

Unit 10: Understanding and Undertaking Mechanisation in Fish Husbandry

Unit code:	H/601/1165
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 associated with mechanisation in fisheries management and aquaculture 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

Fisheries worldwide have realised that advances in technology can completely change a business as well as improve productivity to match demand. The need to mechanise the fish-farming industry has led to companies looking at how they can reduce labour intensity and unsanitary conditions, improve storability and increase production. The different stages of fish production can all be mechanised adequately, but a number of different factors should be considered when setting up machinery at a fish farm.

Boats are a major part of modern fishery, and many fish farms in Scotland are based off land that develops a better quality of fish in some species. This means that fisheries staff must be competent small-boat users. To minimise the cost to the business, many fish farms buy their own boats and operate, service and repair them in-house to keep running costs down. This knowledge of engine maintenance is also essential for a great deal of other equipment. From lawn mowers to leaf blowers a great deal of larger, industrial-scale equipment is powered by petrol or diesel engines. This is the same in the fisheries industry and knowledge of how to prepare and use the equipment safely is vital.

This unit aims to introduce learners to a variety of equipment that they would potentially have to use in their future career on a fish farm, or in a number of other land-based disciplines which require a knowledge of engines and mechanised equipment.

● Learning outcomes

On completion of this unit a learner should:

- 1 Understand the working principles and operation of two-stroke and four-stroke engines
- 2 Understand the working principles and operation of electric motors and pumps
- 3 Be able to demonstrate safe handling and use of trimmers
- 4 Be able to safely handle a small boat powered by an outboard engine.

Unit content

1 Understand the working principles and operation of two-stroke and four-stroke engines

Purpose and operation of two-stroke and four-stroke engines: commonly found controls and regular pre-start checks and service requirements; operational procedures to follow when using equipment powered by two- and four-stroke engines; common causes of malfunction of two- and four-stroke engines and remedial action; types of equipment powered by two- and four-stroke engines in the fish-farming, sport fishery management and aquatics industries; storage requirements of equipment and petrol/diesel; health and safety when dealing with engines; personal protective equipment (PPE); relevant current legislation and codes of practice, eg Control of Pollution (Oil Storage) (England) Regulations 2001, Health and Safety at Work Act 1974.

2 Understand the working principles and operation of electric motors and Pumps

Purpose and operation of electric motors and pumps: types of equipment powered by electric motors in the fish-farming, sport-fishery management and aquatics industries; working principles of electric motors; types of equipment powered by electric pumps in the fish-farming, sport-fishery management and aquatics industries; working principles of a water pump and a fish pump; operational procedures to follow when using equipment powered by electric motors; commonly causes of malfunction and how to correct them in electric motors and pumps; health and safety; relevant environmental and fish welfare issues.

3 Be able to demonstrate safe handling and use of trimmers

Trimmer handling operations: safe operation in accordance with manufacturer's guidelines, health and safety recommendations and codes of practice; reasons for using trimmers in the fish-farming, sport-fishery management and aquatics industries; variety of trimmer types available and their attachments; functions of the major trimmer components, eg emergent weed control; common causes of trimmer malfunction and remedial action; relevant environmental issues; health and safety; PPE.

4 Be able to safely handle a small boat powered by an outboard engine

Boat handling operations: types and uses of craft powered by inboard and outboard engines in the fish-farming and sport-fishery industries, eg work boats, weed-cutting boats, electro fishing craft and rigid inflatable boats (RIBS); types and working principles of petrol and electric outboard engines; maintenance and service requirements; familiarity with controls and components of common small boats; pre-start checks; launch and recovery; start-up procedures; small boat handling (underway, coming alongside) using outboard engines; safety procedures for small boats; advantages and disadvantages of outboard engines against inboard engines; relevant 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 working principles of two-and four-stroke engines	M1 explain how to identify and resolve common malfunctions in engines	D1 describe how the use of engines has changed the fisheries industry	
P2 discuss differences between a two-stroke and a four-stroke engine			
P3 explain the working principles of a selected electric motor	M2 explain the welfare and environmental issues related to using fish pumps in different situations		
P4 explain the working principles of a selected pump			
P5 safely strim an area of vegetation to meet given objectives	M3 discuss the advantages of strimming in the fisheries industry		D2 select, with justification, a small boat with an engine suitable for carrying out and maintaining a specified operation within a fish farm.
P6 explain the function of a given strimmer and its attachments where relevant			
P7 safely carry out a specified small-boat handling exercise	M4 describe the safety procedures used in small boat operation.		
P8 explain the functions of the controls of a selected boat and outboard engine.			

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 CT – creative thinkers	RL – reflective learners TW – team workers	SM – self-managers EP – effective participators
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Essential guidance for tutors

Delivery

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

Unless the centre has a fishery on-site, a lot of the unit delivery will involve site visits, guest speakers and work placements. Some of the material can, however, be delivered using a wide range of techniques including lectures, discussions, seminar presentations, supervised sport-fishery practicals and research using the internet and/or library resources. 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 observe, and attempt, the use of a small boat in a fishery 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 for providing background information on the legal requirements and health and safety considerations when using machinery on a fish farm, for example the welfare considerations when operating machinery near fish. Guest speakers would also be useful to discuss the structure, operation and maintenance of engines. It may be possible to arrange a visit to a garage which builds or maintains boat engines or petrol-powered machinery. Links may also be made to college mechanics courses with the potential of trainee mechanics explaining basic engine structure to land-based learners. There is significant potential in this unit to create links with businesses, organisations and colleges.

Some of the unit requirements can be carried out by contacting local charities such as The Wildlife Trust, who will provide equipment and support with a small cost. If inland, then a number of local water boards and local councils run and operate lakes which are often maintained using similar equipment to a fish farm, and they may provide a site for small, boat handling. Outward-bound courses and post-16 field education centres are also potential ways for learners to carry out practical tasks.

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.

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 for 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: Operation of Engines (P1, P2, M1, D1)

Introduction to assignment.

Topic and suggested assignments/activities and/assessment
Supervised practical work, site visits, workshop diary, presentations.
Assignment 2: Electric Motors and Pumps (P3, P4, M2)
Introduction to assignment.
Supervised practical work, site visits, workshop diary, presentations.
Assignment 3: Strimmers (P5, P6, M3, D2)
Introduction to assignment.
Supervised practical work, site visits, workshop diary, presentations.
Assignment 4: Boat handling (P7, P8, M4)
Introduction to assignment.
Supervised practical work, site visits, workshop diary, presentations.
Unit review.

Assessment

For P1, learners must explain the working principles of two- and four-stroke engines. Learners should consider two-stroke and four-stroke engines that power machinery likely to be used within the fisheries industry, for example vehicles, boats, generators, pumps and mowers. This could be assessed directly by the tutor during practical activities with witness statements and observation records. Alternatively, a work log, workshop diary, pictorial presentation with notes or an annotated poster would be suitable.

P2 requires learners to discuss the differences between two- and four-stroke engines. This can be assessed as a practical project with observation records and learner diary where learners investigate for themselves the differences between the engines. Evidence could also be a presentation, a talk, or an annotated poster.

P3 requires learners to explain the working principles of a selected electric motor. Tutors should identify the selected electric motor with learners. Where possible, to ensure assessment is fair, the size and complexity of the selected electric motor should be the same for all learners. Evidence may be in the same form as for P1.

P4 is similar to P3, but learners must explain the working principle of a pump. The same considerations apply, and evidence can take the same form as for P1.

For P5, learners must trim an area of vegetation safely to meet given objectives. Tutors should identify the area of vegetation to be trimmed and the objectives of the exercise, or agree them through discussion with learners. This could be assessed directly by the tutor during practical activities. If this format is used, suitable evidence from guided activities would be observation records completed by learners and the tutor, and accompanied by appropriate work logs or other relevant learner notes. If assessed during a placement, witness statements should be provided by a suitable representative and verified by the tutor.

For P6, learners must explain the function of a given trimmer and its attachments where relevant. This can be assessed in a similar way to P2.

P7 requires learners to carry out a specified small-boat handling exercise. Tutors should identify the boat and the exercise which should be related to the fisheries industry. It is expected that this will include, as a minimum, pre-start checks, launch and recovery, start-up procedures and handling (underway and coming alongside). Learners must wear appropriate PPE during this exercise. Evidence may be in the same form as for P5.

P8 requires learners to explain the functions of the controls of a selected boat and outboard engine. This can be linked to work carried out during P7 and can be assessed by using a question and answer session with learners, a mock interview, a presentation, or a talk.

For M1, learners must explain how to identify and resolve common malfunctions in engines. This can be a practical task with supporting documentation or a written task where learners produce a flow diagram guide for operators.

M2 requires learners to explain the welfare and environmental issues related to using fish pumps in different situations. Evidence could be a booklet, leaflet or annotated poster, a presentation, a web page, or a guide for fisheries owners.

M3 requires learners to discuss the advantages of strimming in the fisheries industry. This can be assessed in a similar way to M2 though it is possible to assess this while on a work placement if learners are interviewed.

For M4, learners must describe the safety procedures used in small-boat operations. This can be assessed in a similar way to M2 though it could be assessed during a placement. Witness statements should be provided by a suitable representative and verified by the tutor.

D1 requires learners to describe how the use of engines has changed the fisheries industry. Evidence could take the form of a project, presentation, annotated poster or similar written piece of work.

D2 requires learners to select, with justification, a small boat with an engine suitable for carrying out and maintaining a specified operation within a fish farm. This can be assessed in a similar way to D1.

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	Operation of Engines	You work at a traditional fish farm but the owner has decided to buy new equipment to improve operations. Your task is to look at the engines that are available and get up to speed with those that will be used at the fish farm.	Witness statements, diary.
P3, P4, M2	Electric Motors and Pumps	The new motors and pumps have arrived at the fish farm and you must set them up with your colleagues and take care not to disturb or harm the fish.	Diary, witness statements, observation records.
P5, P6, M3, D2	Strimmers	The new equipment is all working but weed growth has taken over a little. You must use the new strimmers that you were recently trained on to clear the growth.	Diary, witness statements, observation records.
P7, P8, M4	Boat Handling	You have been sent on a training course to operate a small boat which you will then use at the fish farm. The course is at a local college that has a lake.	Diary, witness statements, observation records.

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	
Participate in Providing Estate Maintenance	Understanding River Fisheries Creation and Management	
Introduction to Fish Farming	Understanding Stillwater Fisheries Creation and Management	
	CU27 Maintain equipment and machines	
	CU13 Prepare and operate small craft	

Essential resources

Learners will need access to appropriate workshops which comply with relevant government health and safety standards, a variety of two-and four-stroke engines (to include pumps and outboard motors), electrically operated equipment (to include pumps and outboard motors), trimmers with a variety of attachments and heads, and the appropriate protective equipment. Learning outcome 4 requires a small, stable boat fitted with an appropriate outboard engine, carrying an appropriate first-aid kit, fire extinguisher and oars.

Access to fisheries that operate the equipment identified in this unit would be ideal. This will ensure that learners have the opportunity to observe and, if possible, to use specialist equipment which may not be available at their place of learning.

Tutors delivering this unit should be competent and experienced in the fisheries industry.

Employer engagement and vocational contexts

This unit provides numerous opportunities for employer engagement. Learners would benefit from having access to a working environment. Often this is 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

Bartlett T – *The RYA Book of Outboard Motors* (Adlard Coles Nautical, 2003) ISBN 0713668733

Bell B – *Farm Machinery* (Old Pond Publishing, 2005) ISBN 1903366682

Culpin C – *Farm Machinery* (Blackwell Science, 1992) ISBN 063203159X

Health and Safety Executive – *Clearing Saw* (HSE Books, 2003) ISBN 0717626326

Lawson T – *Fundamentals of Aquacultural Engineering* (Kluwer Academic Publishers, 1994) ISBN 0412065118

Royal Yachting Association – *RYA Boat Safety Handbook, 2nd Edition* (Royal Yachting Association, 1994) ISBN 0901501557

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

Shippen J and Turner J – *Basic Farm Machinery, 3rd Edition* (Butterworth-Heinemann, 1980) ISBN 0080249116

Websites

www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.environment-agency.gov.uk	Environment Agency
www.hse.gov.uk	Health and Safety Executive
www.hse.gov.uk/agriculture/forestry.htm	Health and Safety Executive
www.ifm.org.uk	The Institute of Fisheries Management
www.lantra.co.uk	Sector Skills Council for the Environment and Land-based Industries
www.rya.org.uk	Royal Yachting Association

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, and practical tasks
Creative thinkers	suggesting and carrying out improvements to tasks
Reflective learners	assessing own work and improving skills
Teamworkers	completing practical tasks
Self-managers	completing tasks on time, meeting targets for assessments
Effective participators	completing group 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	carrying out research
Creative thinkers	applying techniques studied to the working environment
Reflective learners	suggesting improvements to techniques and sites
Teamworkers	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	carrying out research on relevant 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 work
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	working on engines and trouble shooting
Identify the situation or problem and the mathematical methods needed to tackle it	working on engines and trouble shooting
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	maintaining engines
English	
Speaking and listening – make a range of contributions to discussions and making 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.