

Unit 28: Understanding Freshwater Fish Population Survey and Management

Unit code:	Y/600/9235
QCF Level 3:	BTEC National
Credit value:	10
Guided learning hours:	60

● Aim and purpose

This unit aims to introduce learners to freshwater fish population survey and management skills and knowledge 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

As awareness of environmental issues increases around the world, many people are now far more conscious of ecological matters. In the UK, new marine and fresh water conservation laws are being drafted regularly as conservation groups provide new evidence of collapsing fish stocks and damage being done to the water environment. However, in spite of this new awareness, many people still want to fish and to eat fish. This unit looks at how, through scientific knowledge and understanding, we can seek to create a balance between these factors.

This practically-based unit gives learners the opportunity to investigate ways of surveying fish populations as well as practising techniques widely applied in still and running waters. Learners may also get a chance to work alongside a professional fisheries worker to gain experience of how fish populations are adjusted.

Some of the skills gained in this unit may also be applied more broadly to other scientific disciplines such as terrestrial ecology. The unit also addresses the vital areas of animal welfare, health and safety and environmental issues.

● Learning outcomes

On completion of this unit a learner should:

- 1 Understand the methods commonly used to survey fish populations in freshwaters
- 2 Be able to undertake fish capture operations
- 3 Understand estimation techniques used to determine the nature and size of fish populations
- 4 Know the methods commonly used to adjust fish populations.

Unit content

1 Understand the methods commonly used to survey fish populations in freshwaters

Survey methods: used in lakes and ponds eg seine netting or trapping; used in rivers eg seine nets, traps or tow nets; used in streams eg quantitative electric fishing, drift nets/traps, connective rod snakes; advantages and disadvantages of sampling methods in different habitats; equipment and human resource requirements; health and safety; relevant current legislation and codes of practice; animal welfare issues; environmental impact

2 Be able to undertake fish capture operations

Fish capture operations: planning and considerations of fish capture and removal eg dewatering/drain down, legal requirements, water depth, sequence of survey activities, stress minimisation for animals; selection of correct technique and equipment for the situation; methods for data collection and recording (fish species, weights, total and fork length, age, condition); health and safety; animal welfare issues; relevant current legislation and codes of practice; environmental impact

3 Understand estimation techniques used to determine the nature and size of fish populations

Estimation techniques: direct observation; remote sensing eg telemetry, hydroacoustics; mark-release-recapture techniques; methods used to mark and tag fish eg dyes, anchor tags, DNA analysis; removal or depletion models; advantages and disadvantages of these techniques; information required and the calculations used to estimate fish populations using each method eg Lincoln-Petersen method and variants, Carle & Strub; possible causes of error using estimation techniques

4 Know the methods commonly used to adjust fish populations

Fish population adjustment: reasons to adjust fish species; numbers and sizes to be removed; equipment required to collect, maintain and transport fish including relevant health and safety; legal requirements and codes of practice for adjusting fish species numbers; reasons why fish should be stocked; appropriate fish species to adjust, numbers and weights/sizes which should be stocked in a fishery, their sources and costs; live fish transportation methods; fish release methods.

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 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 methods commonly used to safely survey fish populations in freshwaters [IE]	M1 explain the advantages and disadvantages of two methods of surveying fish populations	D1 evaluate the current legislation in place to protect freshwater fish species in the UK
P2 compare commonly used fish population survey methods		
P3 Use suitable fish capture methods to meet given objectives	M2 explain the roles and responsibilities of operators in a fully quantitative fishery survey	D2 discuss potential environmental impacts of a range of fishery survey techniques and applicable methods to minimise those impacts
P4 describe the factors in the selection of an appropriate fish capture method for a given scenario		
P5 accurately record species, weight, total and fork length for fish captured in a fishery survey [CT, TW, EP, SM]		
P6 compare the advantages and disadvantages of selected methods for marking and tagging fish for population estimation	M4 calculate a fish population estimate from selected data using a stated estimation model	
P7 discuss potential causes of error in estimating fish populations [RL]		
P8 describe live fish transportation methods commonly used during fishery stocking operations.	M5 with reference to accurate data collection and fish welfare, describe appropriate methods for fish holding, handling and release in fishery survey operations.	D3 discuss the benefits, risks and legal requirements of stocking live fish in recreational fisheries in the UK.

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 a wide range of techniques including lectures, discussions, seminar presentations, supervised fishery practicals, site visits, guest speakers and research using the internet and/or library resources.. Delivery will involve practical assessments, written assessment, visits to suitable collections and will links 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 be 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 use fish capture methods 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.

Guest speakers would be useful to provide background information in relation to legal requirements and health and safety considerations when handling fish, for example an Environment Agency fishery officer could describe the methods they use to carry out fish population surveys.

Some of the surveying techniques may be carried out by contacting local charities for example the Wildlife Trust who may provide equipment, support and a site to survey for a small cost and occasionally funding may be available depending on the area of the country and current focus of the organisation.

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

Learning outcome 1 requires learners to understand surveying techniques. This will mainly be delivered through formal lectures, guest speakers, research sessions and site visits.

Learning outcome 2 may be delivered in part through a work placement or through site visits, supervised practicals, lectures and guest speakers.

Learning outcomes 3 and 4 can be delivered in a similar way to learning outcome 2. However, a university or research group may also be suitable as mark-release-recapture experiments are commonly used by university biologists. If this is not possible, delivery methods used for learning outcome 2 are also suitable.

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 and overview to the unit.

Assignment 1: Surveying Fish (P1, P2, M1, D1)

Introduction to assignment.

Research and formal lectures on the methods used.
Assignment 2: Your First Survey (P3, P4, P5, M2, M3, D2)
Introduction to assignment.
Guided site visits, supervised practical work, work placement.
internet research, lectures and guest speakers.
Assignment 3: Estimating Fish Populations (P6, P7, M4)
Introduction to the assignment.
Work placements, guest speakers, site visits, demonstrations, supervised practical, internet research, library research, demonstrations and lectures.
Assignment 4: Managing Population Sizes (P8, M5, D3)
Introduction to the assignment.
Work placements, guest speakers, site visits, demonstrations, supervised practical, internet research, library research, demonstrations and lectures.
Unit review.

Assessment

For P1, learners must explain methods commonly used to survey fish. Evidence can take the form of a presentation, PowerPoint presentation, annotated poster, leaflet or information booklet.

P2 can be linked to P1. Learners must compare the different surveying methods available for. Evidence for this can take the same form as for P1.

P3 requires learners to carry out practical fishery surveying techniques. This can be assessed during a work placement using witness statements and observation records as well as a learner diary or by observed practical work.

For P4, learners must state the reasons for the selection of fish capture methods for a given situation. This could be assessed through an interview with supporting witness statements, annotated diagrams or posters, a presentation, a guidance booklet for example for the Environment Agency.

P5 can be linked to P3 and evidence can take the form of practical notes and data collected from the survey as well as notes in the learner diary.

For P6, learners must explain the advantages and disadvantages of commonly used methods for marking and tagging fish for population estimation. Learners should relate their evidence to the methods used to estimate fish populations. Evidence may be in the same format as for P1 or in response to short-answer questions.

P7 requires learners to describe potential areas where error can occur in fish population estimation exercises. This can be based on the site used in P3 and evidence can take the same form as for P1.

For P8, ideally, fisheries that have been used during delivery of the unit or as part of learners' previous experience should be consulted here. However, it would be acceptable for learners to cite other real cases as evidence if required. Evidence could take the form of notes from a site visit, presentation, booklet, guide for fisheries owners or a web page.

For M1, learners must explain the advantages and disadvantages of two methods of surveying which could be methods they have used or tried. If evidence is from a work placement it could be taken from a learner diary or from discussion with the site owner. If a work placement is not possible then a written piece of work may be more appropriate such as a table, annotated diagram, annotated leaflet or poster.

M2 can also be completed whilst on a work placement, site visit or during supervised practical work. Evidence

can take the same form as for P3 and P5.

M3 requires learners to describe health and safety relating to the techniques used. Evidence can take the form of a discussion, presentation, leaflet, guide for an employer or site owner or new employee handbook.

For M4, learners should show that they can use calculations accurately to estimate fish populations. Data can be taken from learners' own work or provided by the tutor.

For M5, learners should describe how to handle, hold and release fish safely in a fishery survey operation. Evidence can take the form of internet research, notes from a work placement or fishery survey, lecture notes or a presentation.

For D1, learners should evaluate current legislation. Evidence can take the form of internet research, a leaflet, annotated poster, presentation, web page, a role play of a court case where fish have been removed from a site illegally.

D2 requires learners to discuss the environmental impact of surveying. Evidence could take the form of a letter to the government about a specific area, a speech by an environmental charity, a web page calling for action about a local area or planning a project that school children could carry out to tidy up an area after a problem has occurred.

For D3, learners must discuss the benefits, risks and legal requirements for stocking fish in recreational fisheries. Evidence can be presented 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, M1, D1	Surveying Fish	You have recently been employed by the Environment Agency as an assistant to the chief biologist in charge of fisheries. You have been asked to investigate the different methods that the agency can use to assess the populations of fish in English and Welsh waters.	Written work, presentations, posters.
P3, P4, P5, M2, M3, D2	Your First Survey	You have been asked to join the chief biologist on a survey of a local site to investigate the population of a common fish species. The biologist has asked you to be prepared to record any necessary data.	Witness statements, observation records, learner diary, annotated photos.
P6, P7, M4	Estimating Fish Populations	Now that you have had training you have been asked to work with a local school to help them complete a mark- release- recapture experiment as part of their biology course. You have been asked to guide them through the practical and to help interpret any data.	Calculations, witness statements, learner diary.
P8, P9, M5, D3	Managing Population Sizes	A local fishery has asked for support and guidance from the Environment Agency regarding stocking fish, they are new to the industry and will need advice on all aspects of stocking a fishery.	Leaflet, booklet, poster, web page.

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
Undertake Freshwater Sport Fishery Management	FiM3 Monitor fisheries habitat FiM4 Collect fish samples to monitor the condition of a fishery
Introduction to Fish Farming	Understanding Fishery Management

Essential resources

Access to a fishery or agency that surveys fisheries and waterways is key to this unit. Fish-marking equipment, anchor tags and aqueous dyes will be required for learners to carry out fish population estimation work.

Fishery survey equipment will also be required such as a boat adapted for electric fishing and seine netting operations. The craft should be fitted with oars and an outboard motor and carry an appropriate first aid kit, fire extinguisher, anchors and lifebuoy. At least one seine net, fish trap (for example, fyke net) and basic, hand-held electric fishing apparatus – together with suitable hand nets, aerators, fish-holding tanks, weighing, measuring and recording equipment – will be required to enable learners to carry out fishery surveys. Field data should be recorded on waterproof notepads. Fish scales for ageing purposes should be retained in small envelopes for subsequent laboratory investigation using a low-magnification microscope or microfiche reader.

Employer engagement and vocational contexts

Learners should have access to a working environment. Often this can be achieved by creating links with local businesses or charitable organisations who may even benefit from taking on learners. Local authorities can be a useful source of information as can business education alliances. Charitable organisations can often provide guest speakers to give lectures as well as demonstrations.

Indicative reading for learners

Textbooks

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

Environment Agency – *Code of Practice for Safety in Electric Fishing Operations*

Howarth W – *Freshwater Fishery Law* (Blackstone Press, 1987) ISBN 1851850309

Maitland P – *Hamlyn Guide to Freshwater Fish of Britain and Europe* (Hamlyn, 2000) ISBN 0600596907

Murphy B and Willis D – *Fisheries Techniques* (American Fisheries Society, 1996) ISBN 188856900X

Seagrave C – *Management of Carp Fisheries* (Mitchellwing Publications, 2001) ISBN 0954005406

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

Journals and magazines

Fish (The magazine of the Institute of Fisheries Management)

Fisheries Management and Ecology

Journal of Animal Ecology

Journal of Ecology

Journal of Fish Biology

Websites

www.efishbusiness.co.uk

A multi agency government site for aquaculture in England and Wales

www.environment-agency.gov.uk

Environment Agency

www.ifm.org

Institute of Fisheries Management

www.goodquarry.com

The environment and quarrying.

www.wildlifetrusts.org

The Wildlife Trusts movement

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	Carrying out internet research and library research
Creative thinkers	suggesting and carrying out improvements to tasks
Reflective learners	assessing own work and improving skills.
Team workers	completing surveying
Self-managers	completing tasks on time, meeting targets for assessments
Effective participators	completing group surveys.

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	Carrying out research
Creative thinkers	applying techniques studied to the working environment
Reflective learners	suggesting improvements to techniques and sites
Team workers	practising techniques
Self-managers	producing written work on time
Effective participators	participating in team activities.

● 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 appropriate legislation
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	Carrying out research
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: <ul style="list-style-type: none"> • text and tables • images • numbers • records 	producing written pieces
Present information in ways that are fit for purpose and audience	presenting their work
Mathematics	
Identify the situation or problem and the mathematical methods needed to tackle it	using calculations
Select and apply a range of skills to find solutions	using formulae
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	using different calculations in population estimation
Draw conclusions and provide mathematical justifications	calculating populations and discussing errors
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	producing presentations, video, blogs, and group presentations.
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading information as part of internet and library research
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	completing reports, diaries and other assessments.