Unit 24: Understanding Aquatics Management

Unit code: H/600/9223

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit aims to introduce learners to the skills and knowledge associated with aquatic management 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

Understanding the principles of keeping fish in aquaria and ornamental ponds is vital for anyone working in the animal care industry where fish are involved. These include fish sold in the retail or wholesale trade or kept as one group in a zoo or wildlife park's animal collection. Those employed within the industry will need this understanding to, for example, ensure the welfare of captive fish, build display systems and advise customers in an appropriate manner.

This unit will give learners the technical knowledge and practical skills needed to maintain fish and invertebrate stocks and the aquariums and ponds they live in. Animal welfare and health and safety will be emphasised during delivery of this unit.

Learners will identify the more commonly kept species and develop understanding of aspects of their anatomy and breeding biology. They will consider the diets and feeding requirements of fish in aquaria and ponds and be able to use this information to devise appropriate feeding regimes for given species of fish.

Learners will look at the systems fish are kept in and how fish (and invertebrates) are maintained in those systems in a healthy way. Learners will investigate equipment requirements for aquaria and ornamental ponds and use the knowledge developed to maintain healthy stock. They will investigate the causes of ill health in fish, both environmental and pathogenic.

Learning outcomes

On completion of this unit a learner should:

1 Understand commonly kept fish species and aspects of their biology

2 Be able to demonstrate knowledge of a range of feeds and feeding techniques

3 Understand how to develop and maintain aquatic systems

4 Know the main fish diseases and causes of ill health.

Unit content

1 Understand commonly kept fish species and aspects of their biology

Commonly kept species and their biology: identification and biology of species from the major ecosystems, eg tropical, marine, temperate, brackish; compatibility and mixing of species; external and internal anatomy; relevant current legislation and codes of practice

Internal and external structures: skin, scales, fins, lateral line, liver, kidney, swimbladder, dentition, gonads, gills, eye, nares; functions of major internal and external structures and organs

Breeding: differentiation of sexes; cues to sexual maturation, spawning inducers eg temperature, light, photoperiod, food availability

Breeding strategies: k and r strategies, mouth brooders, livebearers, egg scatterers, nest builders, egg carriers; juvenile rearing methods and management; animal welfare issues

2 Be able to demonstrate knowledge of a range of feeds and feeding techniques

Diets and feeding: dietary requirements; types and preparation of food eg live, dry, frozen, fresh, freeze dried; components of food eg vitamins, proteins, lipids, minerals, carbohydrates, fibre and colour enhancers; storage of food; feeding records; seasonal variation to feeding; fry foods; animal welfare issues; costs of feed and storage; health and safety; current legislation

Feeding strategies: filter feeders, piscivores, carnivores, omnivores, herbivores, topwater feeders, substrate feeders

Delivery of food: feeding methods and frequency of delivery; feed quantity and quality

Incorrect feeding: effects of over- or under-feeding; effects of feeding/fasting; animal welfare issues eg fish health, fish mortalities, water quality deterioration; health and safety; relevant current legislation and codes of practice

3 Understand how to develop and maintain aquatic systems

Aquatic systems: aquarium types eg marine, freshwater, tropical, temperate, plants; invertebrates, fish; stand- alone systems, central filtration; maintenance regimes

Location: eg floor loading, windows and radiators, availability of electricity, water, facility for disposal of water; risk assessment; health and safety

Equipment: temperature control; lighting; filtration; aeration; stocking regimes; stocking densities; sources of system instability

Water quality: dissolved oxygen, temperature, pH, ammonia, nitrite, hardness, salinity; stabilising and maintaining water quality; monitoring and record keeping

Health and welfare: animal welfare issues; health and safety; relevant current legislation and codes of practice

4 Know the main fish diseases and causes of ill health

Health: recognition of normal and abnormal condition and behaviour; common causes of ill health, eg stress, presence of pathogens, predators

Common diseases: eg viral, bacterial, fungal, parasites, environmental and genetic conditions

Treatments: preventative, prophylactic and therapeutic eg medication by immersion, oral, injection, topical application; record keeping; relevant current legislation

Disease prevention: environmental management, isolation and quarantine, hygiene, transportation methods, sources of specialist advice; treatments for common diseases; maintenance routines

Records: maintenance routines and records; of practice; date of birth, species, number in collection, acquisitions, disposals, deaths, treatments, notes, water testing regime

Welfare issues: health and safety and animal welfare;relevant current legislation and codes of practice

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 functions of selected anatomical structures of given fish species [IE, SM, RL]	**M1** explain how the anatomy of a given fish species can indicate its niche	**D1** explain how the anatomy and behavioural habits of a fish species can be used to produce a combination of different species for a given display aquarium
P2 describe contrasting breeding strategies of given species of fish [IE, SM, RL]		
P3 describe the feeding strategies of given fish species [IE, SM, RL]		
P4 discuss methods of presenting foods to fish in an aquarium [IE, SM, RL,TW, CT]	**M2** explain how age and time of year can influence the food requirements of fish	
P5 explain how incorrect feeding of fish can impact on water quality [IE, SM, RL,TW, CT]		**D2** discuss the challenges to successful aquatic animal husbandry posed by the presence of water soluble vitamins in commercial diets
P6 explain the equipment requirements for a selected aquarium [IE, SM, RL,TW, CT]	**M3** explain how fish and invertebrate stocking densities can be affected by the equipment used in an aquarium	
P7 evaluate given locations for suitability for an aquarium [IE, SM, RL,TW, CT]		
P8 explain the health and safety requirements of a given aquarium [IE, SM, RL]		
P9 describe the common causes of disease in fish [IE, SM, RL,TW, CT]		

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:**
P10 explain why prevention of disease is preferable to treating disease [IE, SM, RL,TW, CT]	**M4** discuss the different methods of treating a given, common fish disease.	**D3** discuss how a given aquarium system complies with relevant current legislation and codes of practice.
P11 describe the records which should be kept for a given aquarium. [IE, SM, RL,TW, CT]		

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

Tutors delivering this unit have opportunities to use as wide a range of techniques as possible. Lectures, discussions, seminar presentations, site visits, supervised practicals, research using the internet and/or library resources and the use of personal and/or industrial experience would all be suitable. It is essential that learners have access to aquarium systems and ornamental ponds that reflect those in common usage in the industry. Delivery of this unit will involve practical assessments and assessment, visits to suitable collections and will link to work experience placements. Delivery should stimulate, motivate, educate and enthuse learners.

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 maintain aquaria or ornamental ponds and they should ask for observation records and/or witness statements to be provided as evidence of this. Guidance on the use of observation records and witness statements is provided on the Edexcel website.

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

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.

All the learning outcomes in this unit are directly linked. Delivery is likely to include formal lectures, discussion, site visits, supervised practicals and independent learner research. Learners will become aware of aspects of fish anatomy, physiology and biology and the methods and associated activities commonly used to maintain fish health and welfare. Human health and safety issues must be addressed before learners work with any aquarium or ornamental pond. Adequate personal protective equipment (PPE) must be provided and used following the production of suitable risk assessments. Visiting expert speakers could add to the relevance of the subject for learners. For example, an aquarist or curator could talk about their work, the situations they face and the methods they use.

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
Introduction to the unit.
External and internal features of fish Practical session.
Commonly kept species and habitats.

Topic and suggested assignments/activities and/assessment
Assignment 1: Specialists and Generalists (P1, M1, D1)
Introduction to assignment.
Self- directed time/research for assignment.
Breeding and breeding strategies.
Assignment 2: Breeding Strategies (P2)
Introduction to assignment.
Feeding and foods.
Feeding strategies.
Food components.
Assignment 3: Feeding Strategies (P3)
Introduction to assignment.
Self- directed time/research for assignment.
Incorrect feeding.
Assignment 4: Feeding Fish (P4, P5, M2, D2)
Introduction to assignment.
Self- directed time/research for assignment.
Aquatic systems.
Location.
Equipment.
Health and safety.
Water quality.
Assignment 5: Setting up an Aquarium (P6, P7, P8, M3)
Introduction to assignment.
Diseases.
Assignment 6: Common Fish Diseases (P9, P10, M4, D3)
Introduction to assignment.
Self- directed time/research for assignment.
Records required.
Assignment 7: Record Keeping (P11)
Introduction to assignment.
Self- directed time/research for assignment.
Unit review.

Assessment

For P1, learners are required to explain the function of the major external and internal organs of a selected fish. Evidence could be generated through a practical assessment with short answers to questions on live, preserved or dissected fish specimens. However, it could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster or leaflet or laboratory report.

For P2, learners are required to compare the contrasting breeding strategies of a range of ornamental

fish species. It is not acceptable to describe species using similar strategies. For example, it would not be appropriate to choose goldfish and koi carp as representative species since both are egg scatterers. Evidence could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster or leaflet or project.

P3 requires learners to describe feeding strategies for contrasting ornamental fish species such as a top water feeder (for example a halfbeak) and a bottom feeder (for example loricariid). Where possible, to ensure assessment is fair, the size and complexity of the specified situation should be the same for all learners.

P4 requires learners to discuss methods of presenting food to fish in an aquarium. Tutors should identify the aquarium or ornamental pond which could be at the centre, in a linked retail or wholesale business or in a zoo, wildlife park or public aquarium,or agree it through discussion with learners. Where possible, to ensure assessment is fair, the size and complexity of the specified situation should be the same for all 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 learners and the tutor, together with appropriate work records or logs. If assessed during a placement, witness statements should be provided by a suitable representative and verified by the tutor.

P5 requires learners to explain how incorrect feeding of fish can affect water quality. Learners should be able to consider the effects of feeding on fish condition, water quality and the waste products of the fish through digestion of food or fasting.

P6 requires learners to explain the equipment requirements for a selected aquarium. This could be for a marine or freshwater aquarium, as identified by the tutor. Where possible, to ensure assessment is fair, the size and complexity of the specified situation should be the same for all learners.

P7 requires learners to evaluate given locations in terms of their suitability for an aquarium. This could be assessed during practical sessions, as a written exercise or a presentation. It could be linked to P6.

For P8, learners are required to explain the health and safety requirements of an aquarium. This could be linked to P6 and P7 but include a suitable risk assessment.

For P9, learners need to describe the common causes of disease in fish. This should include both environmental and pathogenic causes. Evidence could be in the form of a presentation or a written assessment

P10 requires learners to compare and contrast disease prevention and bio security against therapeutic treatment of disease. Evidence can be presented as a group discussion, presentation or a written exercise.

For P11, learners are expected to be familiar with the records kept for an animal collection. Evidence could be presented as a group discussion or a written exercise. It could be generated as part of a practical exercise in the centre's animal unit, public aquarium, zoo collection or retail business.

For M1 learners are expected to relate the physical characteristics identified in P1 to a fish's lifestyle and behaviour ie the niche it occupies. Species can be the same as used in P1. Where possible to ensure assessment is fair, the size and complexity of the specified situation should be same for all learners.

M2 is directly linked to P4 and P5. Learners are expected to consider feeding over the whole lifetime of a fish and explain how the nutritional requirements of the animal may change over time. Evidence can be a written exercise or be by observation during practical sessions.

For M3, learners are expected to use the knowledge they gained for P5 and P6 and apply it. Evidence could be presented as a group discussion or a written exercise. It could be generated as part of a practical exercise in the centre's animal unit, public aquarium, zoo collection or retail business. Care must be taken to ensure that welfare issues are not compromised if practical exercises are carried out.

For M4, learners are required to look at a common fish disease and explain different methods of treating it.

D1 is directly linked to P1 and M1 requiring learners to use the information gathered for P1 and M1 and

develop it further. Where possible, to ensure assessment is fair, the size and complexity of the specified situation should be same for all learners.

D2 requires learners to look at commercial fish food and at how manufacturers solve the problem of water soluble vitamins in diet formulations. Evidence could be presented as a written exercise or presentation.

D3 requires learners to be familiar with current legislation and codes of practice and explain how a given aquarium meets the associated requirements. This could be an individual aquarium or a collection. Tutors should identify the aquarium which could be at the centre, in a linked retail or wholesale business or in a zoo, wildlife park or public aquarium or agree it through discussion with learners. Where possible, to ensure assessment is fair, the size and complexity of the specified situation should be the same for all learners.

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 only 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 M1, D1	Specialists and Generalists	Produce annotated diagrams of the external and internal features of a fish and fully label them explaining the function of each. The physical shape of a fish can indicate where it lives, where it feeds, what it feeds on and how it hunts. Look at a halfbeak, a plecostomus catfish and an angel fish and explain what their features can tell us about their habitat and niche. Suggest a suitable collection of fish for an agreed aquarium – you need to explain how each fish's features indicate it is suitable for the collection.	Practical dissection with diagrams Presentation or written evidence.
P2	Breeding strategies	Fish show an amazing variation in their breeding strategies. A salmon and a discus show very different breeding behaviour. Look at their respective life cycles and compare them. You are to judge which you think is the most effective.	Written evidence or presentation.
P3	Feeding strategies	The aquatic environment has limited food available, so fish have evolved to be effective feeders exploiting many different niches. An archerfish fires a pellet of water at an insect, whereas a koi carp will constantly graze on the bottom. Judge the benefits and drawbacks to each strategy you identify.	Written evidence or presentation.
P4, P5, M2 D2	Feeding fish	Having looked at the features of the fish and feeding strategies, we now look at how we give food to fish and how what we give them will change during the year and depending on the age. Take the koi carp as an example and explain how koi food is manufactured, how the components of the food changes depending on the season and why koi farmers use belt feeders to maximise growth of their fish. What would happen to the digestive system of the koi if they were only fed twice a day?	Written evidence or presentation.

Criteria covered	Assignment title	Scenario	Assessment method
P6, P7, P8, M3, D3	Setting up an aquarium	To keep fish successfully, the initial setting up of an aquarium is very important. You are required to produce an advice sheet on where to locate the aquarium, the sort of positions to avoid, and the life support and safety equipment you need. You must explain why you need each piece of equipment. Your evidence must explain the health and safety issues. You must explain why the capacity and quality of the filter, once mature, will allow you to stock at a slightly higher density than recommended for beginners and how a poor filter reduces the number of fish that can be kept successfully.	Written evidence.
P9, P10, M4	Common fish diseases	There are many diseases fish can suffer from. You are required to state the symptoms of a range of diseases eg velvet disease, whitespot disease, dropsy,and *Saprolegnia*. You must explain at least two methods of treatment for whitespot disease. Explain why preventing a disease is important and suggest ways of preventing to do this.	Written evidence or presentation.
P11	Records	It is very important to keep records of animal collections. Fish are no exception. You are required to explain what records should be kept and produce a practical record sheet for an aquarium.	Written evidence or presentation.

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 links to Level 3 National Occupational Standards in Fisheries Management and Animal Care.

Level 2	Level 3
Introduction to Fish Biology	Understanding Aquaculture Systems
Introduction to Aquatic Ecology	Understanding Fish Health and Welfare

Essential resources

Learners will need access to aquatic facilities and equipment required to carry out the activities for this unit.

Employer engagement and vocational contexts

This unit focuses on the practical aspects and underpinning knowledge of fish husbandry and management. Centres are encouraged to create and develop links with local aquatic facilities. This could be via guest lectures or visits to appropriate visitor attractions, retail and wholesale facilities.

Textbooks

Andrews C, Exell A and Carrington N – *The Interpet Manual of Fish Health, 2nd Edition* (Interpet Publishing, 2002) ISBN 1842860674

Bailey M and Burgess P – *Tropical Fishlopaedia: A Complete Guide to Fish Care* (Howell Books, 2000) ISBN 1582451664

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

Haywood M and Wells S – *The Manual of Marine Invertebrates* (Salamander Books Ltd, 1996) ISBN 086101474X

Papworth D – *An Interpet Guide to Garden Ponds* (Interpet Publishing, 1999) ISBN 1902389549

Spotte S – *Marine Aquarium Keeping: The Science, Animals and Art, 2nd Edition* (John Wiley and Sons, 1993) ISBN 047159489X

Journals and magazines

Aquatic Trader magazine

Freshwater and Marine Aquarium magazine

Koi Carp magazine

Koi magazine

Practical Fish Keeping

Todays Aquarist magazine

Websites

www.aquariumcouncil.org	Marine Aquarium Council
www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.famamagazine.com/FAMA	Freshwater and Marine Aquarium Magazine
www.fishdoc.co.uk	FishDoc
www.hsegov.uk	Health and Safety Executive
www.lantra.co.uk	Sector Skills Council for the Environmental and Land-based sectors
www.ornamentalfish.org	Ornamental Aquatic Trade Association
www.practicalfishkeeping.co.uk	Practical Fish Keeping magazine
www.tropicalfishcentre.co.uk	Tropical Fish Centre

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 ...
Independent enquirers	Researching for assignments
Creative thinkers	developing record sheets and systems
Reflective learners	applying knowledge across learning outcomes
Team workers	producing group presentations
Self-managers	meeting deadlines for various projects/assignments
Effective participators	participating in group discussions.

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	researching fish features researching aquatic systems researching different methods of disease treatment
Creative thinkers	developing record sheets evaluating breeding strategies evaluating feeding strategies
Reflective learners	applying knowledge across learning outcomes applying knowledge across units
Team workers	participating in group activities sharing knowledge and experiences in group discussion
Self-managers	completing work to meet given deadlines and at a suitable level
Effective participators	sharing research sharing relevant experience.

Functional Skills – Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	researching tasks to support underpinning knowledge and further enhance formal teaching
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	using the internet to research and collect information
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	producing word processed work for either a presentation or a written assignment
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	producing word processed work for either a presentation or a written assignment
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	producing word processed work for either a presentation or a written assignment using ICT programmes producing record sheets
Bring together information to suit content and purpose	producing word processed work for either a presentation or a written assignment
Present information in ways that are fit for purpose and audience	producing word processed work for either a presentation or a written assignment
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	calculating volumes and weights looking at treatments using baths working out stocking densities
Identify the situation or problem and the mathematical methods needed to tackle it	looking at treatments using baths working out stocking densities

Skill	When learners are ...
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	producing a presentation participating in a group discussion
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	carrying out research written assignments using a variety of sources
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	producing written assessments producing a presentation.