content</th>
<th>Teaching Techniques</th>
</tr>
</thead>
</table>

*This teaching plan develops basic student competencies in aquacrop harvesting.*

Present the objectives using T IV-G-1 or by writing on the chalkboard. Allow students time to write the objectives in their notebooks.

---

### I. What is harvesting?

<table>
<thead>
<tr>
<th>A. Harvesting is gathering an aquacrop so it can be used for its intended purpose.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Harvesting involves capturing fish.</td>
</tr>
<tr>
<td>- Capturing includes confining the fish in an area or container where they can be moved.</td>
</tr>
<tr>
<td>- Cultured fish are typically harvested in large quantities using sophisticated machinery.</td>
</tr>
<tr>
<td>- Wild fish are harvested by capturing much the same as cultured fish.</td>
</tr>
<tr>
<td>2. Aquacrops may be harvested several times in their cycle of production.</td>
</tr>
<tr>
<td>- Fingerlings may be harvested and marketed to a food fish grower.</td>
</tr>
<tr>
<td>- Food fish may be harvested and marketed to a processor.</td>
</tr>
<tr>
<td>- Broodfish may be harvested and marketed to a hatchery.</td>
</tr>
</tbody>
</table>

| A. Use T IV-G-2 or the chalkboard to present a definition of harvesting. |

<table>
<thead>
<tr>
<th>B. Harvesting is an important step in realizing gain from the crop that has been produced.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Harvesting procedures must keep the product in good condition.</td>
</tr>
<tr>
<td>- Injured or damaged aquacrops are not marketable.</td>
</tr>
</tbody>
</table>

| B. Use T IV-G-3 or the chalkboard to outline three harvesting considerations. |

| 2. Help students understand harvesting may occur at several times or stages. Use examples from the local community. |

| 1. Ask students to review the meaning of stress and how it effects fish. |
MODULE IV-G

- Consumers do not want products that have been injured by improper handling.
- Harvesting stresses fish; only approved procedures should be followed.

2. Harvesting procedures must be efficient.
- Harvesting equipment must perform without failure. Fish must not be able to escape through a hole in the seine. Fish that remain in a pond don't provide income.
- Workers must know how to use harvesting equipment to insure a quality harvest.
- All harvesting procedures must consider the safety of the persons operating the equipment.

3. Market outlets must be ready to receive the harvested crop. It needs to be moved quickly to its destination.
- It is very difficult to store live fish more than a few hours in a water facility and retain quality.
- With certain food fish, a flavor check should be done prior to harvesting. A crop that is off-flavor should not be harvested or marketed. (Checking for off-flavor involves collecting a sample of two or three fish (depending on the volume to be harvested) and quickly cooking to sample the taste. A trained person will know the flavor of fish and be able to detect off-flavor.)

II. What types of harvests are used?
A. Approaches to harvesting vary. Differences depend on how the crop is to be managed and produced.

B. Two harvesting strategies are used:
   1. Topping — harvesting only a portion of the crop in a water facility.
   - Topping typically involves removing fish of certain sizes and leaving the others to continue growing.
   - Topping tends to result in higher total production from a pond because some of the fish can be harvested when their growth rate begins to slow down. Those that remain grow at a faster rate.

   2. Explain that fish escaping through a net may be compared to a calf ready for market escaping from the roundup.

   3. Ask students what they would do with fish that have been harvested if there is no place to sell them. Example: release them back into the pond.

B. Use T IV-G-4 or the chalkboard to explain the two harvesting strategies.

   - Ask students to offer their explanations of why growth rate slows down and how topping can speed it up.
• The grower can market some of the crop when the price is optimum.
• Since harvesting occurs repeatedly, more labor is required for the harvesting work.
• The application of topping depends on the nature of the crop being produced.

Two examples of topping:
(1) Crawfish are seeded into a pond about every five years; each year the largest crawfish are harvested, while some are allowed to remain and reproduce; at the end of five years, production has deteriorated and the pond has a total harvest and is restocked.
(2) Catfish are often stocked for a maximum weight of 5,000 lbs. per acre. Topping might involve harvesting 1,000 lbs. of the larger fish and allowing the remaining 4,000 lbs. or less to grow, with 1,000 new seed being stocked after each partial harvest. When weight reaches nearly 5,000 lbs. again, another partial harvest is done. This allows ponds to stay in continuous production without being drained. Some have been in production for over 10 years using partial harvests.

2. Total harvest is removing all of the fish from a growing facility at the same time. It is much like clear-cutting a forest — everything is taken.
• Total harvesting does not select on the basis of size or other criteria. Fish may need to be sorted by size and species after harvest. Crops that have even growth rates are preferred.
• With a total harvest, the pond may be drained and dried after the crop is removed, and readied for another crop of fish. This practice reduces disease losses.
• Total harvesting has a lower labor requirement than topping. The grower only needs a harvesting crew one time for a pond.

• Arrange for students to visit an aquafarm where topping is used. Have them observe a partial harvest and the management practices used after the partial harvest.

2. Ask students if they have seen a forest that has been clear cut. How many trees are left? Ask them how clearcutting relates to a total harvest from a pond.
III. What methods of harvesting are used?

A. Five methods of harvesting are used with fish crops:

1. Seining involves pulling a seine (specially-made net) across a water facility and lifting the fish into a haul tank. Aquafarms often have powered seine haulers pulled by tractors. Seines may selectively harvest, as with topping.
   - Total harvesting requires a seine with a mud line. Mud lines are heavy, strong, multiple-strand bottom ropes that resist mud and can withstand a lot of pressure and pulling force.
   - As a general rule, seines for total pond harvests should be one-third deeper than the deepest part of the pond and one-third longer than the widest part of the pond. Seine size typically ranges from 200 to 1,600 ft. long and 8 ft. deep; the seine is usually made of nylon netting. The mud line and top line (also known as cork line) are usually of strong, durable twine.
   - With some species of fish, seine material needs to be coated with tar or asphalt to prevent fish fins from catching in the material. When fins get hung, fish are damaged when the seine is pulled.
   - Partial harvests are made with lead-line seines; these tend to be lighter than mud-line seines.

2. Draining involves removing all of the water from a facility.
   - With ponds, a pipe is used to drain the water or it is pumped out. Ponds are constructed with a harvest basin, somewhat like a small pond within the larger pond that remains after draining. The fish crop is temporarily concentrated in the harvest basin from which they are lifted to hauling tanks.

3. Crowding and collecting involves crowding the fish into an area of a tank using a screen. The fish are lifted out of the tank with dip nets or fish pumps. This method is often used with raceways.

A. Use T IV-G-5 or the chalkboard to outline the five methods of harvesting.

1. Have students observe the kinds of seines and seine haulers at an aquaculture equipment exposition. They may develop a collection of brochures and prepare a bulletin board for the classroom.

   - Use H IV-G-1, Basic Seining Procedures, and seine a pond. (See the section on application. Caution: Be sure to follow all safety procedures. Students should receive safety instruction. All safety devices should be available for student use.)

   - Ask students to explain what could happen to a fish when a fin gets caught in the seine material.

3. Have students observe the use of crowding and collecting on an aquafarm.
4. Trapping involves using traps to capture the fish.
- Trapping can be used in natural water facilities where seining is impossible because of very deep water, an uneven bottom and obstructions in the water.
- Several trap designs are available.
5. Hooking involves using a hook and line, much as the sport fisherman would. Hooking is often used in recreational ponds.

B. Method selected varies with water facility, kind of harvest and preferences.
1. Seining and draining are used on large aquafarms with ponds.
- Seining and draining are used to harvest large volumes of fish.
- Specialized equipment is often needed. Skill is needed by the equipment operators to perform an efficient harvest.
2. Trapping and hooking are used in natural bodies of water as well as ponds.
- Trapping and hooking are used to capture small volumes of fish.
- Investment in equipment is smaller unless an individual has a large number of traps.
3. Crowding and collecting are typically used with small water facilities that can be blocked off easily.
- Large volumes of fish can be harvested with this method provided they are in tanks.
- Investment in equipment is small.

IV. How are aquacrops stored?

A. Farmers must often hold aquacrops in captivity for a short while before hauling. Maximum length of time may be overnight.
1. Storing procedures that assure a quality product must be used.
- Storing stresses fish. If not properly managed, stress builds into disease problems.

A. Explain that the terms “holding” and “storing” are used synonymously. “Holding” doesn’t refer to grasping a fish in the hands.

2. Ask students to describe how they have used a hook-and-line to capture fish. Have them describe their equipment and experiences in catching fish.
• Fish are subject to injury or damage from each other while being held in very dense populations.

B. Several ways of storing (holding) fish are available.

1. Same facility — Fish may be held in the facility where they have been grown.

• Live cars may be used in ponds to store fish. These are large, enclosed nets that hold thousands of pounds of fish. After seining, the fish are guided through an opening in the seine into the live car. The live car can be closed, allowing thousands of pounds of fish to be held in the water where they were grown.

• Other short delays in moving can be used to temporarily store live fish.

• Caution: Careful monitoring of DO is essential throughout the storing of live aquacrops.

2. Another facility — Fish may be moved from the growing facility to a holding tank, small pond or vat.

• DO and other water quality factors must be monitored; aerators must be in place.

• Fish are more likely to be injured because of the additional lifting, loading and unloading.

C. Several management factors should be considered in holding fish.

1. Weight loss — Fish lose weight while in storage, particularly during the first 48 hours of storage.

2. Water temperature — Fish should usually be held in water with a temperature somewhat below that in which they grow best; this reduces respiration rate and stress.

• Oxygen and other water factors — Water in which fish are held should be monitored carefully for problems. Fish can die quickly in storage.

B. Use T IV-G-6 or the chalkboard to outline storing methods.

1. Explain holding fish in the same facility results in less stress, is more economical, and there is less chance of injury due to less handling of the fish.

• Ask a student to review the importance of monitoring the DO in water where the fish are being held.

C. Use T IV-G-7 or the chalkboard to outline management factors for fish being held.
4. Withholding feed — Many growers do not feed aquacrops within several hours of harvesting procedures. Some producers withhold feed for 24 hours prior to harvest, which allows the digestive system to handle feed so that newly-eaten, undigested food is not present. Feed can be disengorged by the fish from its stomach; withholding feed keeps the water from being fouled at harvest time.

4. Visit a local aquafarm and investigate feeding practices before harvesting. Provide reports or observations in class.
Review

Review by having students demonstrate their mastery of the problem area objectives. Asking students to explain the objectives is a good review strategy. Review activities also occur during laboratory activities, application and evaluation.

Application

Application can be achieved in several ways. Here are a few examples.

- Students can apply harvesting in their supervised experience programs.
- Students can harvest aquacrops in the school aquaculture laboratory.
- Students can observe harvesting practices of local aquafarms.
- Students can visit an aquaculture equipment exposition to observe the various harvesting equipment and supplies.
- Students can participate in harvesting fish on a farm. (Refer to H IV-G-1, Basic Seining Procedure.)

Evaluation

Evaluation should focus on the extent to which the students have achieved the problem area objectives. Here are a few examples.

- Question students about the content of the objectives, as listed in the review.

- Observe how the students perform with projects, such as science fair displays, bulletin boards, and laboratory activities.

- Observe how students harvest aquacrops in their supervised experience programs or in the school laboratory.

- Give a written test. (See attached sample.)
Farming in Water

Problem Area: Harvesting the Crop

Instructions: Answer the following questions. Be sure
to spell correctly and provide the most
complete information you can.

Name______________________________________________

1. What is harvesting? ________________________________

__________________________________________________________________________________

2. Explain how an aquacrop can be harvested several times in its production cycle.

__________________________________________________________________________________

3. Two major strategies are used in harvesting. Name and describe them.

   a. ____________________________________________________________

   b. ____________________________________________________________

4. Five methods are used in harvesting. Name the methods and briefly describe each.

   a. ____________________________________________________________

   b. ____________________________________________________________

   c. ____________________________________________________________

   d. ____________________________________________________________

   e. ____________________________________________________________

5. Management is as important in harvesting as it is throughout the production cycle. Indicate which
of the following are good management practices at harvesting time by placing an “X” in the
appropriate blank.

   _____ withholding feed for a few hours prior to harvest

   _____ ignoring injury when storing or moving fish

   _____ carefully monitoring DO in areas where live fish are stored

   _____ ignoring water temperature when storing live fish

   _____ storing fish in live cars for indefinite periods of time
1. Gathering an aquacrop so it can be used for its intended purposes.

2. Fingerlings may be harvested and marketed to a food fish grower.
   Food fish may be harvested and marketed to a processor.
   Broodfish may be harvested and marketed to a hatchery.

3. a. Topping — harvesting only a portion of the crop, removing fish that are certain sizes, depends on the nature of the crop.
   b. Total harvest — removing all fish at the same time; fish may need to be sorted by size and species after harvest.

4. a. Seining — pulling a seine across water, lifting fish into a haul tank; seines may selectively harvest.
   b. Draining — Involves removing all water, leaving the fish crop concentrated in the basin from which they are lifted to hauling tanks.
   c. Crowding — (Collecting) crowding fish into area of tank using a screen; fish are lifted with dip nets or fish pumps.
   d. Trapping — using traps to capture fish; can be used in very deep water, uneven bottomed facilities or those with obstructions.
   e. Hooking — using a hook and line, much like sport fishing; often used in recreational ponds.

5. **X** withholding feed for a few hours prior to harvest
   _____ ignoring injury when storing or moving fish
   **X** carefully monitoring DO in areas where live fish are stored
   _____ ignoring water temperature when storing live fish
   _____ storing fish in live cars for indefinite periods of time
Farming in Water:
Harvesting the Crop

OBJECTIVES
• Define harvesting
• Describe types of harvesting
• Explain harvesting methods
• Describe how to store aquacrops
Harvesting

DEFINITION:
Gathering an aquacrop so it can be used for its intended purpose

INVOLVES:
- Capturing
- Harvesting may occur several times based on stage of development or use, such as:
  1. Fingerlings
  2. Food fish
  3. Broodfish
Considerations in Harvesting Aquacrops

- Must keep the product in good condition
- Must use efficient procedures
- Must have market outlets ready
Types of Harvests

- Topping (partial)
  - Remove fish of a certain size, leaving the others to grow
  - Add new seed to the facility
- Total harvest
  - Remove all fish regardless of size or species
  - Is not selective
  - Allows pond drainage
Methods of Harvesting

- Seining
  - Commercial ponds
  - Large volumes
- Draining
  - Commercial ponds
  - Expensive to refill pond
- Crowding and collecting
  - Tanks
- Trapping
  - Natural ponds
  - Streams
- Hooking
  - Natural ponds
  - Streams
  - Fee lakes
Storing Aquacrops
Also known as holding

TWO MAIN WAYS:
1. Same facility
2. Move to another facility
Managing Fish Being Held

WEIGHT LOSS
• small percentage
• most in first 48 hours

WATER TEMPERATURE
• most species prefer cooler than optimal for growth

DO
• very important
• check often

WITHOLDING FEED
• 24 hours before harvest
• less fouling of water
• fish are cleaner