APICULTURE AND AQUACULTURE WEEK 13: BREEDING AND STOCK MANAGEMENT, BREEDING TECHNIQUES. SELECTION IN FISH BREEDING

BY

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Methods of timing when to harvest fish

Timing the harvesting of fish in aquaculture is crucial for optimizing yield, quality, and profitability. Factors like market demand, fish growth rates, environmental conditions, and seasonal variations play important roles in determining the ideal harvest time (Adeleke et al., 2020). Here are 12 ways to time fish harvesting effectively:

1. Based on Market Demand

Description: Harvesting fish to align with peak market demand can maximize profits. This approach considers the timing of holidays, festivals, or specific periods when fish demand is high.

Timing Strategy: Farmers track market trends and plan harvests accordingly. For instance, fish might be harvested in higher quantities around holidays or in tourist seasons when seafood demand surges.

Advantage: Higher selling prices can be achieved when demand is high.

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2. Growth Rate Monitoring:

Description: Regularly measuring the growth rate by sampling fish weights and lengths to determine when they reach the desired market size.

Advantages: Ensures fish are harvested at peak size for profitability and maximizes feed conversion efficiency.

Disadvantages: Labor-intensive and time-consuming; requires accurate tracking and record-keeping.

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3. Size-Based Harvesting

Description: Harvesting fish when they reach a predetermined size that meets market or processing requirements.

Advantages: Meets market demand for specific sizes, ensuring higher market prices.

Disadvantages: Size variation within a population can require multiple partial harvests, which can be costly and time-consuming.

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4. Water Quality Assessment

Description: Monitoring water quality factors such as dissolved oxygen, ammonia, pH, and temperature, and harvesting early if quality deteriorates.

Advantages: Prevents fish stress and mortality due to poor water conditions, preserving the overall yield.

Disadvantages: Requires sophisticated equipment and may lead to premature harvesting if water quality unexpectedly declines.

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5. Feed Conversion Ratio (FCR) Monitoring:

Description: Monitoring FCR, or the amount of feed required to gain a specific weight, and harvesting when FCR increases, indicating slower growth.

Advantages: Optimizes feed efficiency, reducing feed costs and maximizing profitability.

Disadvantages: Requires careful feed and growth tracking; if not monitored frequently, harvest timing can be missed.

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6. Fish Condition Scoring:

Description: Assessing fish health, color, and overall physical condition to determine harvest readiness.

Advantages: Produces high-quality, healthy fish, leading to better market value and consumer satisfaction.

Disadvantages: Requires expertise in assessing fish condition and can be subjective without standardized metrics.

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7. Environmental Temperature Monitoring:

Description: Harvesting based on water temperature, as higher temperatures often increase growth rates, but extremely high temperatures can lead to stress.

Advantages: Ensures fish are harvested before thermal stress occurs, preserving quality.

Disadvantages: Limited control over environmental temperatures; may lead to premature harvests in warm climates.

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8. Sampling and Trial Harvesting:

Description: Sampling a small group of fish to evaluate growth, health, and quality before harvesting the main population.

Advantages: Provides real-time feedback on readiness, reducing risk of poor-quality harvests.

Disadvantages: Labor-intensive; sampled fish may experience handling stress.

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9. Seasonal Growth Patterns:

Description: Timing harvests based on natural growth cycles that align with seasonal changes in temperature, daylight, and feed availability.

Advantages: Takes advantage of natural growth rates, reducing feed costs and ensuring healthy fish.

Disadvantages: Not ideal for controlled-environment systems where seasonal patterns may not affect fish as strongly.

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10. Body Composition Analysis:

Description: Measuring fat, protein, and moisture levels to determine ideal harvest time for maximum flavor, texture, and nutritional quality.

Advantages: Produces premium-quality fish tailored to consumer preferences for flavor and texture.

Disadvantages: Requires specialized equipment and expertise, adding operational costs.

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11. Economic Feed Analysis:

Description: Timing harvests when feed costs rise or when feed conversion efficiency drops, minimizing operational expenses.

Advantages: Reduces costs by optimizing harvest based on feed expenses and market conditions.

Disadvantages: Fish may be harvested before reaching ideal market size if feed prices increase unexpectedly.

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12. Photoperiod Management:

Description: Adjusting lighting in controlled environments to influence growth rates and, subsequently, harvest timing.

Advantages: Allows for precise control over growth rates and harvest timing in indoor systems.

Disadvantages: Only applicable in controlled environments with artificial lighting systems; requires energy and technology investment.

Tools commonly used in fish harvesting

- Fish harvesting tools vary based on the species, aquaculture system, and scale of operation. Here's a detailed look at various tools used in fish harvesting on aquaculture farms:
- **1. Seine Nets**

- **Description**: Seine nets are large, rectangular nets with weights along the bottom edge and floats along the top edge. They are dragged through the water, surrounding a group of fish, which are then pulled in for harvesting.
- **Application**: Commonly used in ponds, lakes, or large tanks to capture a large number of fish in one go.
- **Advantages**: Efficient for large-scale harvests and can be used in both small and large water bodies.
- **Disadvantages**: May cause stress or injury to fish if not handled carefully, and can be challenging to use in heavily vegetated or debris-filled waters.

Tools commonly used in fish harvesting

1. Seine Nets:

Description: Large nets with weights along the bottom and floats along the top, typically dragged through the water to encircle and capture fish.

Use: Ideal for ponds, lakes, and large tanks where a significant number of fish are harvested at once.

Advantages: Highly efficient for mass harvesting.

Disadvantages: Can cause stress or injury to fish if not used carefully and may be difficult to operate in waters with heavy vegetation or debris.

Tools commonly used in fish harvesting

2. Cast Nets:

Description: Circular nets with weights around the edge, thrown by hand to capture fish as the net closes around them when pulled.

Use: Best for smaller areas or shallow waters with lower fish densities.

Advantages: Easy to use and suitable for selective harvesting.

- **Disadvantages**: Limited to shallow waters; requires skill to throw effectively.

Tools commonly used in fish harvesting

3. Lift Nets:

Description: A net attached to a frame and lowered into the water; fish swim over the net, which is then lifted to capture them.

Use: Commonly used in smaller aquaculture systems or tanks.

Advantages: Minimal fish stress and allows for selective harvesting.

Disadvantages: Only suitable for small to medium-sized harvests.

Tools commonly used in fish harvesting

4. Traps and Fish Baskets:

Description: Containers or enclosures that allow fish to enter but make exit difficult, often baited to attract fish.

Use: Effective in ponds or natural water bodies where fish are free to roam.

Advantages: Fish are captured alive with minimal stress.

Disadvantages: Limited by the number of traps and the size of the fish; may take time to capture enough fish.

Tools commonly used in fish harvesting

5. Hand Nets (Dip Nets):

Description: Small nets with a handle, manually used to scoop fish from tanks or ponds.

Use: Ideal for selective harvesting or handling individual fish.

Advantages: Allows for precise selection and minimal stress to individual fish.

Disadvantages: Not practical for large-scale harvesting due to its manual nature

Tools commonly used in fish harvesting

6. Grading Baskets or Boxes:

Description: Containers with perforations or slots that allow smaller fish to escape while larger ones are retained.

Use: Useful in grading fish by size during harvest, particularly in tanks or cages.

Advantages: Ensures uniformity in fish size, which can be advantageous for market requirements.

Disadvantages: Limited to size grading; may be labor-intensive if grading is required on a large scale.

Tools commonly used in fish harvesting

7. Pumps:

Description: Mechanical pumps that move fish from one location to another, often using water to keep fish alive and minimize stress.

Use: Common in large operations where fish are transferred from one tank to another or from a tank to a holding area.

Advantages: Fast and efficient, with minimal handling stress on fish.

Disadvantages: Requires power and careful monitoring to prevent fish injury.

Tools commonly used in fish harvesting

8. Fish Harvesting Bags:

Description: Large mesh bags placed in the water to corral and contain fish during harvesting.

Use: Suitable for pond and cage culture to collect and hold fish in the water while sorting or grading.

Advantages: Reduces fish handling stress by keeping fish in water during harvest.

Disadvantages: Limited to relatively calm waters and may require multiple bags for large-scale operations.

Tools commonly used in fish harvesting

9. Siphon Tubes:

Description: Long tubes used to create a water flow that gently pulls fish through into another area or a holding tank.

Use: Commonly used in indoor aquaculture systems or recirculating aquaculture systems (RAS) where minimal stress handling is essential.

Advantages: Gentle on fish, reduces stress and potential injury.

Disadvantages: Limited to systems with manageable fish sizes and controlled environments

Tools commonly used in fish harvesting

10. Airlift Systems:

Description: Systems that use air bubbles to create lift, pushing fish up through a column to a new location or holding tank.

Use: Often used in aquaculture systems to transfer small to medium-sized fish with minimal handling.

Advantages: Fish experience minimal stress and injury; efficient for continuous harvesting.

Disadvantages: Limited to lighter fish and requires a controlled environment.

Tools commonly used in fish harvesting

11. Harvesting Cranes:

Description: Mechanical cranes fitted with baskets or nets, used to lift fish from larger tanks or ponds.

Use: Mostly used in large-scale aquaculture facilities with high fish density.

Advantages: Efficient for large-scale harvests; minimizes manual labor.

Disadvantages: High initial cost and requires trained operators; may stress fish if not done carefully.

Tools commonly used in fish harvesting

12. Electric Fish Stunners:

Description: Devices that momentarily stun fish with a mild electric current to immobilize them during harvesting.

Use: Often used in large-scale fish farms or processing plants to make handling easier and safer.

Advantages: Reduces fish movement, making it easier to handle and transport fish during harvest.

Disadvantages: Requires caution, as incorrect settings can harm fish or affect quality.

Tools commonly used in fish harvesting

13. Harvesting Tubs or Holding Tanks:

Description: Tubs or tanks filled with water, used to temporarily hold fish after harvest before transport or processing.

Use: Common across all types of aquaculture systems to reduce handling stress.

Advantages: Allows fish to remain in water, reducing stress and maintaining quality.

Disadvantages: Occupies space and requires proper oxygenation to keep fish healthy.

Tools commonly used in fish harvesting

14. Aerators:

Description: Devices that increase oxygen levels in holding tanks or tubs during and after harvest.

Use: Often added to holding tanks or temporary storage tubs to ensure fish stay oxygenated and stress-free.

Advantages: Maintains fish quality post-harvest and reduces mortality.

Disadvantages: Requires a power source; needs to be monitored to prevent overcrowding.

Tools commonly used in fish harvesting

15. Automatic Grading Machines:

Description: Machines that sort fish by size or weight automatically, used in large-scale aquaculture operations.

Use: Efficient for grading fish in large quantities before transport or sale.

Advantages: High efficiency and reduces labor costs.

Disadvantages: Expensive, with maintenance requirements; unsuitable for small-scale farms

Tools commonly used in fish harvesting

16. Fish Scoops or Shovels:

Description: Handheld tools used to scoop or lift fish, commonly used with smaller fish or fry.

Use: Primarily used in hatcheries or nurseries for transferring fry or juvenile fish.

Advantages: Simple to use and minimizes stress for small fish.

Disadvantages: Inefficient for large fish or high-density harvests.

Tools commonly used in fish harvesting

17. Weighing Scales:

Description: Precision scales used to weigh fish, often during grading or for market preparation.

Use: Essential for ensuring harvested fish meet market weight requirements.

Advantages: Ensures accurate weight tracking for pricing.

Disadvantages: Only suitable for individual or small batches; can be time-consuming in large harvests.

Methods of harvesting fish on aquaculture farms

1. Seine Netting:

Description: This method uses a large net called a seine, which is dragged through the water to encircle the fish and gather them. The net has floats on the top edge and weights on the bottom, allowing it to create a “wall” in the water that fish cannot escape.

Process: The net is deployed from one end of the pond or tank and pulled across to the other side, trapping the fish. Once the fish are encircled, the net is tightened, and the fish are guided towards a specific area where they can be collected.

Advantages: Seine netting is efficient for harvesting a large number of fish at once and can be used in both ponds and larger bodies of water.

Disadvantages: If not done carefully, seine netting can cause stress and injury to the fish, especially if they are tightly packed. Additionally, it requires trained personnel to avoid damaging the net or losing fish.

Methods of harvesting fish on aquaculture farms

2. Gill Netting:

Description: Gill nets are vertical nets that fish swim into and become entangled by their gills. These nets are generally set in the water column and can be fixed in one place or allowed to drift.

Process: The net is deployed in the pond, lake, or other aquaculture setup. Fish that attempt to swim through the net become entangled and are unable to escape.

Advantages: This method can selectively capture certain sizes of fish, depending on the net's mesh size. It is useful for catching fish of a specific size or age group.

Disadvantages: Gill netting can result in injury or stress to the fish and may not be suitable for farms where fish need to be kept alive after harvesting. It is also less efficient than other methods for large-scale harvesting.

Methods of harvesting fish on aquaculture farms

3. Trap Netting:

Description: Trap nets are designed with one or more chambers that lead fish into an enclosed area from which they cannot easily escape. This method works by directing fish into a confined space.

Process: The trap net is placed in a location where fish are likely to enter, such as near feeding areas. Once the fish enter the trap, they are guided into a chamber where they cannot find their way back out. The trap is then lifted to retrieve the fish.

Advantages: Trap nets are less stressful for the fish since they are captured in a gentler way and can often be kept alive until they are needed.

Disadvantages: Trap netting may not be as effective for large-scale harvests and may require multiple traps or more frequent collection.

Methods of harvesting fish on aquaculture farms

4. Draining and Harvesting:

Description: This method involves partially or completely draining the pond or tank where the fish are held, making it easier to collect them.

Process: The water level in the pond or tank is lowered, often by opening a drainage valve. As the water drains, the fish are forced into a smaller area, usually near the drain outlet, where they can be easily captured with nets or baskets.

Advantages: Draining allows for easy collection of fish and is useful for harvesting a large number of fish at once. It also enables cleaning and maintenance of the pond after the harvest.

Disadvantages: Draining can be time-consuming and may not be possible in larger bodies of water. It can also cause stress to the fish if they are not collected quickly.

Methods of harvesting fish on aquaculture farms

5. Hand Harvesting:

Description: In smaller-scale or artisanal aquaculture setups, fish are often harvested by hand using smaller nets, baskets, or other tools.

Process: Workers wade into the water or use boats to capture fish individually or in small groups using nets or baskets.

Advantages: Hand harvesting is gentle and allows for selective harvesting, ideal for high-value fish or small operations.

Disadvantages: This method is labor-intensive and not feasible for large-scale farms. It also requires skilled workers to avoid injury to the fish and to handle them properly.

Methods of harvesting fish on aquaculture farms

6. Cast Netting:

Description: A cast net is a circular net with weights around the edges that is thrown or “cast” over a school of fish. When pulled back, the net closes, trapping the fish inside.

Process: The cast net is manually thrown into the water, and when it sinks, the weights around the edge close the net, trapping any fish underneath. The net is then retrieved with the fish.

Advantages: Cast netting is effective for targeting small schools of fish and works well in shallow water.

Disadvantages: It requires skill and is typically used for smaller harvests. The fish can become stressed or injured if handled roughly.

Methods of harvesting fish on aquaculture farms

7. Electrofishing (Limited Use):

Description: This method uses an electric current to temporarily stun fish, making them easier to collect.

Process: An electric field is created in the water using a portable generator or an electrical probe. Fish within the electric field are momentarily stunned and float to the surface, where they can be netted.

Advantages: Electrofishing is quick and allows selective harvesting in terms of fish size or species.

Disadvantages: It is generally used only in research or regulated harvesting situations due to potential harm to the fish and the risk to handlers. It's also not suitable for fish intended for live transport or consumption immediately after harvest.

Methods of harvesting fish on aquaculture farms

- **8. Purse Seine Netting (for Large Farms)**

Description: A purse seine net encircles fish, and the bottom of the net is pulled together like a drawstring purse, trapping the fish inside.

Process: The net is deployed around a school of fish, and then the bottom is drawn closed, trapping the fish in the center. The net is then pulled in, and the fish are collected from the water.

Advantages: This is efficient for large-scale operations and allows harvesting of large quantities of fish quickly.

Disadvantages: Purse seine netting requires boats and a large crew, making it costly and complex. It can also result in stress or injury to the fish if they are tightly packed.

Methods of harvesting fish on aquaculture farms

9. Harvesting with Pumps:

Description: Some farms use pumps to transfer fish directly from the pond or tank to the sorting and processing areas.

Process: The pump creates a flow of water that transports the fish through pipes to a designated collection point. These pumps are designed to minimize stress and injury to the fish.

Advantages: Pump harvesting is efficient, especially for large tanks or raceways. It reduces handling stress and can be automated to some extent.

Disadvantages: Pumps require a significant initial investment and may not be suitable for delicate fish species or smaller operations.

Methods of harvesting fish on aquaculture farms

10. Partial Harvesting:

Description: Rather than harvesting all fish at once, partial harvesting involves removing a portion of the stock at a time.

Process: Selective nets or traps are used to capture fish of a certain size or type, allowing the remaining fish to continue growing.

Advantages: Partial harvesting allows for continuous production and optimizes yield by harvesting fish as they reach market size.

Disadvantages: It requires careful stock management and regular harvesting schedules to avoid disrupting the remaining stock.

Reference:

Adeleke, B., Robertson-Andersson, D., Moodley, G., & Taylor, S. (2020). Aquaculture in Africa: A Comparative Review of Egypt, Nigeria, and Uganda Vis-À-Vis South Africa. Reviews in Fisheries Science & Aquaculture, 29(2), 167–197. https://doi.org/10.1080/23308249.2020.1795615

Thank you.

We we will meet next week 14.