# Unit 2: Understanding Fish Biology and Behaviour

**Unit code:** A/600/9227

**QCF Level 3:** BTEC National

**Credit value:** 10

**Guided learning hours:** 60

## Aim and purpose

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

## Unit introduction

The need to improve the management of fish populations in fisheries, fish farms and ornamental situations has become increasingly important as environmental awareness, animal welfare issues and the industries have grown. The purpose of this unit is to equip learners with the underpinning knowledge of fish biology and enable them to understand how the environment will influence the behaviour of the fish.

Understanding the basic needs of a fish will enable workers in many areas of the fish industry not only to provide for these basic needs but also to appreciate their importance in keeping the fish healthy. Suitable environmental conditions should allow a fish to grow more quickly, survive disease outbreaks and stay in better condition. All these factors will help any business to be more profitable no matter which part of the industry it operates in. Furthermore, increased environmental and animal welfare awareness means that providing the correct conditions for fish to thrive and exhibit normal behaviour is the minimum that is the legal, moral and ethical responsibility of anyone looking after fish.

The first part of the unit deals with the internal and external anatomy of a fish and how this relates to the physiological processes. The unit goes on to look at normal and abnormal behaviour of fish species and how understanding the physiological processes can allow the learner to link the behaviour to the conditions prevalent for the fish. These aspects are then explored in more detail using the particular example of fish nutrition, looking not only at what the fish are fed but when, where and how much they are fed.

This unit is important for anyone interested in fish and will be important to workers in sports fisheries, aquaculture and the ornamental sectors.

## Learning outcomes

**On completion of this unit a learner should:**

1 Know the external and internal anatomy of given fish species

2 Understand the functions and activity of the major organs of given fish species

3 Understand normal and abnormal behaviour of given fish species

4 Know the formulation of the diet and feeding regime for given fish species in different situations.

# Unit content

## 1 Know the external and internal anatomy of given fish species

*Main external features*: structure of major external features eg skin, fins, eyes, nares, lateral line; types and functions of fish scales; fish ageing from scales

*Main internal organs*: position and normal or abnormal condition of major internal organs; skeleton of teleost fish; body shape and relationship to lifestyle; basic classification

## 2 Understand the functions and activity of the major organs of given fish species

*Function of major organs*: main systems (circulatory, digestive, endocrine, reproductive, immune and nervous systems); function of sensory organs; osmoregulation; respiration; excretion; relationship between physiology and environment

## 3 Understand normal and abnormal behaviour of given fish species

*Normal behaviour*: importance in relation to stress and other fish health and welfare issues; normal resting, swimming, feeding, breeding and escape response; normal behaviour in the wild and in captivity; life cycles of fish

*Abnormal behaviour*: causes eg presence of predators, ill health, water quality; remedial action; recognition and significance of abnormal behaviour; physiological indicators eg blood cortisol levels

## 4 Know the formulation of the diet and feeding regime for given fish species in different situations

*Principles of nutrition*: main components of food and their roles; basic nutritional requirements of given fish species; natural diets of given fish species; metabolism of foodstuffs; factors affecting metabolism of given species; feeding behaviour; methods used to produce fish food; food storage; recognition of food spoilage; significance of food spoilage

*Feeding regimes*: ration size; ration dispersal; timing of feeding; husbandry and feeding; food conversion rates; effects of overfeeding

# 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** identify and describe the major internal organs and external features of given fish species | **M1** explain the relationship between body shape and lifestyle of fish | **D1** examine a selection of fish species to attain a definitive, explained, identification and age for each fish. |
| **P2** explain the functions of the major external features of a typical fish | **M2** explain the major physiological processes of fish | **D2** plan and explain a balanced feeding regime for given fish species in captivity. |
| **P3** explain the functions of the major internal organs [SM] | **M3** explain the importance of recognising and interpreting changes in the behaviour of selected fish species | |
| **P4** describe the process of osmoregulation in freshwater and saltwater fish | **M4** explain the factors that affect the metabolism of selected fish species. | |
| **P5** illustrate normal and abnormal behaviour in a typical fish [CT, IE] | | |
| **P6** describe the life cycles of given fish species | | |
| **P7** describe the major components of a diet for a specified fish species [SM] | | |
| **P8** plan feeding for given fish species in captivity. | | |

**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

This unit is likely to be delivered using 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. Delivery of this unit will involve practical assessments, written assessment and visits to suitable collections and will have links to industrial experience placements.

Work placements can play an important role in delivering parts of this unit. Experience of a wide variety of fish-keeping situations will allow a deeper understanding of the range of behaviours of those fish. For example, learners may have the opportunity to observe fish behaviour and feeding regimes. Assessors should complete observation records or witness statements to confirm assessment evidence and learners' achievement.

Visiting expert speakers could add to the relevance of the subject for learners. For example, a fishery, fish farm or aquarium manager or aquarist could talk about their work and the methods they use.

Whichever delivery methods are used, it is essential that tutors stress the importance of health and safety procedures, animal welfare and sound, legal environmental management. Health and safety issues relating to working in and around water must be stressed and regularly reinforced, and risk assessments must be undertaken prior to practical activities. Adequate personal protective equipment (PPE) must be provided and used following the production of suitable risk assessments.

Learning outcomes 1 and 2 are directly linked. They provide the underpinning knowledge for understanding fish. These are likely to be delivered by formal lectures, discussion, laboratory practicals and independent learner research. Learners will become aware of the major anatomy and physiology of a range of fish species and how these relate to their lifestyle and environment.

Learning outcome 3 covers the importance of recognising normal and abnormal fish behaviour. Delivery techniques should be varied and can be linked to the delivery of learning outcomes 1 and 2. It would be expected that observations of fish stocks and site visits would form part of the delivery of this learning outcome as well as formal lectures and discussions.

Learning outcome 4 looks at the principles of nutrition and the appropriate diets for selected fish species. Learners will become aware of the formulation of diets but also how these diets may be delivered to the fish in the best way. It would be expected that formal lectures, demonstrations, independent learner research and site visits would form part of the delivery of this learning outcome.

## 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. |
| Main external features and internal anatomy. |
| Practical dissection to reveal external and internal anatomy. |
| **Assignment 1: Fish Species** (P1, P2, P3, M1, M2)<br>Tutor introduces assignment brief. |
| Fish Physiology – main systems (circulatory, digestive, endocrine, reproductive, immune and nervous systems). |
| Set up fish-keeping facility and maintain to a set standard. |
| Introduce fish behaviour. |
| Normal behaviour. |
| Abnormal behaviour. |
| Practical – observe and log behaviour of selected fish. |
| **Assignment 2: Fish Keeping** (P5, P6, P7, P8, M3, D2)<br>Tutor introduces assignment brief. |
| Fish nutrition – basic principles. |
| Fish feeding discussion – What do we need to consider when we are establishing a feeding regime for a population of fish? |
| Fish ageing and identification. |
| **Assignment 3: Fish Identification and Ageing** (D1, P4, M4)<br>Tutor introduces assignment brief. |
| Unit review. |

## Assessment

For P1, learners must identify and describe the major internal organs and external features of a typical fish. It is expected that learners will provide complete evidence for one species but describe differences for at least three fish species (to include at least one herbivorous fish and one omnivorous fish). Evidence for this could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster, a project or a series of laboratory reports.

P2 and P3 require learners to explain the function of the major external and internal organs of selected fish species. The learners should be able to explain the function and use of organs and systems listed in the content. Evidence could be in the same format as for P1. It is expected that learners will provide, as a minimum, evidence that relates to two species, including one coarse-or one game-fish species.

P4 requires learners to describe the process of osmoregulation in freshwater and saltwater fish. Learners could select particular species of fish as their models for providing evidence for this criterion. These may be species that have been used to provide evidence for other grading criteria. Evidence could be in the same form as for P1 and linked to other assessment and grading criteria.

For P5, learners are required to illustrate normal and abnormal behaviour of selected fish species. Learners should relate their evidence to the normal resting, swimming, feeding, breeding and flight behaviour of fish. Carrying on from the description of normal behaviour, examples should be cited as to how behaviour can deviate from normal. As well as gathering information from literary sources where possible, learners should have the opportunity to observe fish stocks and draw conclusions from what they witness. Evidence for this criterion could take the form of a pictorial presentation with an annotated poster, webpage or leaflet, or a project.

For P6, learners must describe the life cycles of selected fish species. It is expected that a minimum of two fish species are included in the evidence; these could be the same species used to provide evidence for P1 and the evidence may be in the same format as for P1.

P7 requires learners to describe the major components of a diet for a specified fish species. Learners should ensure that they cover the main components of food and the roles each play. Learners could include in their evidence the basic nutritional requirements of selected fish species. Evidence may be in the same form as for P1.

For P8, learners are required to plan feeding for two different fish species held in captivity. The fish species and the circumstances in which the fish are kept should be chosen in discussion with the tutor. The feeding plan must include not only a description of the diet but amounts, timing and mode of feeding. Evidence is likely to be in the form of a report or an instruction sheet.

M1 requires learners to explain the relationship between body shape and the lifestyle of fish. Learners should include in their evidence the commonly found fish shapes. They should give several named examples of fish which have these shapes, and relate the shape to the fish's lifestyle and environment. Evidence could be in the same form as for P1.

For M2, learners must explain the major physiological processes of fish. This information should expand on information provided for P2 and should include circulatory, digestive, endocrine, nervous, reproductive and immune systems. Learners should choose a particular fish species to concentrate on in discussion with the tutor. Evidence could be in the same form as for P1.

M3 requires learners to explain the importance of recognising and interpreting changes in the behaviour of selected fish species. Tutors should agree the species through discussion with learners. It is expected that learners will provide evidence for at least two species, including one coarse-fish species or one game-fish species, in both wild and captive situations. These may be the same species as those used to provide evidence for other criteria. Evidence could be in the same form as for P1.

For M4, learners need to explain the factors that affect the metabolism of selected fish species. Learners should be able to identify how the metabolism of these fish species may be adversely or favourably affected by such factors. Tutors should identify the species or agree them through discussion with learners. It is expected that learners will provide evidence for at least two species, including one coarse-fish species or one game-fish species, in both wild and captive situations.

For D1, learners are required to examine a selection of fish to attain a definitive, explained identification and estimated age for fish. Learners should be provided with at least three different species. Each learner's fish identification should include at least three different identifying features. The ages must be knowledgeably estimated and included in the report using an accepted protocol. The fish must be handled with due regard for their welfare. The evidence for this outcome may be in the form of an assessed practical with a written report or log.

For D2, learners are required to plan a balanced feeding regime for two, different fish species held in captivity and to explain the methodology behind the plan in terms of considerations such as diet composition, feeding method, frequency and ration size. The fish species and the circumstances in which the fish are kept should be chosen in discussion with the tutor. The feeding plan must include not only a description of the diet but amounts, timing and mode of feeding. Evidence is likely to be in the form of a report or an instruction sheet.

### 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, M1, M2 | Fish Species | Your task is to complete web pages revealing information on British freshwater fish. Each page should contain a picture of the fish with all the major external features labelled, with links to explanations of their function. The body shape should be analysed and explained against their lifestyle. Another photo on another page should be used to reveal the position of the major internal organs. Links are put in place to an explanation of their function. | Web-page report. |
| P5, P6, P7, P8, M3, D2 | Fish Keeping | Learners should maintain a population of fish. A report should be completed which details the major components of fish food diet and how this informs the development of a feeding plan for the fish. Factors that affect the metabolism of your group of fish should be analysed and taken into account developing the feeding regime. This fish population should be observed and normal and abnormal behaviour should be recorded in detail over a period of time. The importance of this record of behaviour should be analysed and any information should be acted upon to make the fish exhibit more normal behaviour. For each species a detailed page on their life cycle should be included. | Log book, written report. |
| D1, P4, M4 | Fish Identification and Ageing | A group of fish is presented to you. For three individuals identify them and record details of the identification features. Complete a simple procedure to obtain an age for the fish and explain your results. Select a single fish species and explain, using diagrams, the major physiological processes. Explain the process of osmo-regulation as it applies to the fish you have identified. How does this differ from a marine fish? | Practical tasks.<br>Report/log. |

## 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 Biology | Understanding Fish Health and Welfare |
| Introduction to Fish Health | Understanding Freshwater Aquarium Systems |
| | Understanding Marine Aquarium Systems |

## Essential resources

Learners must have access to a laboratory which has equipment suitable for dissecting, internally examining, measuring and determining the age of fish. A supply of fresh or frozen fish will be necessary for identification purposes and anatomical investigations.

Learners must also have access to a population or community of fish which they can observe and maintain over a period of time sufficient to allow them to gather evidence to satisfy the assessment and grading criteria.

Tutors must be competent and experienced in examining and handling fish.

## Employer engagement and vocational contexts

This unit focuses on the underlying learning required to understand fish biology. It goes on to cover more practical issues of understanding observed behaviour and fish nutrition. Learners should be encouraged to develop this knowledge during work experience placements. Guest lectures and off-site visits should also be used to highlight how this knowledge is important within the industry.

## Indicative reading for learners

### Textbooks


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

Barnes R and Mann K – *Fundamentals of Aquatic Ecology, 2nd Edition* (Blackwell Science, 1991) ISBN 0632029838

Bone Q, Marshall N B and Blaxter J H S – *Biology of Fishes* (Nelson Thornes, 1996) ISBN 041274113OX

Bone Q and Moore R – *Biology of Fishes, 3rd Edition* (Taylor & Francis, 2005) ISBN 0415375622

Bromage N and Shepherd C – *Intensive Fish Farming* (Blackwell Science, 1992) ISBN 063203467X

Greenhalgh M – *The Pocket Guide to Freshwater Fish of Britain and Europe* (Mitchell Beazley, 2001) ISBN 1840003928

Greenhalgh M – *Atlantic Salmon: An Illustrated Natural History* (Stackpole Books, 2005) ISBN 081170145X

Greenhalgh M and Ovenden D – *Collins Pocket Guide: Freshwater life of Britain and N. Europe* (Harper Collins, 2007) ISBN 0007177771

Harding P (Editor) – *Freshwater Fishes in Britain: Their Species and Distribution* (Harley Books, 2004) ISBN 0946589763

Lovell T – *Nutrition and Feeding of Fish, 2nd Edition* (Kluwer Academic Publishers, 1998) ISBN 0412077019

Southgate P and Lucas J – *Aquaculture: Fish and Shellfish Farming* (Fishing News Books, 2003) ISBN 0852382227

Templeton R – *Freshwater Fisheries Management, 2nd Edition* (Blackwell Science, 1995) ISBN 085238209X

**Journals**

*Anglers Mail*

*Angling Times*

*FISH magazine*

*Journal of Fish Biology*

*Journal of Fisheries Management and Ecology*

*Salmon and Trout*

**Websites**

| | |
|---|---|
| www.defra.gov.uk | Department for the Environment, Food and Rural Affairs |
| www.environment-agency.gov.uk | Environment Agency |
| www.efishbusiness.co.uk | Centre for Environment, Fisheries & Aquaculture Science |
| www.fishbase.org | Online fish species database |
| www.ifm.org.uk | The Institute of Fisheries Management |
| www.ornamentalfish.org | "Ornamental Fish" is designed for aquatic hobbyists and the aquatic industry. |
| www.salmon-trout.org | Salmon and Trout Association – Game anglers for fish, people, the environment |

## 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** | illustrating normal and abnormal behaviour in a typical fish |
| **Creative thinkers** | illustrating normal and abnormal behaviour in a typical fish |
| **Self-managers** | explaining the functions of the major internal organs planning a feeding regime for a given fish species. |

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 relationship between body shape and lifestyle of fish |
| **Creative thinkers** | explaining the relationship between body shape and lifestyle of fish |
| **Self-managers** | examining a selection of fish species to attain a definitive, explained, identification and age for each fish<br>explaining the importance of recognising and interpreting changes in the behaviour of selected fish species |
| **Effective participators** | examining a selection of fish species to attain a definitive, explained, identification and age for each fish. |

## 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 | describing the major internal organs and external features of a typical fish |
| Use ICT to effectively plan work and evaluate the effectiveness of the ICT system used | describing the major internal organs and external features of a typical fish |
| Manage information storage to enable efficient retrieval | describing the major internal organs and external features of a typical fish |
| **ICT – Find and select information** | |
| Select and use a variety of sources of information independently for a complex task | explaining the relationship between the body shape and lifestyle of fish |
| **ICT – Develop, present and communicate information** | |
| Enter, develop and format information independently to suit its meaning and purpose including:<br>• text and tables<br>• images<br>• numbers<br>• records | explaining the function of the major internal organs<br>explaining the function of the major external features of a typical fish |
| Present information in ways that are fit for purpose and audience | explaining the life cycles of selected fish species |
| **English** | |
| Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions | explaining the function of the major internal organs<br>explaining the function of the major external features of a typical fish |
| Writing – write documents, including extended writing pieces, communicating information, ideas and opinions effectively and persuasively | explaining the function of the major internal organs<br>explaining the function of the major external features of a typical fish. |