Republic of Rwanda
Ministry of Education

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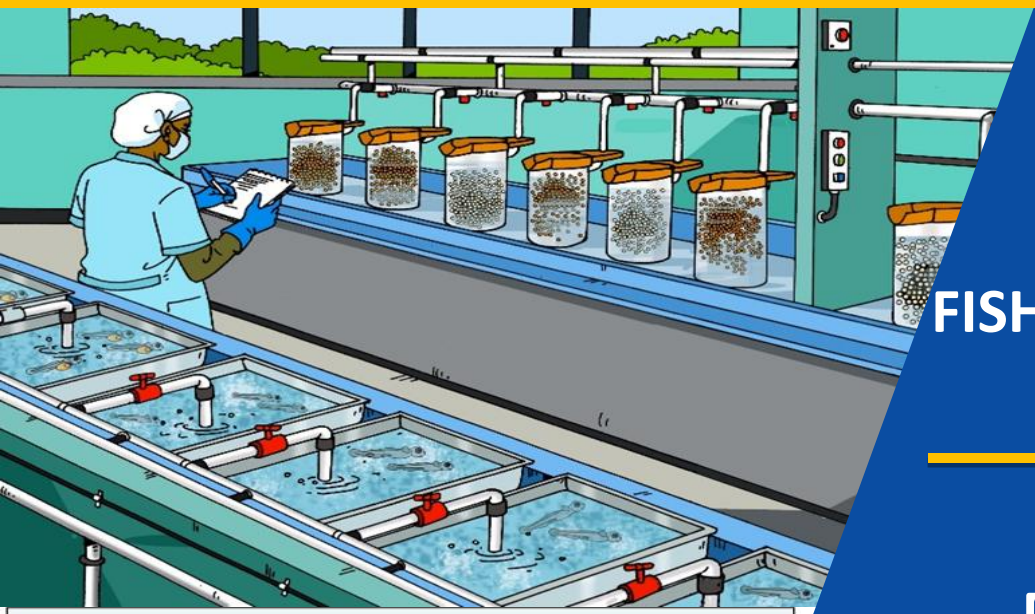
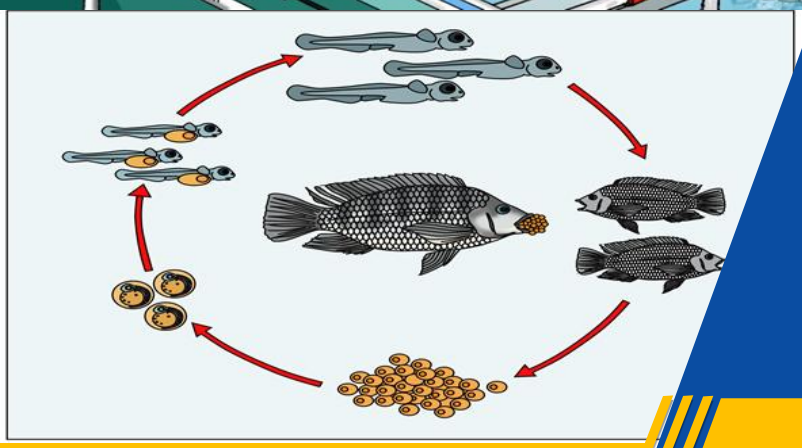
SHORT COURSE





FISH FARMING AND PROCESSING

FFPEI001

Monitoring Eggs Incubation Process

TRAINER'S MANUAL

August 2025

Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

MONITORING EGGS INCUBATION PROCESS

LUXEMBOURG AID & DEVELOPMENT

2025

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TABLE OF CONTENT

LIST OF ABBREVIATIONS AND ACRONYMS

C&D: Cleaning and Disinfection

CBA: Competency Bases Assessment

CBT: Competency Based Training

DO: Dissolved Oxygen

EE: Egg Evaluation

FCR: Feed Conversion Ratio

HSS: Hatching Stages Summary

M&E: Monitoring and Evaluation

Mg/L: Milligrams per Litre

PPE: Personal Protective Equipment

QA/QC: Quality Assurance /Quality Control

RQF: Rwanda Qualification Framework

RTB: Rwanda TVET Board

SOPs: Standard Operating Procedures

Temp: Temperature

TVET: Technical and Vocational Education and Training

INTRODUCTION

This trainer's manual encompasses all necessary skills, knowledge and attitudes required to Monitor eggs incubation process. Students undertaking this module shall be exposed to practical activities that will develop and nurture their competences. The writing process of this training manual embraced competency-based education and training (CBET) philosophy by providing practical opportunities reflecting real life situations.

The trainee's manual is subdivided into units, each unit has got various topics, you will start with a self-assessment exercise to help you rate yourself on the level of skills, knowledge, and attitudes about the unit. A discovery activity is followed to help you discover what you already know about the unit.

After these activities, you will learn more about the topics by doing different activities by reading the required knowledge, techniques, steps, procedures, and other requirements under the key facts section, you may also get assistance from the trainer. The activities in this training manual are prepared such that they give opportunities to students to work individually and in groups.

After going through all activities, you shall undertake progressive assessments known as formative and finally conclude with your self-reflection to identify your strengths, weaknesses, and areas for improvement.

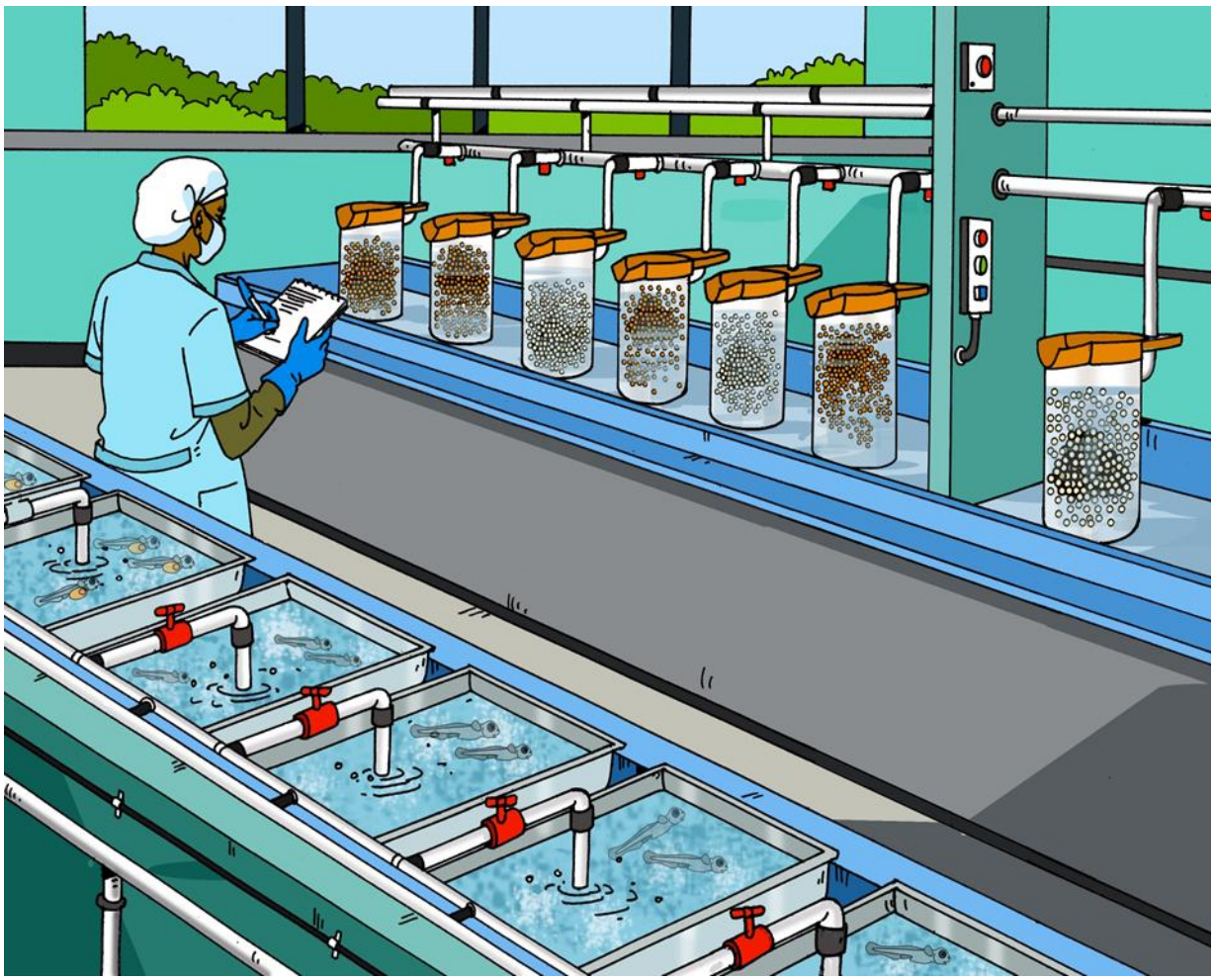
Do not forget to read the point to remember the section which provides the overall key points and takeaways of the unit.

MONITORING EGGS INCUBATION PROCESS

Learning Outcomes	Learning Hours	Topics
1. Monitor hatching stages	30HRS	1.1. Identification of the various stages of hatching conditions
		1.2. Identification of abnormalities in the hatching process
		1.3. Maintenance of hatchery environmental conditions
2. Maintain cleanliness and health	20 HRS	2.1. Removal of dead and unhatched eggs
		2.2. Cleaning and sanitizing hatching trays and equipment
		2.3. Disposal of dirty materials in accordance with biosecurity protocols.
		2.4. Monitor water quality parameters regularly and adjust to support fry health.
3. Manage hatching equipment	20 HRS	3.1. Removal of hatching trays for the major farmed species catfish/mirror carp from the tank
		3.2. Inspection of hatching trays/Jars for any signs of wear or damage and report for maintenance
		3.3. Report damaged equipment
		3.4. Ensure all equipment used are functioning properly.
4. **Monitor fry development**	30 HRS	4.1. Observe yolk sac absorption
		4.2. Monitor the survival rates

		4.3. Adjust management practices based on fry survival
		4.4. Keep accurate and detailed records of fry survival rates, and any interventions made.

LEARNING OUTCOME 1: MONITOR HATCHING STAGES



Learning outcome 1: Self-Assessment

1. Ask trainees to look at the unit illustration in their Trainee's Manuals and together discuss: What does the illustration show? What do you think will be topics to be covered under this unit based on the illustration?
2. After the discussion, inform students that this unit is intended to provide them with the knowledge, skills and attitudes to monitor hatching stages. They will cover the skills required to identify the various stages of hatching conditions, identify abnormalities in the hatching process and maintain hatchery environmental conditions.
3. Ask trainees to fill out the self-assessment at the beginning of the unit in their Trainee's Manuals. Explain that:
    a. The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.
    b. There are no right or wrong ways to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
    c. They should think about themselves: do they think they have the knowledge, skills or attitudes to do this? How well?
    d. They read the statements across the top and put a check in column that best represents their level of knowledge, skills or attitudes.
    e. At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, areas of improvement and actions to be taken.

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify different hatching stages	1. Monitor hatching stages	1. Being observant and Team work
2. Describe the key embryonic development stages	2. Categorize fish eggs based on development stage	2. Respect the developmental process
3. Identify hatchery environmental conditions	3. Maintain hatchery environmental conditions	3. Maintain focus during observations and Respect the developmental process
4. Distinguish abnormalities in hatching	4. Inspect eggs and fry for signs of abnormalities	4.Pay attention to every detail
5. Identify common abnormalities in hatching	5. Correct abnormalities	5.Pay attention to details
6. Identify types of Hatchery Equipment	6. Clean and disinfect hatchery equipment	6.Pay attention while cleaning and disinfecting hatchery equipment

Steps:

Discovery activity

Task 1

1. Using an appropriate methodology such as pair-share, large group discussion and presentation, the objective is to foster engagement and knowledge exchange among students.
2. Take students through the following steps:
    a. Firstly, organize trainees into pairs or small groups and guide them through a structured discussion about questions on task 1 in trainee's manual. Ensure active participation and understanding of instructions.
    b. Secondly, bring the trainees back together as a large group for presentations. Each pair or group should summarize their discussions, sharing insights and learnings with the class. Encourage all trainees to contribute their own experiences and reflections.
    c. Conclude the activity with feedback and reflection. Emphasize that the purpose was not to find right answers but to provide a look into trainees' scheduling of laundry roaster.
3. Introduce topic 1.1: Identification of the various stages of hatching conditions

Topic 1.1: Identification of the various stages of hatching conditions

Objectives:

By the end of the topic, trainees will be able to:

a. Define properly the term hatching as used in fish farming.

b. Identify correctly the hatching stages in fish farming. .

c. Understand properly the importance of fertilisation in fish farming.

Time Required: 6 hours.

Learning Methodology:

Group discussion, Individual work, demonstration, observation, field visit Presentation.

Materials, Tools and Equipment Needed:

✓ Mature Fish mainly Tilapia and catfish, Fish eggs of different stages, nets, scoop nets, hatching trays and jars, a simple hatching equipment with running water.

Preparation:

- ❑ Read and understand the scenario before giving it to the students
- ❑ Gather in advance tools, materials, and equipment needed to deliver the session.
- ❑ Arrange a conducive learning environment
- ❑ Make sure the trainees are dressed in the right PPEs for the right exercise

Cross Cutting Issues:

✓ **Gender balance:** Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.

✓ **Inclusive education:** Ensure inclusivity while allocating tasks to trainees and provide facilities/environment that enable/allows participation of all.

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management and

- fish disease management.

Activity 1: Problem-Solving

Task 2

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You have been employed in a medium scale aquaculture facility whose bigger operation is fish breeding using 2 species Tilapia and Catfish. In your daily hatchery management, you will be expected to identify the different stages of the hatching conditions for the two species. These stages and conditions will help you to start feeding at the right time".
2. Tell them to discuss and answer the following questions:
    1. What are the stages of hatching conditions in Tilapia?
    2. What are the stages of hatching conditions in Catfish?
    3.
    4. Which stage of hatching is feeding recommended to start?

✓ Allow 8-10 minutes for discussion.
✓ Move around the classroom to check progress and provide clarification if any.
✓ Nominate or tell the group to nominate one speaker to share the findings of the group
✓ Give 2-3 minutes per group

3. After all groups have presented, thank them and then provide the correct responses:

1) Answer: The stages of hatching conditions in Tilapia are the following: Fertilization stage, Water hardening stage, Embryonic development stage, Pre-hatching stage, Hatching stage and Post-hatching (yolk sac absorption)

2) Answer: The stages of hatching conditions in Catfish

The stages are nearly the same only that fertilisation in catfish is mostly done artificially. In Tilapia brooding is done in the mouth and this the time when embryonic development takes place.

3) Answer The different management conditions for different hatching stages are shown in the table below:

Stage	Purpose	Key Management Conditions
Broodstock Conditioning	Prepare fish for spawning	- Water temp: 27–30°C - High-protein diet - DO ≥ 5 mg/L - Healthy broodstock
Fertilization	Achieve successful fertilization	- Use clean tools (for artificial fertilization) - pH 6.5–8.0 - Immediate incubation
Egg Incubation	Support embryonic development	- Temp: 28–30°C - DO ≥ 5 mg/L - Gentle water flow - Fungal control (e.g., methylene blue)
Hatching Stage	Allow larvae to emerge from eggs	- Maintain temp and oxygen - Slightly reduce water agitation - Remove egg shells/dead larvae
Yolk Sac Larvae	Support internal feeding (no external feed yet)	- No feeding - Clean water - Gentle aeration - Avoid stress and overcrowding
Larval Rearing / First Feeding	Begin external feeding & prepare for nursery	- Feed artemia or microdiets - Feed 4–6x/day - Maintain temp - Grade to reduce cannibalism

4) **Answer** the stage of hatching is feeding recommended to start is**After yolk sac absorption.**

4. Wrap up by Highlighting key points related to the scenario:

- Identification of the key hatching stages
- The different conditions required for different hatching stages

5. After the sharing session, let trainees to the Key facts 1.1 for further enhancement.

Activity 2: Guided Practice

Task 3

1. Using an appropriate methodology such as individual work, pair-share, small group work and observations, guide trainees to carry out the activities provided under task 3 in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 1.1 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on the identification of different hatching stages and corresponding hatching conditions (task 3)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	
✓ Fertilization Stage is examined			
✓ Water Hardening Stage is examined			
✓ Pre-Hatching Stage is examined			
✓ Hatching Stage is examined			
✓ Post-Hatching Stage (Yolk Sac Absorption) is examined			
✓ Observations of each stage are recorded			

Activity 3: Application

Task 4

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 4 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
   - ✓ Locations within the school compound
   - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.

5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
   - ✓ The tasks being performed
   - ✓ Tools and equipment in use
   - ✓ Best practices and safety measures
   - ✓ The costs regarding equipment materials and their maintenance
7. After the visit, have each trainee write a report that includes:
   - ✓ An overview of the workplace
   - ✓ Key observations and experiences
   - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 1.2: Identification of abnormalities in the hatching

Objectives:

By the end of the topic, trainees will be able to:

a. Define correctly the term abnormality as used in hatching
b. Identify correctly different abnormalities in hatching.
c. Correct properly different abnormalities in hatching.

Time Required: 16hours.

Learning Methodology:

Group discussion, Individual work, demonstration, observation, field visit Presentation

Materials, Tools and Equipment Needed:

✓ Mature Fish mainly Tilapia and catfish, Fish eggs of different stages, some healthy and others with abnormalities, water parameter measuring equipment, nets, scoop nets, hatching trays and jars, a simple hatching equipment with running water.

Preparation:

- ❑ Read and understand the scenario before giving it to the trainees
- ❑ Gather in advance tools, materials, and equipment needed to deliver the session.
- ❑ Arrange a conducive learning environment
- ❑ Make sure the trainees are dressed in the right PPEs for the right exercise

Cross Cutting Issues:

✓ Gender balance: Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.

✓ Inclusive education: Ensure inclusivity while allocating tasks to trainees and provide facilities/environment that enable/allows participation of all.

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management and
- fish disease management.

Activity 1: Problem-Solving

Task 5

1) Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are an internee on one of the fish farms that also operates a hatchery nearby. The hatchery is currently incubating eggs. After 2 days, the Manager notices some abnormalities in the hatching and asks you to investigate. We have had an unusually low hatching rate and some of the eggs are floating, others have turned white and fuzzy. I want you to inspect the setup, identify what's going wrong, and suggest possible solutions. Observe the water conditions, the egg development, and anything unusual in the tanks".
2) Tell them to discuss and answer the following questions:
    1) What kind of abnormalities do you know?
    2) Why do you think the abnormalities occurred?
    3) How can you differentiate the different abnormalities?

4) How can the abnormalities be rectified?

- ✓ Allow 8-10 minutes for discussion.
- ✓ Move around the classroom to check progress and provide clarification if any.
- ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
- ✓ Give 2-3 minutes per group

3. After all groups have presented, thank them and then provide the correct responses:

1) of the following are common abnormalities: Answer: **White, cotton-like growths on eggs, Delayed or incomplete hatching, hatched fry with visible deformities or cannot swim properly (malformed Fry), Clumped eggs (eggs stick together in masses), Cloudy eggs.**

2) abnormalities occurred because:

Answer **Unfavorable water parameters, poor broodstock management, fungal infections, or improper incubation techniques**.

3) You can differentiate the different abnormalities as follow:

Answer: By looking at the colour of the eggs whereby fertilized eggs will look brown and tend to sink while unfertilized eggs look white band float. Eggs with embryo have a dark point at one edge while the one without it will tend to have a uniform colour. Eggs that are dead and infected with fungi will have a cotton like threads on them. Also by looking at the swimming abilities. In normal circumstances eggs are supposed to be evenly dispersed in the jar or tray, with an abnormality encroaching they tend to stick together a form called clumped eggs.

4) The abnormalities can be rectified as follow:

Answer: **By identifying the cause you can rectify, correct and optimize the water parameters, Follow proper hygienic conditions and biosecurity measures, practice proper broodstock management and apply antifungal agents when necessary.**

4. Wrap up by Highlighting key points related to the scenario:

- Importance of identifying key abnormalities in egg hatching and development
- Understanding the importance of water parameters in egg hatching and development

5. After the sharing session, let trainees to the Key facts 1.2 for further enhancement.

Activity 2: Guided Practice

Task 6

1. Using an appropriate methodology such as individual work, pair-share, small group work and observations, guide trainees to carry out the activities provided under task 6 in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 1.2 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on the identification of different abnormalities in hatching (task 6)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	
✓ White, cotton-like growths on eggs are identified			

✓ Delayed or incomplete hatching eggs (eggs take longer than expected or hatch partially) are identified			
✓ Hatched fry with visible deformities or cannot swim properly (malformed Fry) are identified			
✓ Clumped eggs (eggs stick together in masses) are identified			
✓ Cloudy eggs are identified			
✓ Foul smell are detected			
✓ Root causes of abnormalities are identified			
✓ Corrective measures for the identified abnormalities are implemented			

Activity 3: Application

Task 7

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 7 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound

- ✓ Local farms

4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
    - ✓ The costs regarding equipment materials and their maintenance
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 1.3: Maintenance of hatchery environmental conditions

Objectives:

By the end of the topic, trainees will be able to:

a. Describe correctly the importance of maintaining optimum hatchery environmental conditions

b. Identify correctly the different water quality tests required for proper hatchery functioning.

c. Maintain properly water flow and circulation in hatchery.

d. Maintain properly sanitation and biosecurity in hatchery

e. Maintain properly hatchery environmental conditions in fish farming

Time Required: 8 hours.

Learning Methodology:

Group discussion, Individual work, demonstration, observation, field visit Presentation.

Materials, Tools and Equipment Needed:

✓ Fish eggs of different stages, Functioning hatchery , Water parameter measuring equipment, nets, scoop nets, hatching trays and jars, Sanitation and cleaning materials and equipment.

Preparation:

- ❑ Read and understand the scenario before giving it to the trainees
- ❑ Gather in advance tools, materials, and equipment needed to deliver the session.
- ❑ Arrange a conducive learning environment

❑ Make sure the trainees are dressed in the right PPEs for the right exercise
Cross Cutting Issues: ✓ Gender balance: Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership. ✓ Inclusive education: Ensure inclusivity while allocating tasks to trainees and provide facilities/environment that enable/allows participation of all.
Prerequisites: ▸ Broodstock management and preparation, ▸ feeds and fish feeding, ▸ water parameters testing and management ▸ fish disease management.

Activity 1: Problem-Solving

Task 8

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario **"**You are a hatchery technician on one of the fish farms, over the last week, you have observed a significant decline in egg hatchability having dropped to less than 50% of the usual status. Several eggs appear cloudy, some are clumped, and a foul odour is detected near certain trays. Therefore, you decide to suspect that environmental conditions in the hatchery may be the cause and maintain the hatchery".

2. Tell them to discuss and answer the following questions:

    1) Why is it important to maintain hatchery environmental conditions?
    2) What are the major water quality test to be carried out in the hatchery?

3) List major sanitation and biosecurity procedures to be carried in the hatchery.

4) Why is light essential for maintaining suitable conditions in a hatchery?

- ✓ Allow 8-10 minutes for discussion.
- ✓ Move around the classroom to check progress and provide clarification if any.
- ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
- ✓ Give 2-3 minutes per group

3. After all groups present, thank them and then provide the correct responses:

1. The importance of maintaining hatchery environmental conditions is **to avoid stressing the fry which can cause fry mortality and making them susceptible to disease infection:**

2. The major water quality test to be carried out in the hatchery are**: Temperature, Dissolved Oxygen, pH, and Ammonia**

3. The major sanitation and biosecurity procedures to be carried in the hatchery are: **Disinfection of eggs, Keep the hatchery clean and limit entry of outsiders, Sterilize equipment and use footbaths or hand sanitizers to avoid contamination, Monitoring and record keeping.**

4. Light is essential for maintaining suitable conditions in a hatchery because: it regulates biological rhythms, supports feeding and development in larvae, enables health monitoring, and can enhance growth. Managing light properly is key to raising healthy and productive fish

4. Wrap up by Highlighting key points related to the scenario:
    - Understand the real cause of poor egg hatchability
    - Maintenance of environmental conditions to improve egg hatchability
5. After the sharing session, let trainees to the Key facts 1.3 for further enhancement.

Activity 2: Guided Practice

Task 9

1. Using an appropriate methodology such as individual work, pair-share, small group work and observations, guide trainees to carry out the activities provided under task

9 in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.

2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 1.3 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on the maintenance of hatchery environmental conditions to ensure healthy eggs and fry survival (task 9)

Indicator (Elements to be checked)	**Observation**		**Marks allocation**
	Yes	**No**	
✓ Optimum Water temperature is maintained			
✓ Optimum dissolved oxygen is maintained			
✓ Optimum pH is maintained			
✓ Ammonia and Other Nitrogenous Waste are controlled			
✓ Light is adjusted			
✓ Water Cleanliness is maintained			

✓ Records are kept			

Activity 3: Application

Task 10

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 10 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
    - ✓ The costs regarding equipment materials and their maintenance
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Formative Assessment

I. Choose the most correct answer.

1. Which of the following is a normal condition in the pre-hatch stage?

   A. Cloudy water

   B. Active embryo movement inside the egg

   C. Presence of unfertilized eggs

   D. Fungus on the eggs

2. What is the ideal dissolved oxygen (DO) level range for most freshwater fish egg incubation?

   A. 1–3 mg/L

   B. 3–5 mg/L

   C. 5–7 mg/L

   D. 7–10 mg/L

3. Which of the following is an abnormality during the hatching process?

   A. Uniform hatching times

   B. High mortality before hatch

   C. Clear egg envelopes

   D. Increased water circulation

II. Answer True or False

4. Maintaining a stable temperature is critical during the incubation and hatching stages. **True**
5. Fungal growth on eggs should be ignored as it does not affect survival rates. **False**
6. Abnormal hatching patterns may indicate poor water quality or handling stress. **True**
7. Hatching trays or jars must be cleaned and disinfected before each use. **True**

III. Short Answer Questions

8. List three common abnormalities observed during hatching and state one possible cause for each.

Any Three of the following:

No	Abnormalities	Possible causes
1	**White, cotton-like growths on eggs**	✓ Poor water quality that Supports fungal growth,

		✓ Low dissolved oxygen that weakens egg resistance, ✓ High organic matter/debris that provides a growth medium for fungi, ✓ Lack of prophylactic fungal treatment that will allow uncontrolled fungal spread ✓ Poor handling of the eggs that might damage them and allow easy fungal penetration
2	**Delayed or incomplete hatching**	✓ Poor environmental conditions, low oxygen, or early bacterial or fungal infection.
3	**Hatched fry with visible deformities or cannot swim properly**	✓ Stress, poor water conditions, or genetic issues during incubation.
4	**Clumped eggs (eggs stick together in masses)**	✓ Fungal or bacterial infections, ✓ Poor water quality like high levels of ammonia, low oxygen, unsuitable pH and Inadequate water flow or aeration ✓ Poor handling during artificial spawning or egg collection.
5	**Foul smell**	✓ Failure to timely removal of dead or decomposing eggs ✓ Fungal growth or bacterial contamination that generate foul smelling byproducts, ✓ Overcrowded eggs in the trays or incubation jars that do not allow easy water exchange and generally poor water supply.

9. Describe two key environmental parameters that must be monitored during egg incubation and explain their importance.

Answer: Temperature and Dissolved Oxygen.

The temperature of the incubation water directly influences the metabolic rate and development speed of fish embryos. Each fish species has an optimal temperature range for proper embryonic development. Too low slows growth and delays hatching; too high may cause deformities or mortality.

Dissolved Oxygen(DO) Supports embryo respiration and egg health. Poor oxygenation often results in dead eggs turning white and increasing the risk of fungal infections.

10. **Why is it important to identify different developmental stages during the hatching process?** *Each stage is characterized by distinct physiological and morphological changes, and each requires specific environmental conditions such as optimal temperature, oxygen levels, and water quality for proper development*.

11. **What immediate action should be taken if abnormal embryo development is observed in multiple eggs?**

Step	Action
Isolate Affected Eggs	Carefully remove or separate eggs showing abnormalities (e.g., discoloration, fungus, deformation)
Assess Environmental Conditions	Check and record water temperature, dissolved oxygen (DO), pH, and ammonia levels
Increase Water Flow / Aeration	Improve circulation and oxygenation around eggs
Remove Dead or Fungus-Infected Eggs	Use egg-picking tools or siphon gently
Review broodstock and Egg Handling Practices	Assess broodstock health, egg disinfection protocols, and handling during fertilization/incubation
Apply Safe Antifungal Treatment (If Applicable)	Use approved treatments (e.g., hydrogen peroxide or formalin in correct dosage)
Document and Monitor Closely	Keep daily records and increase frequency of observations

Self-Reflection

1. Ask learners to re-take the self-assessment at the beginning of the unit. They should then fill in the table in their Trainee's Manual to Identify their areas of strength, areas for improvement and actions to take to improve.

1. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).

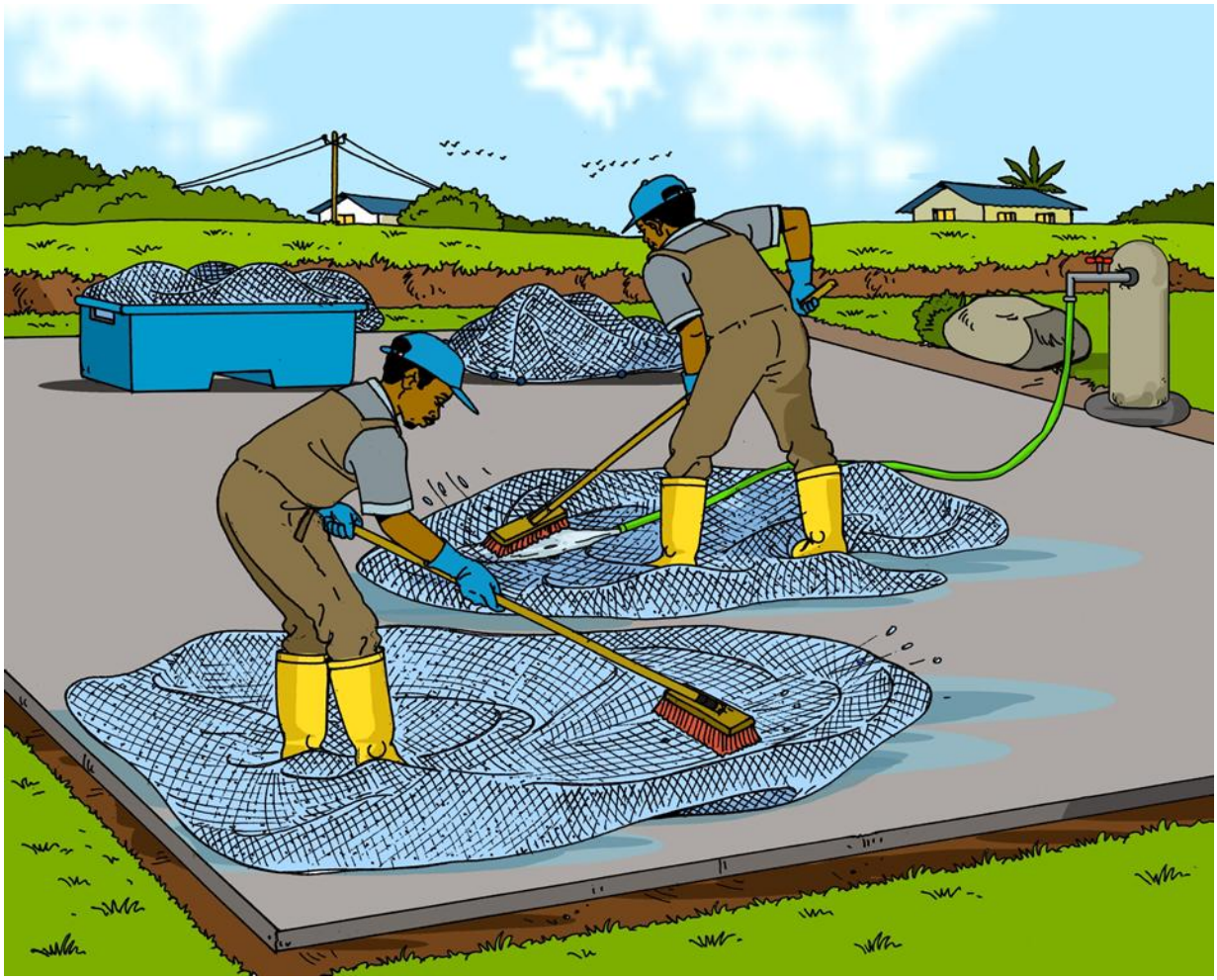
Points to Remember

- Should maintain Optimal Water Quality all through the hatching stages – Regularly check dissolved oxygen, temperature, pH, and ammonia levels to keep them within the recommended range.
- Ensure Proper Aeration – Use aerators or air stones to maintain adequate oxygen supply for eggs, fry, and fingerlings.
- Ensure proper Cleaning and Sanitizing of Tanks/Ponds – Remove excess feed, wastes, and dead organisms to prevent water pollution.
- Ensure Biosecurity and Hygiene – Use disinfectants, footbaths, and clean equipment to prevent disease introduction.

Further Information for the Trainer

Make further research about the identification of the various stages of hatching conditions, identification of abnormalities in the hatching process, and maintaining hatchery environmental conditions.

LEARNING OUTCOME 2: MAINTAIN CLEANLINESS AND HEALTH



Learning outcome 2: Self-Assessment

1. Ask trainees to look at the unit illustration in their Trainee's Manuals and together discuss:

   What does the illustration show?

   What do you think will be topics to be covered under this unit based on the illustration?

2. After the discussion, inform students that this unit is intended to provide them with the knowledge, skills and attitudes to implement learning outcome 2. They will cover the skills required to remove dead and unhatched eggs, cleaning and sanitizing hatching trays and equipment, disposal of dirty materials in accordance with biosecurity protocols monitor water quality parameters regularly and adjust to support fry health.

3. Ask trainees to fill out the self-assessment at the beginning of the unit in their Trainee's Manuals. Explain that:

   a. The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.

   b. There are no right or wrong ways to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.

   c. They should think about themselves: do they think they have the knowledge, skills or attitudes to do this? How well?

   d. They read the statements across the top and put a check in column that best represents their level of knowledge, skills or attitudes.

   e. At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, areas of improvement and actions to be taken.

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the causes and risks of dead/unhatched fry	1. Remove dead and unhatched fry/eggs	1. Being patient and carefulness while removing dead eggs and unhatched fry
2. Describe the correct cleaning agents and disinfection procedures	2. Clean and sanitize hatching trays, tools, and equipment	2. Demonstrate consistency and carefulness in maintaining hygiene standards
3. Identify waste materials	3. Disposal waste materials	3. Be attentive when removing waste materials
4. Distinguish water quality parameters and their ideal ranges for fry development	4. Monitor water parameters	4. Accuracy and attention to detail while monitoring water parameters
5. Identify the Waste water treatment methods	5. Perform the water treatment	5. Demonstrate responsibility when performing water treatment procedures to ensure water quality and protect fish health.

Steps:

Discovery activity

Task 11

1. Using an appropriate methodology such as pair-share, large group discussion and presentation, the objective is to foster engagement and knowledge exchange among students.
2. Take students through the following steps:
    a. Firstly, organize trainees into pairs or small groups and guide them through a structured discussion about questions on task 11 in trainee's manual. Ensure active participation and understanding of instructions.
    d. Secondly, bring the trainees back together as a large group for presentations. Each pair or group should summarize their discussions, sharing insights and learnings with the class. Encourage all trainees to contribute their own experiences and reflections.
    e. Conclude the activity with feedback and reflection. Emphasize that the purpose was not to find right answers but to provide a look into trainees' scheduling of laundry roaster.

Topic 2.1: Removal of dead and unhatched eggs

Objectives:

By the end of the topic, trainees will be able to:

a. Identify correctly dead and unhatched fish eggs in the incubators

b. Describe properly the removal procedures of dead and unhatched fish eggs in the incubators

c. Remove properly dead and unhatched fish eggs in the incubators

d. Dispose properly the dead and unhatched fish eggs from the incubators

Time Required: 4 hours.

Learning Methodology:

Group discussion, Individual work, observation, field visit, Presentation, Interactive presentation. Video watching.

Materials, Tools and Equipment Needed:

✓ Hatching jars/trays, Aeration stones, Filtration stones, Thermometer, PH meter, DO meter, Record book, Brushes, Mops, Brooms

Preparation:

- ❑ Read and understand the scenario before giving it to the trainees
- ❑ Gather in advance tools, materials, and equipment needed to deliver the session.
- ❑ Arrange a conducive learning environment
- ❑ Make sure the trainees are dressed in the right PPEs for the right exercise.

Cross Cutting Issues:

✓ Gender balance: Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.

✓ Inclusive education: Ensure inclusivity while allocating tasks to trainees and provide facilities/environment that enable/allows participation of all.

✓ Environmental concerns: ensure proper disposal of the waste materials respecting environmental concerns.

Prerequisites:

- Broodstock management and preparation,

- feeds and fish feeding,
- water parameters testing and management
- fish disease management.

Activity 1: Problem-Solving

Task 12

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario" You are employed at big fish hatchery where thousands of tilapia and catfish eggs are incubated each month in different systems. Recently, staff have noticed a spike in egg fungus outbreaks, cloudy water, and reduced hatch rates. Inspection reveals many unhatched and dead eggs are left in the trays too long, becoming a source of contamination that affects healthy eggs. The hatchery also lacks a standardized method for identifying and removing dead or unfertilized eggs during the incubation period".

   You are therefore requested to develop and implement a consistent system to detect and remove dead/unhatched fish eggs early to reduce contamination and improve hatch
2. Tell them to discuss and answer the following questions:
   1. Identify the dead and unhatched eggs?
   2. What are the removal procedures?
   3. What are the preventive measures?
   4. What are the dangers of overcrowding eggs in trays with minimal water exchange?
   5. Why is record keeping essential in a fish hatchery?

   ✓ Allow 10 - 15 minutes for discussion.
   ✓ Move around the classroom to check progress and provide clarification if any.
   ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
   ✓ Give 3 - 5 minutes per group
3. After all groups present, thank them and then provide the correct responses:

1. The dead and unhatched eggs are identified through regular **visual inspection and observation of changes in the egg's appearance and condition.**
2. The removal procedures are: **Prepare and disinfect tools before use, remove the dead and the unhatched fry using appropriate equipment to avoid disturbing heathy ones.**
3. The preventive measure is: **Maintenance of optimal water parameters Use of egg disinfectants, avoid overcrowding and ensure adequate water flow across egg trays.**
4. The dangers of overcrowding eggs in trays with minimal water exchange are **leading to stress and poor water exchange which can further lead to mortalities.**
5. Record keeping is essential in a fish hatchery in order to **maintain high performance, and preventing disease outbreaks. Monitoring dead and unhatched eggs through consistent documentation allows hatchery Managers to make informed, data-driven decisions.**

4. Wrap up by Highlighting key points related to the scenario:
    - Dangers of leaving dead and unhatched eggs in the trays and jars for a long time
    - Proper identification of dead, unhatched and infected eggs.
    - Importance of record keeping in a fish hatchery
5. After the sharing session, let trainees to the Key facts 2.1 for further enhancement.

Activity 2: Guided Practice

Task 13

1. Using an appropriate methodology such as individual work, pair-share, small group work and observations, guide trainees to carry out the activities provided under task 9 in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide

support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.

3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 2.1 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on the maintenance of hatchery environmental conditions to ensure healthy eggs and fry survival (task 13)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	
✓ Dead and unhatched fish eggs are identified.			
✓ Dead and unhatched fish eggs are removed			
✓ Right procedures to remove the dead and unhatched are respected			
✓ The dead and unhatched fish eggs are disposed properly.			
✓ The tools to be used are disinfected before use			

Activity 3: Application

Task 14

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 14 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
    - ✓ The costs regarding equipment materials and their maintenance
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 2.2: Cleaning and sanitizing hatching trays and equipment

Objectives:

By the end of the topic, trainees will be able to:

a) Describe clearly the objectives of cleaning and sanitising hatching trays, jars and other equipment.

b) Identify properly the required materials and equipment used in cleaning and sanitising in fish hatchery.

c) Implement properly the cleaning and sanitising procedures of the materials and equipment in the fish hatchery

d) Clean properly the hatching trays and equipment used in fish hatchery

e) Sanitize hatching trays and equipment used in fish hatchery

Time Required: 6 hours.

Learning Methodology:

Individual work, Field visit, Practical, Observation, Video watching, Demonstration Group work.

Materials, Tools and Equipment Needed:

✓ Cleaning brushes,Scoop nets,Scrappers ,Cleaning pads,Aeration stones,Thermometer,PH meter,DO meter,Plastic bucket,PPE,Siphoning tube, Record books,Detergents,Disinfectants, Weighing scales, Oxygenated tank,Pressure cleaner.

Preparation:

❑ Read and understand the scenario before giving it to the trainees

❑ Gather in advance tools, materials, and equipment needed to deliver the session.

❑ Arrange a conducive learning environment

	❑ Make sure the trainees are dressed in the right PPEs for the right exercise.
	Cross Cutting Issues: ✓ Gender balance: Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership. ✓ Inclusive education: Ensure inclusivity while allocating tasks to trainees and provide facilities/environment that enable/allows participation of all. ✓ Environmental concerns: ensure proper disposal of the waste materials respecting environmental concerns
	Prerequisites: ▸ Broodstock management and preparation, ▸ feeds and fish feeding, ▸ water parameters testing and management ▸ fish disease management.

Activity 1: Problem-Solving

Task 15

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario "You are a technician at a freshwater fish hatchery, the hatchery has recently experienced a spike in egg mortality and fungal outbreaks in the hatching trays. The Manager suspects the issue may be related to improper cleaning and sanitization of equipment such as egg trays, incubation jars, siphon hoses, and egg graders. Despite routine cleaning, egg fungus and bacterial infections are spreading rapidly in certain batches. As the technician in charge of the hatchery, you're asked to identify the root cause and implement corrective actions to restore healthy hatchery conditions".
2. Tell them to discuss and answer the following questions:

1. Explain the objective of cleaning and sanitizing hatching trays and equipment.
2. What are the main types of disinfectants used in a fish hatchery?
3. Identify steps for cleaning procedures
4. Explain why you have to do quality control in the hatchery.

- ✓ Allow 8-10 minutes for discussion.
- ✓ Move around the classroom to check progress and provide clarification if any.
- ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
- ✓ Give 2-3 minutes per group

3. After all groups have presented, thank them and then provide the correct responses:
    1. The objective of cleaning and sanitizing hatching trays and equipment are:
    a) to eliminate harmful microorganisms such as Saprolegnia, Aeromonas, Pseudomonas, and other bacteria, fungi, or parasites
    b), create a clean, healthy environment to support proper development of eggs and reduce early-stage mortality,
    c)prevent organic waste, slime, and biofilm build up on trays and equipment,
    d) stop the transfer of pathogens between different tanks, batches, or developmental stages (e.g., from dead eggs to healthy ones),
    e) meet internal protocols and external regulations or certifications for hatchery health and hygiene (e.g., HACCP, GAP, or local aquaculture guidelines),
    f) prevent corrosion, clogging, and wear on equipment such as siphons, jars, and aeration systems,
    g) reducing replacement costs,
    h) provide a stable and predictable environment for egg incubation and fry development,
    i) helping meet production targets and customer expectations,
    g) Reduce risks from mould, bacteria, or chemical exposure.
    2. The main types of disinfectants used in a fish hatchery are **: Iodine (e.g., Povidone-Iodine), Chlorine (Sodium hypochlorite), Hydrogen peroxide, Formalin (formaldehyde solution), Quaternary Ammonium Compounds (QUATs)**
    3. The steps for cleaning procedures are **Pre-cleaning. Manual cleaning, rinsing and prepare for sanitising.**
    4. Doing quality control in the hatchery is essential **for maintaining high survival rates, preventing disease outbreaks, ensuring environmental compliance, and producing high-quality fingerlings or juveniles for grow-out or sale to grow out systems. It ensures fish health and survival, maintains genetic integrity, standardizes production.**

4. Wrap up by Highlighting key points related to the scenario:
    - Understand the objectives of cleaning and sanitizing
    - Using proper materials and equipment during cleaning and sanitizing
    - Major steps that have to be followed during cleaning and sanitizing,
5. After the sharing session, let trainees to the Key facts 2.2 for further enhancement.

Activity 2: Guided Practice

Task 16

1. Using an appropriate methodology such as individual work, pair-share, small group work and observations, guide trainees to carry out the activities provided under task 9 in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 2.1 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on the cleaning and sanitizing all hatchery equipment to ensure healthy eggs and fry survival (task 16)

Indicator (Elements to be checked)	Observation	

	Yes	No	Marks allocation
✓ Hatching trays/jars are cleaned			
✓ Hatching trays/jars are sanitized			
✓ Egg-handling equipment are cleaned			
✓ Cleaning/sanitizing procedures are respected			

Activity 3: Application

Task 17

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 17 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
    - ✓ The costs regarding equipment materials and their maintenance
7. After the visit, have each trainee write a report that includes:

- ✓ An overview of the workplace
- ✓ Key observations and experiences
- ✓ Answers to questions raised during the visit

8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 2.3: Disposal of dirty materials in accordance with biosecurity protocols.

Objectives:

By the end of the topic, trainees will be able to:

a. Identify properly the waste materials in a fish hatchery

a. Describe effectively the waste collection procedures in a fish hatchery

b. Describe correctly the disposal methods of waste materials generated in a fish hatchery.

c. Disposal properly the waste materials in accordance with biosecurity protocols.

d. Record systematically the waste materials for future reference.

Time Required: 7 hours.

Learning Methodology:

Individual work, Field visit, Practical, Observation, Video watching, Demonstration Group work.

Materials, Tools and Equipment Needed:

✓ Aeration stones,Thermometer, PH meter, DO meter, Plastic bucket,PPE, Record books, Oxygenated tank,Pressure cleaner

Preparation:

- ❑ Read and understand the scenario before giving it to the trainees
- ❑ Gather in advance tools, materials, and equipment needed to deliver the session.
- ❑ Arrange a conducive learning environment
- ❑ Make sure the trainees are dressed in the right PPEs for the right exercise.

Cross Cutting Issues:

- ✓ Gender balance: Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.
- ✓ Inclusive education: Ensure inclusivity while allocating tasks to trainees and provide facilities/environment that enable/allows participation of all.
- ✓ Environmental concerns: ensure proper disposal of the waste materials respecting environmental concerns

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management
- fish disease management.

Activity 1: Problem-Solving

Task 18

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are a hatchery technician working in the morning shift, as you arrive at the station you notice a black trash bag left beside the entrance to the incubation room, containing used gloves, net covers, egg debris, and paper towels used during tray cleaning. The bag is

neither tied nor in the biohazard waste bin and its slightly leaking. You are supposed to solve the situation following strict biosecurity procedures before the Manager arrives."

2. Tell them to discuss and answer the following questions:
    1. Explain step-by-step how you would respond to this problem (waste collection procedure).
    2. Show any actions you would take to prevent contamination.
    3. Identify what biosecurity risks are present and how you would mitigate them.
    4. Describe what you would report and to whom.
    5. Suggest a way to ensure this type of issue doesn't happen again.
        - ✓ Allow 8-10 minutes for discussion.
        - ✓ Move around the classroom to check progress and provide clarification if any.
        - ✓ Nominate or tell the group to nominate one speaker to share the findings of the group.
        - ✓ Give 2-3 minutes per group.
3. After all groups have presented, thank them and then provide the correct responses:
    1. The following is a step-by-step procedure in waste collection **Stop the leakage by transferring the waste into an appropriate collection material, separate the waste accordingly and put them in designated containers, seal them and label each of them, Transport them to the disposal area and finally sanitize the place where you removed them from.**
    2. To prevent contamination, the following actions should be followed: **Clean and sanitize the place where the bag had been placed. Train staff in better handling of waste to avoid any further mistakes.**
    3. The following are the biosecurity risks present in the scenario and how they should be mitigated a) Waste should not be placed **near the hatchery entrance, leaving it exposed and keeping all the waste together without separating them.**
    4. For the issue in the scenario not to happen again, the following should be done: **Train staff, designate specific areas where waste should be stored**
4. Wrap up by Highlighting key points related to the scenario:
    1. Importance of separating waste materials
    2. Importance of following strict biosecurity procedures
5. After the sharing session, let trainees turn to the Key facts 2.3 for further enhancement.

Activity 2: Guided Practice

Task 19

1. Using an appropriate methodology such as individual work, pair-share, small group work and observations, guide trainees to carry out the activities provided under task 19 in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 2.3 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on the cleaning and sanitizing all hatchery equipment to ensure healthy eggs and fry survival (task 19)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	
✓ All waste materials are identified/collected by types			
✓ The waste materials are segregated			

✓ The waste materials are disposed			
✓ Waste collection procedures are applied.			
✓ Disposal methods of waste materials are applied.			
✓ The biosecurity measures are respected.			
✓ Waste materials are recorded.			

Activity 3: Application

Task 20

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 20 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures

- ✓ The costs regarding equipment materials and their maintenance

7. After the visit, have each trainee write a report that includes:
   - ✓ An overview of the workplace
   - ✓ Key observations and experiences
   - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 2.4: Monitor water quality parameters regularly and adjust to support fry health

	**Objectives:** By the end of the topic, trainees will be able to: a) Describe correctly the key water quality parameters to be monitored in fish farming. b) Monitor regularly the water quality parameters in fish farming c) Adjust properly the water parameters to support fry health in fish farming.
	**Time Required: 3** hours.
	**Learning Methodology:** Group discussion, brainstorming, presentation, Think-Pair-square-share, pair work, Individual work, demonstration, observation, role-play, field visit
	**Materials, Tools and Equipment Needed:** ✓ Aeration stones,Thermometer, PH meter, DO meter, Plastic bucket,PPE, Record books, Oxygenated tank,Pressure cleaner
	**Preparation:** ❑ Read and understand the scenario before giving it to the students

	❑ Gather in advance tools, materials, and equipment needed to deliver the session. ❑ Arrange a conducive learning environment ❑ Make sure the trainees are dressed in the right PPEs for the right exercise
	Cross Cutting Issues: ✓ **Gender balance:** Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership. ✓ **Inclusive education:** Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all.
	Prerequisites: ▸ Broodstock management and preparation, ▸ feeds and fish feeding, ▸ water parameters testing and management ▸ fish disease management.

Activity 1: Problem-Solving

Task 21

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are a hatchery technician monitoring eggs and fry development. Over the past 48 hours, staff have reported a gradual increase in fry mortality. The fry appears sluggish, and some are gasping at the surface. No visible signs of disease or external injuries are present. You are tasked with investigating whether water quality is the cause and recommending actions to correct the issue and protect the remaining fry."
2. Tell them to discuss and answer the following questions:
    1. Why is regular and accurate monitoring of key water quality parameters essential?

2. List the key water quality parameters that should be regularly monitored in a fish hatchery?
3. Why is it important to monitor water temperature in a hatchery?
4. How does dissolved oxygen (DO) affect fish health and development?
5. What is the safe range of nitrate concentration for fish hatcheries?
6. Distinguish two forms of ammonia.

- ✓ Allow 8-10 minutes for discussion.
- ✓ Move around the classroom to check progress and provide clarification if any.
- ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
- ✓ Give 2-3 minutes per group.

3. After all groups have presented present, thank them and then provide the correct responses:
    - Monitoring of key water quality parameters essential because **: Water quality is one of the most critical factors in ensuring the health, growth, and survival of fish in a hatchery, Poor water conditions can lead to stress, disease, low oxygen availability, and even mass mortality, especially in sensitive life stages such as eggs, fry, and fingerlings.**
    - The key water quality parameters that should be regularly monitored in a fish hatchery are Temp, Dissolved Oxygen (DO), pH, Ammonia NH_4^+ NH_3, Nitrite **Nitrite (NO_2^-),** Nitrate **(NO_3)**
    - It is important to monitor water temperature in a hatchery because **It is one of the most critical environmental parameters that affects every stage of fish development. It influences biological processes, including metabolism, respiration, immune function, digestion, and reproduction.**
    - Dissolved Oxygen (DO) affect fish health and development in the following ways:
        1. **Supports Respiration and Survival, Inadequate DO causes stress, suffocation, or death, especially in eggs, larvae, and fry which are more sensitive.**
        2. **Affects Growth and Feed Efficiency because low DO slows metabolism, leading to reduced growth and poor feed conversion. Adequate oxygen promotes faster, healthier development.**
        3. **Maintains Water Quality in that sufficient DO supports beneficial bacteria that break down fish waste, helping to prevent toxic ammonia and nitrite buildup. Reduces Disease Risk because stress from low DO weakens fish immune systems, making them more vulnerable to disease.**
        4. **Essential for Egg Incubation in that fish eggs rely on oxygen diffused through the egg membrane. Low DO can lead to embryo mortality or deformities and ensures efficient hatchery operation.**

- The safe range of nitrate concentration for fish hatcheries is **: < 50mg/L for eggs and Larvae, and < 100mg/L for Fry**
- The two forms of ammonia are distinguished as T**oxic ammonia (NH_3) that increases with higher pH and temperature and Ionized ammonia (NH_4^+) that is less harmful, but still problematic in large amounts. Even small amounts of NH_3 can damage gills, reduce immunity, and cause death especially in eggs and fry.**

4. Wrap up by Highlighting key points related to the scenario:
   - Distinguish between normal conditions and the abnormal ones,
   - That even if there are no visible disease signs abnormal presentations might indicate something wrong
5. After the sharing session, let trainees turn to the Key facts 2.4 for further enhancement.

Activity 2: Guided Practice

Task 22

1. Using an appropriate methodology such as individual work, pair-share, small group work, guide trainees to carry out the activities provided under task **22** in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.

5. After the sharing session, refer trainees to Key Facts 2.4 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on monitoring of water quality parameters (task 22)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	
✓ Key water quality parameters are monitored			
✓ Dissolved oxygen is monitored			
✓ pH is monitored			
✓ Ammonia levels are monitored			
✓ Water quality parameters are recorded			
✓ Necessary adjustments are made			

Activity 3: Application

Task 23

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 23 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms

4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
    - ✓ Cost of the materials and equipment
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Formative Assessment

I. *Choose the correct answer.* ***Answer is in Bold***

1. Which of the following is a correct practice when removing hatching trays for tilapia?
   A. Shake the tray gently to remove excess water
   B. Pull the tray quickly to avoid splashing
   C. Lift the tray slowly and steadily to avoid damaging the eggs
   D. Tip the tray upside down to remove contents

2. Which part of a hatching jar is most commonly affected by damage?
   A. The thermometer
   B. The base or outlet valve
   C. The lid
   D. The water reservoir

3. What is the best time to inspect hatching equipment for damage?
   A. Only after a batch has failed
   B. Once a month

C. Before and after each use
D. Only when a supervisor instructs you

4. Which of the following indicates that a hatching jar is functioning properly?
   A. Water is stagnant
   B. Water is circulating steadily and evenly
   C. Bubbles are forming on the sides
   D. It makes a loud noise when operating

5. What is the purpose of regularly checking temperature control devices in a hatchery?
   A. To cool the worker area
   B. To maintain optimal hatching conditions
   C. To increase water hardness
   D. To reduce humidity in the room

II. Answer the following questions with True or False

6. Functional equipment helps reduce mortality rates during the hatching process: **True**
7. You should wait until the end of the month to report damaged hatchery equipment: **False**
8. If equipment looks clean, it can be assumed to be working correctly. **False**

III. Short answer questions

9. What are the correct procedures for removing hatching trays?

   Answer: Lift trays slowly and steadily from the incubation tank, Allow any remaining fry to swim out naturally or use a gentle stream of water to encourage exit. Transfer fry to nursery tanks immediately using soft nets or water flow systems. Place removed trays on a clean surface or directly into a designated cleaning area.

10. List the parts of a hatching jar that must be regularly inspected for wear and tear.

    Answer: The lid, the bottom and the place where the jar or tray is connected to water

11. Describe how improper maintenance of trays/jars could impact hatchling survival.

    Answer: Improper maintenance can lead to contamination of jars or trays which can in turn bring in diseases that would lead to egg/fry mortalities. It can also lead to blockages or leaking thus reducing oxygen supply

12. What information should be included in a maintenance report for damaged hatchery equipment?

Answer: **Date and time of inspection, Equipment ID/Location, Detailed description of damage or concern (Hairline crack near outflow valve): Photographs, if possible, Urgency level (Low, Moderate, Urgent), Inspector's name and signature.**

Self-Reflection

1. Ask learners to re-take the self-assessment at the beginning of the unit. They should then fill in the table in their Trainee's Manual to Identify their areas of strength, areas for improvement and actions to take to improve.
2. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).

Points to Remember

- **Dead and unhatched eggs** can decay and promote **fungal and bacterial growth** and that they should be removed on a daily basis
- Use appropriate cleaning methods and **approved sanitizers** (e.g., chlorine, iodine) and rinse thoroughly.
- Follow hatchery **biosecurity plans** to prevent spread of disease between systems.
- Train all staff on **safe handling and disposal procedures**.
- **Hygiene and environmental control are the first line of defense against disease.**

Further Information for the Trainer

Make further research about the removal of dead and unhatched eggs, cleaning and sanitizing hatching trays and equipment, disposal of dirty materials in accordance with biosecurity protocols and regular monitoring of water quality parameters and their adjustment to support fry health.


BROKEN
BROKEN
BROKEN

Learning outcome 3: Self-Assessment

1. Ask trainees to look at the unit illustration in their Trainee's Manuals and together discuss:

   What does the illustration show?

   What do you think will be topics to be covered under this unit based on the illustration?

1. After the discussion, inform students that this unit is intended to provide them with the knowledge, skills and attitudes to put the learning outcome 3. They will cover the skills required to Removal of hatching trays for the major farmed species catfish/tilapia or common carp, Inspection of hatching trays/Jars for any signs of wear or damage and report for maintenance, Report damaged equipment, ensure all equipment used are functioning properly.
2. Ask trainees to fill out the self-assessment at the beginning of the unit in their Trainee's Manuals. Explain that:
   a. The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.
   b. There are no right or wrong ways to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
   c. They should think about themselves: do they think they have the knowledge, skills or attitudes to do this? How well?
   d. They read the statements across the top and put a check in column that best represents their level of knowledge, skills or attitudes.
   e. At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, areas of improvement and actions to be taken.

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe common types of wear and damage found in trays or jars	1. Inspect trays and jars	1. Show diligence and consistency when inspecting trays or jars for signs of damage
2. Identify standard procedures for the removal of hatching trays and jars	2. Remove hatching trays and jars	2. Demonstrate care and responsibility when handling trays and jars hatching equipment
3. Identify labeling methods	3. Label damaged equipment to prevent further use until repaired	3. Maintain honesty and thoroughness when labeling/logs damaged equipment
4. Understand checking procedures of hatchery equipment	4. Check functionality of equipment before and after use.	4. Take initiative to report even minor issues that could lead to major equipment failure
5. Identify the correct procedure for reporting damaged hatchery equipment	5. Prepare report of damaged equipment	5. Value accurate reporting and understand its importance in ensuring timely maintenance

Steps:

Discovery activity

Task 24

1. Using an appropriate methodology such as pair-share, large group discussion and presentation, the objective is to foster engagement and knowledge exchange among students.
2. Take students through the following steps:
   a. Firstly, organize trainees into pairs or small groups and guide them through a structured discussion about questions on task 24 in trainee's manual. Ensure active participation and understanding of instructions.
   b. Secondly, bring the trainees back together as a large group for presentations. Each pair or group should summarize their discussions, sharing insights and learnings with the class. Encourage all trainees to contribute their own experiences and reflections.
   c. Conclude the activity with feedback and reflection. Emphasize that the purpose was not to find right answers but to provide a look into trainees' scheduling of laundry roaster.

Topic 3.1: Removal of hatching trays for the major farmed species from the tank

Objectives:

By the end of the topic, trainees will be able to:

a) Identify properly the importance of removing hatching trays

b) Understand correctly the best timing for the removal of hatching trays for the different farmed species.

c) Describe correctly the removal and cleaning techniques for the hatching trays.

d) Remove properly the hatching trays for the major farmed species from the tank

Time Required: 5 hours.

Learning Methodology:

Individual work, Field visit, Practical, Observation, Video watching, Demonstration Group work.

Materials, Tools and Equipment Needed:

✓ Aeration stones, Plastic bucket,PPE, Record books, Oxygenated tank,Pressure cleaner Cleaning brushes,Scrappers ,Cleaning pads,Aeration stones, Record books,Detergents,Disinfectants,

Preparation:

- ❑ Read and understand the scenario before giving it to the students
- ❑ Gather in advance tools, materials, and equipment needed to deliver the session.
- ❑ Arrange a conducive learning environment
- ❑ Make sure the trainees are dressed in the right PPEs for the right exercise

Cross Cutting Issues:

✓ **Gender balance:** Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.

✓ **Inclusive education:** Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all.

✓ **Environmental concerns:** ensure proper disposal of the waste materials respecting environmental concerns.

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management
- fish disease management.

Activity 1: Problem-Solving

Task 25

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are part of a hatchery team managing a new batch of tilapia and catfish eggs placed in hatching trays nearing the incubation period. This morning, your supervisor asks your team to remove the hatching trays in preparation for the fry transfer. While removing them, you realise that some trays feel stuck or heavy, a few trays have eggs that haven't hatched yet, worst of all a team member starts removing trays without turning off the water flow, causing fry to be flushed out of the tray prematurely and you realize there is no clear labeling on some trays. You must act quickly to prevent fry loss, minimize stress or injury, and ensure the proper handling of the trays and hatchlings.
1. Tell them to discuss and answer the following questions:
2. Why do you think that some trays were heavy?
3. What do you think will be consequence of not labelling the trays?
4. What is the consequence of removing the trays without closing the water flow system?
5. Indicate the best procedure for removing the trays ensuring safety of the fry and equipment.

✓ Allow 8-10 minutes for discussion.
✓ Move around the classroom to check progress and provide clarification if any.

- ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
- ✓ Give 2-3 minutes per group

6. After all groups have presented, thank them and then provide the correct responses:

   I. Some trays were heavy because t***hey contained some waste like dead eggs, debris or un eaten feeds.***

   II. The consequence of not labelling the trays is a likely m***ix up when removing the trays, there could be some trays not functional or need more attention before they are re used.***

   III. The consequence of removing the trays without closing the water flow system is that ***Eggs or fry could be flashed off or even other waste thus dirtying the area which can even cause disease transmission.***

   IV. The best procedure for removing the trays ensuring safety of the fry and equipment is as follows: ***Close the water supply to the incubation tray being removed, Lift trays slowly and steadily from the incubation tank. Allow any remaining fry to swim out naturally or use a gentle stream of water to encourage exit. Transfer fry to nursery tanks immediately using soft nets or water flow systems. Place removed trays on a clean surface or directly into a designated cleaning area.***

7. Wrap up by Highlighting key points related to the scenario:
   - The attitude of the supervisor of attending to every detail
   - Acting swiftly to correct the mistake a colleague had made
   - What were the steps taken to minimize fry loss, stress and injury?
8. After the sharing session, let trainees turn to the Key facts 3.1 for further enhancement.

Activity 2: Guided Practice

Task 26

1. Using an appropriate methodology such as individual work, pair-share, small group work, guide trainees to carry out the activities provided under task **26** in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.

2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 3.1 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on Removal of hatching trays for the major farmed species catfish/Tilapia from the tank (task 26)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	
✓ Removal procedure for hatching trays are applied			
✓ Cleaning techniques for hatching trays are respected			
✓ Hatching trays are disinfected			
✓ Removal procedure for hatching jars are applied			
✓ Cleaning techniques for hatching Jars are respected			
✓ Hatching Jars are disinfected			

Activity 3: Application

Task 27

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 23 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
    - ✓ Cost of the materials and equipment
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 3.2: Inspection of hatching trays/Jars for any signs of wear or damage and report for maintenance

Objectives:

By the end of the topic, trainees will be able to:

a) Understand properly the importance of daily visual inspection of the hatching equipment to ensure proper function, hygiene and integrity of the incubation system.

b) Understand properly the importance of checking and confirming the functional integrity of the hatching equipment before placing the eggs into the system.

c) Inspect properly the hatching trays/Jars for any signs of wear or damage and report for maintenance

d) Clean properly the hatching equipment after the inspection

e) Sanitize correctly the hatching equipment after the inspection

Time Required: 5 hours.

Learning Methodology:

Individual work, Field visit, Practical, Observation, Video watching, Demonstration Group work.

Materials, Tools and Equipment Needed:

✓ Aeration stones, Plastic bucket,PPE, Record books, Oxygenated tank,Pressure cleaner Cleaning brushes,Scrappers ,Cleaning pads,Aeration stones, Record books,Detergents,Disinfectants,

Preparation:

- ❑ Read and understand the scenario before giving it to the students
- ❑ Gather in advance tools, materials, and equipment needed to deliver the session.
- ❑ Arrange a conducive learning environment
- ❑ Make sure the trainees are dressed in the right PPEs for the right exercise

Cross Cutting Issues:

- ✓ **Gender balance:** Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.
- ✓ **Inclusive education:** Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all.
- ✓ **Environmental concerns:** ensure proper disposal of the waste materials respecting environmental concerns.

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management
- fish disease management.

Activity 1: Problem-Solving

Task 28

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are working the early morning shift at a commercial hatchery and you are responsible for inspecting all hatching jars in the incubation room as part of the hatchery's preventive maintenance routine. While inspecting a set of tilapia hatching jars, and you find that one jar isn't filling properly. Upon closer inspection, the water inlet appears loose, and the jar wobbles slightly in its holder. You must assess and respond to the malfunctioning tilapia hatching jar with a loose water fitting and poor stability. **Tell them to discuss and answer the following questions:**
    1. What immediate actions will you take to stabilize the situation without risking egg loss or contamination?
    2. How will you determine the cause of the malfunction?
    3. Which parts or components are most likely damaged or worn?

4. What safety and biosecurity steps should you take during this inspection and response?
5. How will you report the issue for maintenance while continuing your duties?
6. If spare parts or backup jars are not available immediately, what is your backup plan?

✓ Allow 8-10 minutes for discussion.

✓ Move around the classroom to check progress and provide clarification if any.

✓ Nominate or tell the group to nominate one speaker to share the findings of the group

✓ Give 2-3 minutes per group

2. After all groups present, thank them and then provide the correct responses:
    1. The immediate actions to take in order to stabilize the situation without risking egg loss or contamination are ***Fix properly and tightly the water inlet, check for why its wobbling in its holder and fix it too.***
    2. The cause of the malfunction will be determined through the ***inspection of the hatching Jar to determine why its leaking.***
    3. The parts or components that are most likely damaged or worn are ***the inlet part or valve and the bottom part of the Jar.***
    4. The safety and biosecurity steps to be taken during this inspection and response are to ***Check very well to see why the jar is wobbling at its base and fix it to avoid falling and cracking, measure water parameters (DO T^0, NH_4) to ascertain their levels are optimum, if there any dead or unfertilized eggs remove them immediately.***
    5. The issue for maintenance will be reported by first labelling the damaged jars, put it in the log book immediately and continue work***.***
    6. In case spare parts or backup jars are not available immediately, the backup plan will be to ***Distribute the eggs into the other jars and make sure you adjust the water flow considering that you will have increased the stocking density of the other jars.***
3. Wrap up by Highlighting key points related to the scenario:

- The attitude of the supervisor of attending to every detail
- Acting swiftly to correct the malfunction

- Record keeping monitoring.

4. After the sharing session, let trainees turn to the Key facts 3.2 for further enhancement.

Activity 2: Guided Practice

Task 29

1. Using an appropriate methodology such as individual work, pair-share, small group work, guide trainees to carry out the activities provided under task **29** in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 3.2 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on Inspection of hatching trays/Jars for any signs of wear or damage and report for maintenance (task 29)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	

✓ The cracks, wear, or damage in trays are checked/inspected			
✓ The cracks, wear, or damage in jars are checked/inspected			
✓ Trays are cleaned			
✓ Jars are cleaned			
✓ Trays are properly disinfected			
✓ Jars are properly disinfected			

Activity 3: Application

Task 30

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 30 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
    - ✓ Cost of the materials and equipment

7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 3.3: Report damaged equipment

<table>
<tr><td>  </td><td>Objectives:

By the end of the topic, trainees will be able to:

a) Identify clearly the purpose of reporting damaged equipment in fish farming
b) Use correctly the maintenance reporting log or form in fish farming
c) Understand properly the importance of tagging damaged equipment in fish farming
d) Report properly the damaged equipment in fish farming.</td></tr>
<tr><td>  </td><td>Time Required: 4 hours.</td></tr>
<tr><td>  </td><td>Learning Methodology:
Individual work, Field visit, Practical, Observation, Video watching, Demonstration
Group work.</td></tr>
<tr><td>  </td><td>Materials, Tools and Equipment Needed:
✓ Aeration stones, hatching jars and trays, Plastic bucket, PPE, Record books, Oxygenated tank,Pressure cleaner Cleaning brushes,Scrappers , Aeration stones, ,</td></tr>
<tr><td>  </td><td>Preparation:
❑ Read and understand the scenario before giving it to the students
❑ Gather in advance tools, materials, and equipment needed to deliver the session.
❑ Arrange a conducive learning environment
❑ Make sure the trainees are dressed in the right PPEs for the right exercise</td></tr>
</table>

Cross Cutting Issues:

- ✓ **Gender balance:** Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.
- ✓ **Inclusive education:** Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all.
- ✓ **Environmental concerns:** ensure proper disposal of the waste materials respecting environmental concerns.

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management
- fish disease management.

Activity 1: Problem-Solving

Task 31

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are a hatchery technician working the morning shift. While preparing the incubation jars for the next batch of fish eggs, you notice that one jar has a fine vertical crack running down the side. The hatchery is on a tight schedule and eggs are arriving soon and there are no extra jars readily available on the shelf and you are expected to have everything ready before they return".
2. Tell them to discuss and answer the following questions:
    I. What are the immediate risks of using the jar as it is?
    II. How would you report the damage considering the limited time you have?
    III. What steps can you take to prevent disruption to the hatchery's schedule?
    IV. What alternatives could you explore to replace or work around the damaged jar?

✓ Allow 10 - 15 minutes for discussion.

- ✓ Move around the classroom to check progress and provide clarification if any.
- ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
- ✓ Give 3 - 5 minutes per group

3. After all groups have presented, thank them and then provide the correct responses:

    - The immediate risks of using the jar as it is that it ***might slowly leak losing water and thus oxygen leading to stress and possibly death of some eggs***
    - Considering the limited time reporting this damage should be by ***Immediately recording it in the logbook and use the available fastest means of communication (Internet, WhatsApp or even calling the concerned.***
    - In order to prevent disruption to the hatchery's schedule, report and follow up for immediate repair as the damage looks simple most likely doesn't require replacement.
    - The alternatives to explore in order to replace or work around the damaged jar is to review stocking densities to use the available jars, close off the supply to the and allow water to flow to other jars.

4. Wrap up by Highlighting key points related to the scenario:

    - The attitude of the supervisor of attending to every detail
    - Acting swiftly to correct the malfunction
    - Record keeping monitoring.

5. After the sharing session, let trainees turn to the Key facts 3.3 for further enhancement.

Activity 2: Guided Practice

Task 32

1. Using an appropriate methodology such as individual work, pair-share, small group work, guide trainees to carry out the activities provided under task **32** in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.

2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 3.3 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on Inspection of hatching trays/Jars for any signs of wear or damage and report for maintenance (task 32)

Indicator (Elements to be checked)	**Observation**		**Marks allocation**
	Yes	**No**	
Damaged Equipment Record Sheet is properly completed			
✓ Hatchery name is mentioned			
✓ Department/ section is mentioned			
✓ Inspector's name is mentioned			
✓ Date/time of inspection is mentioned			
✓ ID of the damaged equipment is mentioned			
✓ Description of damage is stated			
✓ Photo of damaged equipment is attached			
✓ Urgency level is mentioned			

✓ Recommendations are stated			

Activity 3: Application

Task 33

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 30 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
    - ✓ Cost of the materials and equipment
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.

9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 3.4: Ensure all equipment used are functioning properly.

	**Objectives:** By the end of the topic, trainees will be able to: a) Understand clearly the importance of using a pre-use equipment checklist in a fish hatchery b) Understand clearly the importance on the use of a post-use equipment checklist in a fish hatchery c) Describe correctly the elements to be checked for pre and post-use checklists in a fish hatchery d) Prevent properly the physical damages of equipment in a fish hatchery e) Maintain properly the inventory log of stored equipment in a fish hatchery
	**Time Required: 6** hours.
	**Learning Methodology:** Individual work, Field visit, Practical, Observation, Video watching, Demonstration Group work.
	**Materials, Tools and Equipment Needed:** ✓ Aeration stones, hatching jars and trays, Plastic bucket, PPE, Record books, Oxygenated tank,Pressure cleaner Cleaning brushes,Scrappers , Aeration stones, ,
	**Preparation:** ❑ Read and understand the scenario before giving it to the students ❑ Gather in advance tools, materials, and equipment needed to deliver the session. ❑ Arrange a conducive learning environment ❑ Make sure the trainees are dressed in the right PPEs for the right exercise
	Cross Cutting Issues: ✓ **Gender balance:** Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership. ✓ **Inclusive education:** Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all.

✓ **Environmental concerns:** ensure proper disposal of the waste materials respecting environmental concerns.

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management
- fish disease management.

Activity 1: Problem-Solving

Task 34

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: “You are a hatchery technician assigned to prepare the incubation room for a large batch of fish eggs scheduled to arrive in a few hours. During your prior check before allowing in eggs, you notice that the water flow to one row of incubation jars is inconsistent, some jars are receiving less flow than others, and one isn’t receiving any flow at all. You are unsure whether it's a blocked line, a faulty valve, or an issue with the pump system. Part of your duty is to ensure all equipment is functioning properly”.
2. Tell them to discuss and answer the following questions:
   a) What is your immediate action?
   b) How will you troubleshoot the equipment to identify the problem?
   c) What temporary solutions can you apply to avoid delaying egg loading?
   d) How will you communicate the issue and ensure it is resolved properly after the immediate fix?
   e) How will you document what happened for future reference or follow-up?

✓ Allow 10 - 15 minutes for discussion.

✓ Move around the classroom to check progress and provide clarification if any.

✓ Nominate or tell the group to nominate one speaker to share the findings of the group

✓ Give 3 - 5 minutes per group

3. After all groups have presented, thank them and then provide the correct responses:
    - The immediate action is to ***Check for what is blocking water flow into the jars starting with the one that is receiving nothing, check if there is any constriction of the supply pipe along the whole line***.
    - Troubleshooting the equipment to identify the problem involve ***Inspecting the main supply line, Inspect the Manifold or Distribution Pipe, Inspect each jar independently by removing and inspect the inlet tubing or valves going to each jar. Look for Kinks or Pinches in Tubing by carefully running your hand along the tubing lines to detect any bends or kinks restricting flow. Reconnect and test each jar independently before joining and running the whole system.***
    - The temporary solutions to avoid delaying egg loading will involve ***moving the affected jars to a fully operational water line or incubation row to ensure they receive proper flow. Quickly inspect and clear the inlet screen, tubing, or valve of the jar not receiving flow. Bypass the Manifold or Tubing Blockage by using spare tubing to create a direct bypass from a working line to the affected jar(s).***
    - Communicating the issue and ensuring it is resolved properly after the immediate fix will include ***Writing it in the log book and monitor closely to have it fixed***
    - Documentation of what happened for future reference or follow-up will involve ***Putting it in log book and train staff on better handling of equipment***

4. Wrap up by Highlighting key points related to the scenario:
    - The attitude of the supervisor of attending to every detail
    - Acting swiftly to correct the malfunction
    - Record keeping monitoring.
5. After the sharing session, let trainees to the Key facts 3.4 for further enhancement.

Activity 2: Guided Practice

Task 35

1. Using an appropriate methodology such as individual work, pair-share, small group work, guide trainees to carry out the activities provided under task **35** in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to Key Facts 3.4 and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the task on Inspection of hatching trays/Jars for any signs of wear or damage and report for maintenance (task 35)

Indicator (Elements to be checked)	**Observation**		**Marks allocation**
	Yes	**No**	
✓ Power & Functionality are checked			
✓ Water Flow & Circulation are checked			
✓ Aeration System is checked			
✓ Water Quality Tools are checked			
✓ Sanitation is checked			
✓ Physical Condition is checked			

Activity 3: Application

Task 36

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 30 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
    - ✓ Cost of the materials and equipment
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Formative Assessment

Choose the most correct answer.

What is the primary reason for removing dead or unhatched eggs from hatching trays?

A. To reduce feeding costs

B. To avoid water circulation issues

C. To prevent fungal spread and maintain water quality

D. To make space for more eggs

1. How often should hatching equipment be cleaned and sanitized during the hatching cycle?

   A. Only after the cycle ends

   B. Once a week

   C. Before and after each cycle, and as needed during

   D. Only when contamination is visible

2. Which of the following materials must be disposed of according to biosecurity protocols?

   A. Healthy fry

   B. Filtered water

C. Dead fry, unhatched eggs, and waste materials

D. Oxygen tanks

3. Low dissolved oxygen (DO) levels can result in:

A. Faster growth

B. Enhanced water clarity

C. Fry mortality and stress

D. Increased appetite

Answer True or False

5. Dead eggs left in the tank do not affect healthy fry development.
6. Using the same net or equipment across multiple tanks increases disease risk.
7. Monitoring pH and ammonia levels helps protect fry health.

Section C: Short Answer Questions

8. Name three water quality parameters that should be monitored to ensure fry health and explain why each is important.
9. What steps should be followed when disposing of contaminated waste in a hatchery?
10. Why is it important to sanitize equipment between different hatching batches?

Section D: Practical Scenario

Scenario:

You are monitoring a batch of eggs in a hatching tray. After 48 hours, you observe that a number of eggs have turned white and some fungus is developing. The water smells slightly foul, and oxygen levels are measured at 3.2 mg/L.

Questions:

14 . What immediate steps should you take to restore cleanliness and protect fry health?

15. How might low DO levels be contributing to the issue?

16. After taking action, how would you prevent the issue from recurring in the next batch?

Self-Reflection

1. Ask learners to re-take the self-assessment at the beginning of the unit. They should then fill in the table in their Trainee's Manual to Identify their areas of strength, areas for improvement and actions to take to improve.

2. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).

Points to Remember

- Dead and unhatched eggs can decay and promote fungal and bacterial growth and should always be removed
- Important to keep records so as to closely monitor and respond to defaulties and abnormalities on time.
- Dirty Materials disposal should be in Accordance with Biosecurity Protocols
- Use sealed biohazard containers or compost pits approved by local regulations.
- Never discard waste near live tanks or natural water sources.

Further Information for the Trainer

Make further research about the removal of hatching trays for the major farmed species catfish/tilapia or common carp from the tank, inspection of hatching trays/Jars for any signs of wear or damage and report for maintenance, report damaged equipment and ensure all equipment used are functioning properly.

LEARNING OUTCOME 4: MONITOR FRY DEVELOPMENT

Learning outcome 4: Self-Assessment

Ask trainees to look at the unit illustration in their Trainee's Manuals and together discuss:

What does the illustration show?

What do you think will be topics to be covered under this unit based on the illustration?

3. After the discussion, inform students that this unit is intended to provide them with the knowledge, skills and attitudes to Monitor Fry Development. They will cover the skills required to Observe yolk sac absorption, Monitor the survival rates, Adjust management practices based on fry survival and Keep accurate and detailed records of fry survival rates, and any interventions made.

Ask trainees to fill out the self-assessment at the beginning of the unit in their Trainee's Manuals. Explain that:

a. The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.

b. There are no right or wrong ways to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.

c. They should think about themselves: do they think they have the knowledge, skills or attitudes to do this? How well?

d. They read the statements across the top and put a check in column that best represents their level of knowledge, skills or attitudes.

e. At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, areas of improvement and actions to be taken.

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe the developmental stages of fry	1. Determine developmental stages of fry	1. Attention to details
2. Understand fish biology and behaviour	2. Adjust hatchery management practices	2. Analytical mindset while adjusting hatchery management practices
3. Identify survival rates	3. Monitor the survival rates	3. Be accurate and consistent
4. Interpret reporting forms/logs template	4. Prepare report	4. Attention to details when preparing report
5. Understand the reasons for accurate & detailed records keeping in a hatchery	5. Keep records of fry survival rates, and any interventions made	5. Be accurate and confidential when keeping records

Steps:

Discovery activity

Task 36

1. Using an appropriate methodology such as pair-share, large group discussion and presentation, the objective is to foster engagement and knowledge exchange among students.
2. Take students through the following steps:
    a. Firstly, organize trainees into pairs or small groups and guide them through a structured discussion about questions on task 24 in trainee's manual. Ensure active participation and understanding of instructions.
    b. Secondly, bring the trainees back together as a large group for presentations. Each pair or group should summarize their discussions, sharing insights and learnings with the class. Encourage all trainees to contribute their own experiences and reflections.
    c. Conclude the activity with feedback and reflection. Emphasize that the purpose was not to find right answers but to provide a look into trainees' scheduling of laundry roaster.

4. Topic 4.1: Observing yolk sac absorption

Objectives:

By the end of the topic, trainees will be able to:

a. Describe properly the purpose of observing yolk sac absorption.
b. Use properly the temperature – growth relationship chart.
c. Describe correctly the importance of the following visual inspection, use of magnifying glass or microscope, backlighting technique, behavioural

observation and water testing and observation in monitoring fry development.

d. Observe properly the yolk sac absorption in fish hatchery

Time Required: 6 hours.

Learning Methodology:

Group discussion, brainstorming, presentation, Think-Pair-square-share, pair work, Individual work, demonstration, observation, role-play, field visit

Materials, Tools and Equipment Needed:

Hatching jars and trays, Plastic bucket, PPE, Record books, Oxygenated tank,ure cleaner , Aeration stones, feeds, Water parameter measuring equipment, Magnifying glass or microscope.

Preparation:

Read and understand the scenario before giving it to the students

Gather in advance tools, materials, and equipment needed to deliver the session.

Arrange a conducive learning environment

Cross Cutting Issues:

Gender balance: Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.

Inclusive education: Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all.

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management

- fish disease management.

Activity 1: Problem-Solving

Task 37

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are a hatchery technician working with a batch of recently hatched tilapia fry. According to the hatchery schedule, the fry were expected to complete yolk sac absorption and reach the swim-up stage within 3–4 days after hatching. It's now Day 5, and you notice that many fry still have partially absorbed yolk sacs and there is accumulation of uneaten feed at the bottom of the tanks. Your task is to investigate the cause of the delayed yolk sac absorption, prevent further problems, and recommend corrective actions".
2. Tell them to discuss and answer the following questions:
    1. What is yolk sac absorption?
    2. What is the purpose of observing yolk sac absorption?
    3. Explain why there is a difference between expected vs. actual development timelines.
    4. Explain why there is accumulation of un eaten feeds at the bottom of the tanks.
    5. Recommend appropriate corrective actions.
        - ✓ Allow 8-10 minutes for discussion.
        - ✓ Move around the classroom to check progress and provide clarification if any.
        - ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
        - ✓ Give 2-3 minutes per group
3. After all groups have presented, thank them and then provide the correct responses:
    - The yolk sac absorption is the process by which a newly hatched fish (fry) consumes the yolk sac attached to its body.
    - Observing yolk sac absorption is carried out d**etermine the readiness for first feeding, Monitor growth and development, assess hatchery conditions, Plan feeding schedules and management practices.**

- The difference between expected vs. actual development timelines is due to the fact that in **fish hatcheries, expected timelines for yolk sac absorption and larval development may differ from actual outcomes due to several biological and environmental factors. Key reasons include: Temperature fluctuations** – Development is temperature-dependent; cooler or warmer water than expected can slow or speed up absorption. **Genetic variation** – Different strains or species may develop at different rates. **Water quality** – Poor oxygen levels, pH imbalance, or toxins can delay development. **Nutrition of broodstock** – Parental health affects yolk quality and larval vitality. **Handling stress** – Excessive disturbance can disrupt normal development. These variables make it challenging to predict precise timelines, leading to gaps between expected and actual outcomes in hatchery operations.
- The accumulation of un eaten feeds at the bottom of the tanks is due to the fact that f**eeding was done before complete yolk sac absorption and the fry could not feed on the externally provided feeds when they were still using the nutrients from the yolk sac.**
- The appropriate corrective actions would include c**hecking on water parameters and adjust accordingly.**

4. Wrap up by Highlighting key points related to the scenario:
    - Ensure external feeding at the right time (after complete yolk sac absorption,
    - Clean the incubation system well before feeding
    - Adjust to optimal environmental conditions to make sure yolk sack absorption takes place within the estimated time.
5. After the sharing session, let trainees to turn to the Key facts 4.1 for further enhancement.

Activity 2: Guided Practice

Task 38

1. Using an appropriate methodology such as individual work, pair-share, small group work, guide trainees to carry out the activities provided under **task 38** in their Trainee's

Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.

2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to **Key Facts 4.1** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while assessing the absorption of the yolk sac to determine the appropriate time for external feeding (task 38)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	
✓ Larvae is observed daily at a fixed time			
✓ Yolk sac size is measured/visually compared			
✓ Yolk sac color and shape are noted (clear, normal, abnormal)			
✓ Rate of yolk sac absorption is recorded (shrinking gradually)			
✓ Time taken for full absorption is monitored (days post-hatch)			

✓ Signs of early swim-up behavior are observed			
✓ Mortality or deformities are noted			
✓ Environmental conditions are checked (temperature, oxygen)			
✓ Preparedness for first external feeding are confirmed			
✓ Remarks is provoded			

Activity 3: Application

Task 39

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on task 39 in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
7. After the visit, have each trainee write a report that includes:

- ✓ An overview of the workplace
- ✓ Key observations and experiences
- ✓ Answers to questions raised during the visit

8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 4.2: Monitor the survival rates

Objectives:

By the end of the topic, trainees will be able to:

a) Understand properly the purpose of monitoring survival rates in fish hatchery

b) Understand correctly the importance of setting benchmark targets on survival rates in fish hatchery

c) Track properly the survival rates in fish hatchery

d) Monitor correctly fry survival rate at regular intervals

e) Calculate correctly the survival rate at every stage of development

Time Required: 12 hours.

Learning Methodology:

Group discussion, brainstorming, presentation, Think-Pair-square-share, pair work, Individual work, demonstration, observation, role-play, field visit

Materials, Tools and Equipment Needed:

Hatching jars and trays, PPE, Record books, Oxygenated tank, Aeration stones, feeds, Water parameter measuring equipment,

Preparation:

	Read and understand the scenario before giving it to the students Gather in advance tools, materials, and equipment needed to deliver the session. Arrange a conducive learning environment
	Cross Cutting Issues: **Gender balance:** Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership. **Inclusive education:** Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all.
	Prerequisites: ▸ Broodstock management and preparation, ▸ feeds and fish feeding, ▸ water parameters testing and management ▸ fish disease management.

Activity 1: Problem-Solving

Task 40

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are a hatchery technician responsible for monitoring the survival rates in an intensive commercial hatchery. One morning, while checking on the records you notice a significant drop in survival rate. Your supervisor asks you to investigate the possible causes, using your knowledge and skills in monitoring survival rates".
2. Tell them to discuss and answer the following questions:
    1. How is Mortality rate calculated in the hatchery?
    2. How is survival rated calculated in a fish hatchery?
    3. Which factors could be contributing to the fry mortality?

4. How might early feeding or poor water quality affect survival?
5. What urgent actions should be taken today?
6. What changes in monitoring practices could improve future survival rates?

- ✓ Allow 8-10 minutes for discussion.
- ✓ Move around the classroom to check progress and provide clarification if any.
- ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
- ✓ Give 2-3 minutes per group

3. After all groups have presented, thank them and then provide the correct responses:

1. Mortality rate is calculated in the hatchery as follows**: Mortality rate = (Number of counted mortalities ÷ total number of stocked fry) x 100**
2. Survival rate is calculated in a fish hatchery as follows**: Survival Rate (%) = (Number of Live Fry ÷ Initial Number of Fry) × 100**
3. The factors contributing to the fry mortality are: **Anything stressful to the fry will lead to mortalities including improper environmental conditions, poor handling and disease.**
4. Early feeding or poor water quality affect survival in that: **Feeding before complete yolk sac absorption will lead to uneaten feed accumulation which can block or interfere with water circulation reducing Oxygen and increasing ammonia all these will lead to mortalities.**
5. The urgent actions that should be taken today are: **Check all environmental conditions to assess the most probable cause of mortalities and fix it immediately.**
6. The changes in monitoring practices that could improve future survival rate are**: Regularly monitoring parameters, set up a clear monitoring intervals, set benchmark targets and use properly the ready to use spreadsheets template to track survival rates.**

4. Wrap up by Highlighting key points related to the scenario:

- The proper use of records to monitor survival rates
- Implementing correctly and at the right time corrective measures to minimize mortalities

5.After the sharing session, let trainees to the Key facts 4.2 for further enhancement.

Activity 2: Guided Practice

Task 41

1. Using an appropriate methodology such as individual work, pair-share, small group work, guide trainees to carry out the activities provided under **task 41** in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to **Key Facts 4.2** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while monitoring survival rates (task 41)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	

✓ Initial Stock is recorded			
✓ Total Survivors is recorded			
✓ Survival Rate is recorded			
✓ Remarks/Corrective Actions is stated			

Activity 3: Application

Task 42

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on **task 42** in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.

9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 4.3: Adjust management practices based on fry survival

	**Objectives:** By the end of the topic, trainees will be able to: a) Analyse correctly the survival data trends in a fish hatchery b) Identify properly root causes of mortality. c) Apply correct adjustments to rearing practices based on findings. d) Set properly the performance targets correctly and track improvements
	**Time Required: 6** hours.
	**Learning Methodology:** Group discussion, brainstorming, presentation, Think-Pair-square-share, pair work, Individual work, demonstration, observation, role-play, field visit
	**Materials, Tools and Equipment Needed:** Hatching jars and trays, PPE, Record books, Oxygenated tank, Aeration stones, feeds, Water parameter measuring equipment.
	**Preparation:** Read and understand the scenario before giving it to the students Gather in advance tools, materials, and equipment needed to deliver the session. Arrange a conducive learning environment.

Cross Cutting Issues:

Gender balance: Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.

Inclusive education: Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all.

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management
- fish disease management.

Activity 1: Problem-Solving

Task 43

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are the lead technician in a freshwater fish hatchery rearing tilapia fry across multiple nursery tanks. After reviewing your weekly survival report, you notice that Tank 3 consistently shows lower survival rates (90%) compared to other tanks (98–99%). The hatchery manager asks you to investigate and recommend adjustments to current management practices to improve fry survival in Tank 3."
2. Tell them to discuss and answer the following questions:
    1. What is likely causing lower survival in Tank 3?
    2. How do the conditions differ from the other tanks?
    3. What are the steps to be taken to stabilize Tank 3?
    4. What changes would you make to prevent this in future batches?
    5. How would you monitor their effectiveness?

- ✓ Allow 8-10 minutes for discussion.
- ✓ Move around the classroom to check progress and provide clarification if any.
- ✓ Nominate or tell the group to nominate one speaker to share the findings of the group
- ✓ Give 2-3 minutes per group

3. After all groups have presented, thank them and then provide the correct responses:
    1. The likely cause of lower survival rate in Tank 3 could **be poor water quality, disease, overcrowding, or feeding errors.**
    2. The conditions difference from the other tanks is most likely that they are **having optimal environmental conditions that are facilitating higher survival rates.**
    3. The steps to be taken to stabilize Tank 3 are first **pinpoint the root cause of the mortality and adjust accordingly.**
    4. The changes to be made so as to prevent this in future batches would be to **Set performance targets, monitor closely and fix the environmental conditions divergences timely and track performance closely.**
    5. Their effectiveness are monitored by **tracking improvements closely after changes and updating standard operating procedures (SOPs) accordingly.**
4. Wrap up by Highlighting key points related to the scenario:
    - Importance of close monitoring of survival rates
    - Comparing survival rates in different systems
    - Making appropriate adjustments and monitoring improvements.

5. After the sharing session, let trainees to the Key facts 4.3 for further enhancement.

Activity 2: Guided Practice

Task 44

1. Using an appropriate methodology such as individual work, pair-share, small group work, guide trainees to carry out the activities provided under **task 44** in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.

3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.
5. After the sharing session, refer trainees to **Key Facts 4.3** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while monitoring survival rates (task 44)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	
✓ The survival data trends analysed			
✓ The root causes of mortality Identified			
✓ Adjustments to rearing practices based on findings applied.			
✓ Performance targets set and improvements tracked			

Activity 3: Application

Task 45

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on **task 45** in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees,

and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.

2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.
5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Topic 4.4 Keeping accurate and detailed records of fry survival rates, and any interventions made.

Objectives:

By the end of the topic, trainees will be able to:

a) Understand correctly the reasons for accurate and detailed record keeping in a fish hatchery.

b) Use properly the standardised forms or logs for keeping hatcheries records.

c) Understand properly the need for regular reviews and audit hatcheries records.

d) Keep accurately the details records of fry survival rates and any other interventions made in the hatcheries.

Time Required: 6hours.

Learning Methodology:

Group discussion, brainstorming, presentation, Think-Pair-square-share, pair work, Individual work, demonstration, observation, role-play, field visit

Materials, Tools and Equipment Needed:

Hatching jars and trays, PPE, Record books, Oxygenated tank, Aeration stones, feeds, Water parameter measuring equipment.

Preparation:

Read and understand the scenario before giving it to the students
Gather in advance tools, materials, and equipment needed to deliver the session.
Arrange a conducive learning environment.

Cross Cutting Issues:

Gender balance: Mix girls and boys in order to promote cross-gender interaction. Encourage both genders to take on roles of leadership.

Inclusive education: Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all.

Prerequisites:

- Broodstock management and preparation,
- feeds and fish feeding,
- water parameters testing and management
- fish disease management.

Activity 1: Problem-Solving

Task 46

1. Using various methodologies like pair-share, or small group discussions, Instruct the trainees to join their respective groups and read the following scenario: "You are working as a hatchery technician in charge of record-keeping for a batch of catfish fry reared in four nursery tanks. Two weeks into the rearing cycle, the hatchery manager notices that some data are missing, others are inconsistently recorded, compared to the actual counts during a spot-check. This discrepancy raises concerns about the reliability of the data and whether recent interventions were properly documented."
2. Tell them to discuss and answer the following questions:
    1. Why is it important to keep accurate & detailed records in a hatchery?
    2. Which information should be recorded in a fry development forms/logs?
    3. What would be the problems to be encountered in an inconsistently recorded data?

✓ Allow 8-10 minutes for discussion.
✓ Move around the classroom to check progress and provide clarification if any.
✓ Nominate or tell the group to nominate one speaker to share the findings of the group.
✓ Give 2-3 minutes per group

3. After all groups have present presented, thank them and then provide the correct responses:
    1. The importance of keep accurate & detailed records in a hatchery is to **allow hatchery managers to monitor trends, identify issues timely, make informed decisions, and meet both operational and regulatory requirements. Accurate hatchery records are a foundation for success, helping ensure fish health, operational consistency, regulatory compliance, and continuous improvement**.
    2. The table below indicates the information that should be recorded in a fry development forms/logs:

Date	Tank	Number of Fry	Dead Fry/ mortalities	Water Temp	Observations	Actions Taken

Week	Total Fry Stocked	Mortalities	Average Survival Rate	Major Issues	Management Adjustments	Notes

3. The problems to be encountered in an inconsistently recorded data are **manager's inability to track performance over time, diagnose or prevent problems, comply to regulatory requirements, take informed decisions, improve staff accountably and training nor support research and genetic improvement.**
4. Wrap up by Highlighting key points related to the scenario:
   - The need to keep accurate records on a fish farm
   - The importance of reviews and audit

5. After the sharing session, let trainees to the Key facts 4.4 for further enhancement.

Activity 2: Guided Practice

Task 47

1. Using an appropriate methodology such as individual work, pair-share, small group work, guide trainees to carry out the activities provided under **task 47** in their Trainee's Manuals. Make sure instructions are understood, all the trainees are actively participating, and necessary materials/tools are provided and being used.
2. During the task, trainees should be given a degree of independence to apply the knowledge and skills acquired in activity. Attend to each group, individual and provide support where necessary. Your role is to guide them by using probing questions such as Why? What? How? to enable them to come to informed responses.
3. While trainees are still performing the task, use this opportunity to discuss or address cross-cutting issues that may arise such as gender, inclusivity, financial education among others, even during group formation. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, guide trainees to share their answers to the class. Write their responses for reference. Encourage all trainees to give their views.

5. After the sharing session, refer trainees to **Key Facts 4.4** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.
6. Use the observation/performance checklist below while monitoring survival rates (task 47)

Indicator (Elements to be checked)	Observation		Marks allocation
	Yes	No	
Weekly log is properly completed			
✓ Total fry stocked is mentioned			
✓ Mortalities are mentioned			
✓ Average survival rate is mentioned			
✓ Major issues are stated			
✓ Management adjustments are mentioned			
✓ Notes/remakes are stated			

Activity 3: Application

Task 48

1. Using an appropriate methodology such as individual work, pairs, or small groups, trainees will read the statement provided on **task 48** in the trainees' manual and perform the task. Ensure that all instructions are clear and understood by the trainees, and encourage active participation among all students. This activity requires students to work independently with limited support from the trainer.
2. Provide necessary materials and tools for the task to be completed effectively.
3. Let the trainees Identify suitable workplaces for them or identify workplace for them, which may include:
    - ✓ Locations within the school compound
    - ✓ Local farms
4. Encourage trainees to actively observe technicians as they perform their tasks.

5. Allow trainees to participate in hands-on activities whenever possible to gain practical experience.
6. Encourage trainees to ask as many questions as possible regarding:
    - ✓ The tasks being performed
    - ✓ Tools and equipment in use
    - ✓ Best practices and safety measures
7. After the visit, have each trainee write a report that includes:
    - ✓ An overview of the workplace
    - ✓ Key observations and experiences
    - ✓ Answers to questions raised during the visit
8. Organize a session for trainees to present their reports to the class.
9. Facilitate a discussion to encourage sharing of insights and foster collaborative learning.

Formative Assessment

Choose the most appropriate answer.

1. What does full absorption of the yolk sac in fry indicate?

A. The fry are ready to be harvested

B. The fry are diseased

✓ C. **The fry are ready to begin external feeding**

D. The fry are stressed

2. Which of the following is a sign of healthy fry development?

A. Swollen yolk sacs after several days

B. High mortality after feeding begins

✓ C. **Steady survival rate and active swimming**

D. Fry sinking to the bottom with no movement

3. Why is it important to adjust management practices based on survival rates?

A. To reduce feeding effort

✓ B**. To identify and correct environmental or handling problems early**

C. To save paperwork

D. To delay growth

4. What is one reason for keeping detailed fry survival records?

A. To skip daily checks

✓ B. **To identify trends and improve future hatch cycles**

C. To avoid feeding

D. To minimize water changes

II. Answer with True or False

5.Yolk sac absorption is a reliable indicator of when to start external feeding. **True**

6. Survival monitoring is only necessary during the first day after hatching. **False**

7. Recording daily fry survival and interventions helps in decision-making. **True**

III. Short Answer Questions

8. How would you calculate the survival rate of fry in a tank that started with 2,000 fry and has 1,800 surviving after 5 days? **Answer: {Survival Rate (%) = (Number of surviving fry ÷ Number of stocked fry) × 100}**
(1,800 ÷2000) x100= 90%

9. What key details should be included in a fry survival and intervention log? **Answer: The following are key details to be included in a fry survival and intervention:** Basic data should include: **Date & Time, Tank/Pond ID** or batch number, **Species & Strain,Stocking density (fry per liter/tank) Survival data include :Initial fry count, Daily/weekly mortality count, Cumulative survival rate (%), Size/weight sampling (if applicable). Water Quality Parameters. Interventions & Actions Taken (Type of intervention (e.g., water exchange, zeolite use, antibiotics, probiotics); Date & time of intervention, Dosage or quantity used, Reason for intervention, Response/effect observed.**

IV. Practical Scenario

You are monitoring a batch of catfish fry. On Day 2, 90% still show visible yolk sacs. By Day 5, most fry are swimming actively, but the survival rate has dropped from 95% to 82%. The water temperature is slightly below the optimal range.

Questions:

10. What might be contributing to the drop in survival rate? **Answer: Most likely due to low temperature fry are stressed, initial mortalities could have clogged the holes and the water circulation has been interfered thus reduced DO. a combination of all this will lead to low survival rate.**

11. How would you record this data and intervention? **Answer: By using survival rate and intervention log**

Self-Reflection

4. Ask learners to re-take the self-assessment at the beginning of the unit. They should then fill in the table in their Trainee's Manual to Identify their areas of strength, areas for improvement and actions to take to improve.
5. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).

Points to Remember

- The yolk sac absorption should be closely monitored in order to prepare for external feeding at the right time.
- Track the number of live fry daily or at key intervals (e.g. 3, 5, 7 days post-hatch).
- Memorize the formula for the calculation of survival rate as, survival Rate (%)= (Number of surviving fry ÷ Initial stocked fry)×100
- The importance of the use of survival trends to evaluate hatchery performance and take corrective action.
- Consistent, detailed records provide a basis for **informed decision-making**

Further Information for the Trainer

Make further research about the observe yolk sac absorption, monitor the survival rates, adjust management practices based on fry survival and keep accurate and detailed records of fry survival rates, and any interventions made

Integrated/Summative assessment

Integrated situation

KWIHAZA Cooperative is a fish farm located in KAYONZA District. Recently, the cooperative purchased fry from another fish farm, but unfortunately, all the fry died. As a result, the farm manager has decided to produce their own fry to ensure a sustainable supply.

As a technician in fish farming, you are tasked with taking a key role in this initiative. You have two hours to demonstrate the following essential tasks:

1. Monitor eggs during the hatching process
2. Maintain hatchery cleanliness
3. Manage hatching equipment and fry development
4. Monitor fry development

All materials, tools and equipment are available.

Resources required for the learning outcome	
Equipment	Weighing scales, Brood stock ponds, tanks, Nursery ponds, Oxygenated tank, Pressure cleaner
Materials	Cleaning brushes, Scoop nets, Scrappers, cleaning pads, Aeration stones, Thermometer, PH meter, DO meter, Feeder, Plastic bucket, Algae scrapers, Grader, PPE, Secchi disk, Polyethylene bags, Siphoning tube
Tools	Record books, Detergents, Disinfectants, Fry feed

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	

1. Monitor hatching Stage	1.1The various stages of hatching are identified to ensure optimal conditions for fry emergence.	**Assessment indicator 1:** Hatching stages are identified			6
	1.2 Any abnormalities in the hatching process are identified, and appropriate actions are taken as needed	**Assessment indicator 2:** Abnormalities in hatching eggs are identified			6
		Assessment indicator 3: Abnormalities are corrected			6
	1.3 Environmental conditions within the hatchery are maintained for optimum hatchability	**Assessment indicator 1:** Water quality parameters are maintained			4
		Assessment indicator 2: Water flow & circulation is maintained			4
		Assessment indicator 3: Light is maintained			4
		Assessment indicator 4: Sanitation and biosecurity measures are maintained			4
		Assessment indicator 5: Eggs are handled			4
2. Maintain Cleanliness and Health	2.1 Dead and unhatched eggs are removed promptly to prevent contamination and maintain water quality.	**Assessment indicator 1:** Dead or unhatched eggs are identified			4

		Assessment indicator 2: Dead or unhatched eggs are disposed			4
		Assessment indicator 3: Dead and unhatched eggs are recorded			4
	2.2 Hatching trays and equipment are cleaned and sanitized to ensure a healthy environment for emerging fry.	**Assessment indicator 1:** Hatching trays and equipment are cleaned			4
		Assessment indicator 2: Hatching trays and equipment are sanitised			4
	2.3 Dirty materials are disposed of in accordance with biosecurity protocols to minimize disease risks	**Assessment indicator 1:** Dirty materials are disposed			4
	2.4 Water quality parameters are regularly monitored and adjusted to support fry health.	**Assessment indicator 2:** Water quality parameters are regularly monitored			4
3. Manage Hatching Equipment	3.1 Hatching trays for catfish/mirror carp are removed from the tank at appropriate times based on hatching progress.	**Assessment indicator 1:** Hatching trays for catfish/mirror carp are removed			4
	3.2 Hatching trays and jars are inspected for any signs of wear or damage	**Assessment indicator 1:** Damaged trays and jars are inspected			4

	3.3 Damaged trays and jars are reported for maintenance.	**Assessment indicator 1:**Damaged trays and jars are reported			4
	3.4 All equipment used in the hatching process is ensured to be functioning properly before and after use.	**Assessment indicator 1:**All equipment and materials are used in the hatching process			5
4. Monitor Fry Development	4.1 Yolk sac resorption is observed to determine the readiness of fry for feeding.	**Assessment indicator 1:**Yolk sac resorption is observed			5
	4.2 The survival rates of fry are monitored to assess the effectiveness of rearing conditions.	**Assessment indicator 1:**The survival rates of fry are monitored			3
		Assessment indicator 2: Root causes of mortality is identified			3
	4.3 Management practices are adjusted based on fry survival	**Assessment indicator 1:** key rearing practices based on Findings are adjusted			3
	4.4 Accurate and detailed records of, fry survival rates, and any interventions made are kept.	**Assessment indicator 1:** Interventions are kept			3
Total marks					……/100
Percentage Weightage					100%
Minimum Passing line % (Aggregate):					70%

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