Unit 18: Understanding Cyprinid Fish Farming

Unit code: K/601/0275

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit aims to introduce learners to cyprinid fish farming skills and understanding and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

Unit introduction

Cyprinid fish are farmed on a large scale worldwide not only for food but also for the coldwater ornamental fish industry. In the UK, cyprinids are increasingly important in the development of sports fisheries. In the UK, therefore, there is a good demand for fish from hatcheries and fish farms for food, sports fishery and conservation enhancement and for ornamental cyprinids such as koi and goldfish. The industry has produced good quality fish successfully for many years; however, increasing environmental and animal welfare concerns mean that farming techniques must be monitored constantly and revised to enable the industry to continue to succeed.

The first part of this unit looks at the development and current status of the global cyprinid farming industry, including the major principles behind the pond culture of cyprinids. This type of culture is the most common and practical way of farming cyprinids in a sustainable fashion.

The second part of the unit aims to allow learners to take a more practical approach to some of the diverse methods used to farm cyprinids. The industry is generally split into hatchery production of young fish and then systems for on-growing. Learners will explore both types of farming and some of the methods used to farm cyprinids. This will cover aspects from the selection of broodstock, through obtaining eggs and hatchery processes, to first feeding. In the on-growing situation, learners will explore pond maintenance and other key aspects of on-growing cyprinids. Husbandry skills and monitoring techniques will be developed as learners progress through the unit. Adherence to relevant health and safety legislation, appropriate use and care of equipment and carrying out work with due regard to the overall environment are important in their practical area.

This unit allows learners to consider the cyprinid farming industry and is vital for anyone wishing to enter the fish farming sector and very useful for anyone interested in entering the fisheries and conservation sectors.

Learning outcomes

On completion of this unit a learner should:

1 Understand the global importance of cyprinid fish

2 Know the principles of pond culture technology

3 Be able to carry out cyprinid hatchery operations

4 Be able to carry out on-growing cyprinid farming operations.

Unit content

1 Understand the global importance of cyprinid fish

Development of the cyprinid farming industry: history, development and current status (including principal farming practices, markets and reasons for farming) of cyprinid farming in the UK and globally; environmental requirements of economically important species, eg carp; constraints to further development, eg availability of sites, markets, disease; potential for further development of cyprinid farming in the UK; roles of government and non-government organisations in regulating cyprinid aquaculture; environmental issues; relevant current legislation eg Aquatic Animal Health Act

2 Know the principles of pond culture technology

Pond design: principles of pond culture; planning processes in site development; roles of national and local regulatory authorities; farm design, plans and function; water quality and quantity requirements; suitable geology and soil types; effects of topography; farm access and services; holding units currently in use (their advantages and disadvantages); design and function of on-growing ponds; recirculation systems; bio security; health and safety; environmental issues; relevant current legislation

3 Be able to carry out cyprinid hatchery operations

Cyprinid hatchery management and husbandry tasks: life cycles of economically important species; selection and requirements of cyprinid broodstock; broodstock care for seasonal and year-round fry production; signs of sexual maturity; hormonal control of reproduction; egg development in broodstock; natural reproduction control; use of Dubisch ponds; hatchery design and function; safe use of anaesthetics in commercial farming practice; artificial hormone use; hypophysation techniques; egg preparation, egg incubation and treatment; larval rearing in the hatchery; diet preparation and use for the developing larvae; bio security; health and safety considerations; animal welfare issues; relevant current legislation

4 Be able to carry out on-growing cyprinid farming operations

Farm management and husbandry skills: netting; grading; sorting; counting; water quality monitoring; stocking densities; production plans; fish health monitoring; feeding and nutrition; pond draining and preparation; liming; fertilising; maintenance of ponds and equipment; aeration equipment; pest and predator control; fish transport; identification of zooplankton and phytoplankton species; succession of plankton; recognition of key invertebrate groups; theory of invertebrate population control; bio security; health and safety considerations; animal welfare issues; relevant current legislation

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 explain the environmental requirements of the major farmed species of cyprinid fish	**M1** explain the legislation associated with the production and sale of a named cyprinid fish species on a specified fish farm	**D1** analyse how the current major threats and opportunities in cyprinid fish farming may influence plans for the development of a cyprinid fish farm
P2 discuss the distribution of the major farmed species of cyprinid fish in the UK and globally [CT]		
P3 describe the design of a selected cyprinid farm	**M2** evaluate a specified greenfield site for future use as a cyprinid fish farm	
P4 outline the pond structure and design function of a selected cyprinid farm		
P5 carry out specified cyprinid hatchery operations to meet given objectives [TW]	**M3** explain the techniques involved in the artificial spawning of a selected cyprinid species	**D2** explain invertebrate production and management in the production of a selected species of cyprinid fish.
P6 describe cyprinid hatchery operations carried out		
P7 carry out specified husbandry tasks on a commercial cyprinid farm to meet given objectives [TW]	**M4** explain the annual cycle of pond management practices in the production cycle of a selected cyprinid farm.	
P8 state health and safety considerations with carrying out cyprinid farm tasks [EP]		
P9 outline the principles of pond management.		

PLTS: This summary references where applicable in the pass criteria, in the square brackets, the elements of the personal, learning and thinking skills. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Delivery of this unit will involve practical assessments, written assessment, visits to suitable cyprinid fish farms and will link to work experience placements.

Tutors delivering this unit have opportunities to use as wide a range of techniques as possible. Lectures, discussions, seminar presentations, site visits, supervised cyprinid farming practicals, research using the internet and library resources and the use of personal and industrial experience would all be suitable. Visiting expert speakers would add to the relevance of the subject for learners. For example, a cyprinid fish farm manager or planning officer could talk about their work, the situations they face and the methods they use.

Work placements should be monitored regularly in order to ensure the quality of the learning experience. It would be beneficial if learners and supervisors were made aware of the requirements of this unit before any work-related activities are undertaken so that naturally occurring evidence can be collected at the time. For example, learners may have the opportunity to work with hatchery equipment and stock and they should ask for observation records or witness statements to be provided as evidence of this.

Whichever delivery methods are used, it is essential that tutors stress the importance of animal welfare, bio security, sound environmental management and the need to manage the resource using legal methods.

Health and safety issues relating to working in and around water must be stressed and reinforced regularly and risk assessments must be undertaken before any practical activities or visits to fish farms. Adequate personal protective equipment (PPE) must be provided and used following the production of suitable risk assessments.

Tutors should consider integrating the delivery, private study and assessment relating to this unit with any other relevant units and assessment instruments learners may also be taking as part of their programme of study.

Learning outcome 1 is likely to be delivered through formal lectures, discussion, and independent learner research. Learners will become aware of the development, potential, current status and global standing of the UK cyprinid farming industry. Learners will also be made aware of the legislative framework in which fish farms operate in the UK and the overall importance of the industry. This should lead to an understanding, through discussion, of the major threats and opportunities in the industry.

Learning outcome 2 covers the criteria used to identify suitable sites for cyprinid farms, how they are designed and constructed, and all pertinent legislation relating to their construction and use. Delivery techniques should be varied. It would be expected that formal lectures, discussions and supervised site visits would form part of the delivery.

Learning outcome 3 looks at the hatchery process. Delivery techniques should be varied. It would be expected that formal lectures, practical activities, group discussion, supervised visits and case studies would form part of the delivery. Particular emphasis should be placed on the practical aspects of spawning fish and include the selection of broodstock, artificial spawning of carp and the production of viable fry and first feeding.

Learning outcome 4 looks at the on-growing of stock produced in a hatchery. Delivery techniques should be varied. It would be expected that formal lectures, practical activities, group discussion, supervised visits and work experience placement would form part of the delivery. Particular emphasis is placed on the annual production cycles in a pond system and the production and management of invertebrate foods for the stock.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan gives **an indication of the volume of learning it would take the average learner** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value.**

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment
Development of the cyprinid farming industry.
Legislation involved in the fish farming industry.
Discussion on risks and opportunities.
Identifying and evaluating sites. Future prospects.
Assignment 1: Farm Design (P1, P2, P3, P4, M1, M2, D1) Introduction to assignment.
Pond design.
Site requirements – water quality and quantity.
Holding units.
Biosecurity, environmental issues and animal welfare.
Assignment 2: Hatchery Work (P5, P6, M3) Introduction to assignment.
Theory of hatchery operations.
Practical - hatchery tasks.
Moving to the on-growing of cyprinid fish.
Spawning fish.
Practical – assessed hatchery tasks.
Assignment 3: Cyprinid Farming (P7, P8, P9, M4, D2) Introduction to assignment.
Supervised practical – on-growing tasks.
Theory of pond management.
Practical – assessed on-growing tasks.
Unit review.

Assessment

For P1 learners must describe the environmental requirements of the major farmed species of cyprinid fish. Evidence should contain information on at least two species. Evidence could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster, webpage or leaflet or a project.

P2 requires learners to discuss the distribution of the major farmed species of cyprinid fish in the UK and globally. Evidence could be linked to the species covered in P1 and therefore be in the same format.

P3 requires learners to describe the design of a selected cyprinid farm. Tutors should identify the farm or agree it through discussion with learners. This could be linked to P4 which requires learners to outline the pond structure and design function of a selected cyprinid farm. This farm could be the same as forP1 and should again be agreed with learners beforehand. Evidence could be in the same form as for P1.

P5 requires learners to carry out specified cyprinid hatchery operations to meet given objectives. It is expected that, as a minimum, learners will assist in the hypophysation of broodstock and be able to assist in the fertilisation, preparation and incubation of eggs and in the rearing of fry beyond first feeding. Tutors should identify the species or agree it through discussion with learners. This could be assessed directly by the tutor during practical activities. If this format is used then suitable evidence from guided activities would be observation records completed by the learners and tutor and accompanied by appropriate worklogs or other relevant learner notes. If assessed during a placement, witness statements should be provided by a suitable representative and verified by the tutor.

P6 requires learners to describe the cyprinid hatchery operations carried out in P5. As such it should cover the same range as P5. Evidence is likely to being the form of a workbook. P7 requires learners to carry out specified husbandry tasks on a commercial cyprinid farm to meet given objectives. Tutors should identify the tasks and objectives or agree them through discussion with learners. It is expected that, as a minimum, learners will undertake tasks relating to: netting, grading, sorting and counting fish; water quality monitoring; calculating stocking densities; health monitoring; feeding fish; pond draining and preparation; and maintaining ponds and equipment. Evidence is likely to be in the same form as for P5.

P8 requires learners to state health and safety considerations related to carrying out cyprinid farm tasks. This task can be linked directly to P7 with learners selecting at least three of the tasks and stating the health and safety considerations of each task. Evidence could therefore be included in the evidence for P7.

P9 requires learners to outline the principles of pond management. Learners should outline the main principles involved in the use of pond culture to rear cyprinid fish. Evidence should be realistic and complete. It is likely the evidence will be in the same form as for P1.

For M1, learners must explain the legislation associated with the production and sale of a named cyprinid fish species on a specified fish farm. Tutors should identify the species and farm in discussion with learners. Evidence must include all the main legislation and be realistic. Evidence is likely to be in the same form as for P1.

M2 requires learners to evaluate a specified greenfield site for future use as a cyprinid farm. Tutors should identify the site and the objectives for the farm or agree them through discussion with t learners. Evidence must be complete and realistic and it is recommended that learners include working drawings. Evidence could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector) or a project.

For M3, learners are required to explain the techniques involved in the artificial spawning of a selected cyprinid species. Tutors should identify the species or agree it through discussion with learners. The species may be the same species used to provide evidence for other grading criteria. Evidence could be in the same form as for P1.

For M4 learners must explain the annual cycle of pond management practices used in the production cycle of a selected cyprinid farm. Tutors should identify the farm and species or agree it through discussion with learners. This may be the same farm and species used to provide evidence for other grading criteria. Evidence could be in the same form as for P1.

D1 requires learners to analyse how current major threats and opportunities in cyprinid fish farming may influence the plans for the development of a cyprinid fish farm. Learners must first identify at least four major threats and opportunities, for example disease, food preference, sustainability, and discuss the impact these may have on the industry. This information can then be related to an outline plan for the development of a cyprinid fish farm. Evidence could be in the same form as for P1.

D2 requires learners to explain the invertebrate production and management processes in the production of a selected cyprinid fish. Tutors should identify the species or agree it in discussion with learners. It is expected that learners will include details of live food production for fry as well as the management of ponds to develop different invertebrate life stages. Evidence could be in the same form as for P1.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P4, M1, M2, D1	Farm Design	You are required to produce a report on the development of a cyprinid farm. Select suitable fish species and explain their environmental requirements and current distribution. Describe a current fish farm in terms of its design and the pond structure and design function of this structure. Using this information outline a possible farm design for a selected greenfield site and evaluate the site. Explain the legislation associated with the production and sale of the fish you wish to produce on the farm. Given the major threats and opportunities associated with cyprinid farming at present analyse how the plans for this farm could be influenced by this information.	Report.
P5, P6, M3	Hatchery Work	You are working in a cyprinid fish farm hatchery. Participate in a range of hatchery operations keeping a log of the work completed and describing the hatchery tasks in detail. Explain the techniques involved in the spawning of a selected cyprinid species.	
P7, P8, P9, M4, D2	Cyprinid Farming	You are working on a cyprinid farm. Participate in a variety of husbandry tasks and complete a work log describing the tasks and explaining how the meet a given objectives. Include health and safety considerations for at least three of these tasks. Explain the annual cycle of pond management on the selected fish farm and show how these match the outline principles involved in pond management. Management and production of invertebrates is an important part of ensuring that cyprinids obtain suitable nutrition. Explain how these invertebrates are managed on the selected fish farm.	

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC land-based sector suite. This unit has particular links with:

Level 2	Level 3
Introduction to Fish Farming	Understanding Aquatics Management
	Understanding Fishery Management
	AQU17 Prepare and maintain fish eggs in a hatchery AQU18 Care for Juvenile fish

Essential resources

Learners will need access to a cyprinid hatchery and fish farm capable of rearing a range of cyprinids using a variety of equipment and holding units. They will also need all the necessary equipment to maintain cyprinid eggs, larvae and fry in a condition that meets the requirements of relevant codes of practice and fish welfare guidelines. Commercially acceptable equipment must be used.

Tutors delivering this unit should be competent and experienced in cyprinid farming practices.

Employer engagement and vocational contexts

This unit focuses on understanding the industry and the practical skills learners require to understand cyprinid fish farming. Learners should be encouraged to develop this knowledge during work experience placements. Guest lectures and off site visits should also be used to highlight why this knowledge and skills are important within the industry.

Indicative reading for learners

Textbooks

Baldwin C, et al – *The Sparsholt Guide to the Management of Carp Fisheries* (Mitchellwing Publications, 2001) ISBN 0954005406

Boyd C – *Water Quality Management for Pond Fish Culture* (Elsevier, 1982) ISBN 0444420541

Bromage N and Roberts R – *Broodstock Management and Egg and Larval Quality* (Blackwell Science, 1994) ISBN 0632035919

Billard R – *Aquaculture of Cyprinids* (INRA, 1994) ISBN 2853407918

Billard R – *Carp: Biology and Culture* (Springer-Verlag, 1999) ISBN 1852331186

Egna H and Boyd C – *Dynamics of Pond Aquaculture* (Lewis Publishers US, 1997) ISBN 1566702747

Girdler A, Welcomme R and Wellby I – *Freshwater Fisheries Management* (Blackwell Publishing, 2010) ISBN 1405133325

Horvath L, Tamas G and Seagrave C – *Carp and Pond Fish Culture, 2nd Edition* (Blackwell Science, 2002) ISBN 0852382820

Huet M – *Textbook of Fish Culture: Breeding and Cultivation of Fish, 2nd Edition* (Blackwell Science, 1994) ISBN 0852382197

Jhingran V and Pullin R – *A Hatchery Manual for the Common, Chinese and Indian Major Carp* (International Specialized Book Service, 1988) ISBN 9711022176

Lavens P and Sorgeloos P – *Manual on the Production and Use of Live Food for Aquaculture* (FAO of the UN, 1997) ISBN 9251039348

Pillay T and Kutty M – *Aquaculture: Principles and Practices* (Blackwell Publishing, 2005) ISBN 1405105321

Journals

Aquaculture International

Fish Farmer

Fish Farming International

Journal of World Aquaculture Society

Progressive Fish Culturist

Websites

www.cefas.co.uk	Centre for Environment, Fisheries and Aquaculture Science
www.cfta.org	Coarse Fish trade Organisation
www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.efishbusiness.co.uk	Fisheries legislation and business help
www.environment-agency.gov.uk	Environment Agency
www.hse.gov.uk	Health and Safety Executive
www.ifm.org.uk	Institute of Fisheries Management
www.lantra.co.uk	Sector Skills Council for the Environmental and Land-based Industries

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

Skill	When learners are ...
Creative thinkers	assessing the distribution of the major farmed species of cyprinid fish in the UK
Team workers	carrying out specified cyprinid hatchery operations to meet given objectives carrying out specified husbandry task to meet given objectives
Effective participators	stating health and safety considerations related to carrying out cyprinid farm tasks.

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	explaining the environmental requirements of the major farmed species of cyprinid fish
Creative thinkers	evaluating a specified greenfield site for future use as a cyprinid fish farm
Reflective learners	carrying out specified cyprinid hatchery operations to meet given objectives carrying out specified husbandry task to meet given objectives.

Functional Skills — Level 2

Skill	When learners are ...
ICT – Use ICT systems **ICT – Find and select information**	
Select and use a variety of sources of information independently for a complex task	assessing the distribution of the major farmed species of cyprinid in the UK and globally
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	assessing the distribution of the major farmed species of cyprinid in the UK and globally
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	assessing the distribution of the major farmed species of cyprinid in the UK and globally
Bring together information to suit content and purpose	assessing the distribution of the major farmed species of cyprinid in the UK and globally
Select and use ICT to communicate and exchange information safely, responsibly and effectively including storage of messages and contact lists	describing the design of a selected cyprinid farm
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	assessing the distribution of the major farmed species of cyprinid in the UK and globally
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	explaining the environmental requirements of the major farmed species of cyprinid fish
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	explaining the environmental requirements of the major farmed species of cyprinid fish.