

Higher National Unit Specification

General information for centres

Unit title: Aquatic Ecosystems

Unit code: DP4V 35

Unit purpose: This Unit is designed to enable candidates to analyse and evaluate the factors affecting aquatic ecosystems, and develop the skills necessary to carry out ecological fieldwork. It is intended for candidates who would like to gain knowledge and practical experience in ecology, and expect to take up technician level posts in environmental science or progress to higher level courses.

On completion of the Unit the candidate should be able to:

- ◆ analyse features of aquatic ecosystems
- ◆ evaluate factors affecting biodiversity in aquatic ecosystems
- ◆ perform an investigation of an aquatic ecosystem and analyse the results

Credit points and level: 1 HN Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the centre, however, it would be beneficial if candidates have achieved Units in Environmental Chemistry, Environmental Biology or Ecology and Ecosystems at SCQF level 7.

Core skills: There may be opportunities to gather evidence towards the Core Skills of Working with Others and Communication at Higher Level in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: Outcomes 1 and 2 will be assessed using a single closed-book assessment lasting one and a half hours. Outcome 3 should be assessed by a practical investigation. Candidates should be assessed both on their practical ability using a checklist and on the quality of the investigation report.

Higher National Unit specification: statement of standards

Unit title: Aquatic Ecosystems

Unit code: DP4V 35

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Analyse features of aquatic ecosystems

Knowledge and/or skills

- ◆ factors influencing aquatic ecosystems:
 - chemical characteristics; physical characteristics; geological and geographical factors
- ◆ relationships between organisms in aquatic ecosystems:
 - trophic relationships; interspecific competition; intraspecific competition; predation
- ◆ adaptations of flora and fauna to aquatic ecosystems:
 - structural; physiological; behavioural

Evidence requirements

Candidates will need to provide evidence to demonstrate their knowledge and skills by showing that they can:

- ◆ analyse two different factors influencing two different aquatic ecosystems (one factor for each ecosystem)
- ◆ evaluate relationships between organisms in two different aquatic ecosystems (one relationship for each ecosystem)
- ◆ explain two different adaptations of flora and/or fauna in two different aquatic ecosystems (one factor for each ecosystem)

Evidence for each knowledge and/or skills item should be generated for two ecosystems, one freshwater and the other brackish/intertidal/marine.

Assessment should be integrated with Outcome 2. Evidence should be generated through a closed-book assessment carried out under supervised conditions. This closed-book assessment should take the form of a set of structured and restricted response questions to test the candidate's knowledge and understanding.

Higher National Unit specification: statement of standards (cont)

Unit title: Aquatic Ecosystems

Outcome 2

Evaluate factors affecting biodiversity

Knowledge and/or skills

- ◆ factors influencing biodiversity:
 - pollution; introduced species; habitat destruction
- ◆ measures employed to maintain and increase biodiversity:
 - management for conservation; habitat creation

Evidence requirements

All Knowledge and Skills must be assessed, however sampling is permitted within each knowledge and skills item

Candidates will need to provide evidence to demonstrate their knowledge and skills by showing that they can:

- ◆ analyse two factors reducing biodiversity in two different aquatic ecosystems (one factor for each ecosystem)
- ◆ evaluate two measures employed to maintain and increase biodiversity in two different aquatic ecosystems (one measure for each ecosystem)

Evidence for each knowledge and/or skills item should be generated for two ecosystems, one freshwater and the other brackish/intertidal/marine.

Assessment should be integrated with Outcome 1. Evidence should be generated through a closed-book assessment under controlled conditions of 1.5 hours duration carried out under supervised conditions. This closed-book assessment should take the form of a set of structured and restricted response questions to test the candidates knowledge and understanding.

Assessment guidelines for Outcomes 1 and 2

The assessment for Outcome 1 can be combined with the assessment for Outcome 2 as part of a single assessment of approximately 1.5 hours.

In the assessment, candidates will be required to answer a series of questions which cover all aspects of the Evidence Requirements. Questions will vary from assessment to assessment.

Suitable assessments will require candidates to analyse and evaluate presented information. This information could be presented in a variety of formats including text, graphical, data, map, or a mixture of the above. A mixture of structured and short answer questions should be used to generate evidence. The assessment should be carried out under closed-book supervised conditions.

The assessment should be constructed to give equal weighting to each Knowledge and/or Skills element assessed. The assessment could be worth 60 marks in total, and a score of 60% overall would be required in order for the candidate to pass.

Higher National Unit specification: statement of standards (cont)

Unit title: Aquatic Ecosystems

Outcome 3

Perform an investigation of an aquatic ecosystem and analyse the results

Knowledge and/or skills

- ◆ planning the investigation
- ◆ appropriate sampling techniques
- ◆ measure abiotic factors
- ◆ biological keys
- ◆ analyse results

Evidence requirements

Candidates will need to provide evidence to demonstrate their knowledge and skills by showing that they can:

- ◆ plan experimental work in order to answer the investigation aim
- ◆ use sampling techniques appropriate to the ecosystem under investigation
- ◆ measure abiotic factors appropriate to the ecosystem under investigation
- ◆ use biological keys in order to identify organisms
- ◆ critically analyse the results and relate them to the investigation aims

Candidates will need evidence to show that they can perform, and produce a report of, an investigation of an aquatic ecosystem. Candidates should be given an investigation topic, which would include the aim of the investigation, site location and details of practical work to be performed.

All practical work should be carried out under supervised conditions.

Candidates should be assessed on both their performance in completing the practical work involved in the investigation, and on their ability to produce a report of the investigation.

The report should be in an appropriate scientific format and should include a critical analysis of the results, and may relate the distribution of organisms identified in the investigation to various abiotic features of the ecosystem under study.

A checklist and record of results should be used to assess performance in completing the practical aspects of the investigation.

Assessment guidelines

The practical aspects of the investigation can be performed as part of a group, lasting approximately five hours (two hours for planning and three hours for carrying out the practical aspects of the investigation).

Candidates are permitted to work as part of a group in order to complete the practical aspects of the investigation, but should produce an individual report.

Higher National Unit specification: statement of standards (cont)

Unit title: Aquatic Ecosystems

It is recommended that the candidates should perform and report on at least two investigations from the list provided in the support notes, but only one should be used for assessment purposes.

Administrative Information

Unit code:	DP4V 35
Unit title:	Aquatic Ecosystems
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Higher National Unit specification: support notes

Unit title: Aquatic Ecosystems

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit is developed as part of the HND Environmental Sciences. It provides an opportunity for candidates to gain a broad knowledge of factors affecting aquatic ecosystems, to discuss and evaluate the effects that these have on community structure and ecological biodiversity, and develop skills to carry out ecological fieldwork.

It is anticipated that the candidate could work as part of a team to gather practical data during the investigation, with the subsequent report being the individual work of the candidate.

A selection of four ecosystems from the following list should be included for study, including at least one freshwater and one brackish/intertidal/marine.

- ◆ lochs, lakes and ponds
- ◆ rivers and streams
- ◆ intertidal zones
- ◆ estuaries
- ◆ oceans

It is recommended that the knowledge and/or skills for each ecosystem is taught in its entirety before progressing to the next ecosystem.

It would be preferable if the majority of ecosystems chosen for inclusion were accessible for practical study by the candidates.

An introduction to aquatic ecosystems could include properties of water, and the factors affecting and driving the hydrological cycle.

Outcome 1

A wide range of factors affecting ecosystems should be included, selecting the most appropriate for each ecosystem under study. These could range from factors such as: Autochthonous and allochthonous inputs, changes in salinity, depth, desiccation, flow frequency and flooding, method of lake formation, nutrient content (nitrate, phosphate, calcium), oxygen content, pH, riffles and pools, river classification, river velocity, seiches, substrate type, temperature, thermal stratification, water current; to more complex factors such as catchment geology and management.

Relationships between organisms could include examples of trophic relationships, invertebrate feeding groups, interspecific and intraspecific competition, predation, grazing, shading, competitively dominant species, indicator species and zonation on rocky shores.

Higher National Unit specification: support notes (cont)

Unit title: Aquatic Ecosystems

Appropriate adaptation of organisms could include resistance to desiccation, tolerance of anaerobic conditions, heterophylly, maintenance of blood salt concentration, obtaining oxygen, movement in water.

Outcome 2

Factors reducing biodiversity could include: Pollution (eutrophication, organic pollutants such as sewage, pesticides, thermal pollution), introduction of alien species, canalisation of rivers, dredging, draining of ponds, disturbance.

Factors increasing diversity could include: Management for conservation — engineering works such as dredging, channel deepening/narrowing, on-line flood storage, island creation, riffle/pool creation. Management of vegetation — control of existing vegetation and establishment of new planting. Habitat creation — new ponds, gravel pit restoration, artificial reefs.

Outcome 3

Several aquatic ecosystems are suitable for ecological investigation including:

- ◆ streams, ponds, rocky shores, estuaries

Sampling methods could include kick sampling, dredge netting and line transects.

Various abiotic factors could be investigated depending on the ecosystem under investigation including: pH, oxygen content, nitrate content, phosphate content, calcium content, water current, substrate type, turbidity, height above low tide, B.O.D, C.O.D.

Organisms should be identified using keys, either in the field, or by taking a representative sample of invertebrates to the laboratory for further identification. Presence or absence of indicator species of pollution and oxygen content of the water could also be identified.

Suitable topics for investigation could include:

- ◆ factors affecting zonation in seashore organisms
- ◆ effect of exposure on distribution of seaweed species
- ◆ effect of river flow / substrate type on invertebrate distribution
- ◆ effect of nutrient content / oxygen on organisms distribution in freshwater

Guidance on the delivery and assessment of this Unit

This Unit forms part of the HND Environmental Sciences, which is primarily designed to prepare candidates for employment in a science related post. The emphasis should be on encouraging the candidates to think about the practical implications of the theory they study.

Independent study should be encouraged by using candidate-centred, resource based methodologies.

The assessment of Outcomes 1 and 2 is by a single closed-book assessment under supervised conditions.

Higher National Unit specification: support notes (cont)

Unit title: Aquatic Ecosystems

In Outcome 3 one investigation of an aquatic ecosystem should be performed and reported. Reports should include a critical evaluation of results, relating organism distribution to various abiotic factors.

Should a candidate fail to carry out the investigation to the required standard, further attempts can be offered. Ideally candidates will participate in two investigations, with only one required for assessment purposes.

Open learning

If this Unit is delivered by open or distance learning methods, additional planning resources may be required for candidate support, assessment and quality assurance.

A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes.

For further information and guidance, please see Assessment and Quality Assurance of Open and Distance Learning (*SQA, February 2001, publication code A1030*).

Candidates with additional support needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on the SQA website **www.sqa.org.uk**.

General information for candidates

Unit title: Aquatic Ecosystems

This is a one credit SQCF level 8 Unit intended to be delivered as part of the HND Environmental Sciences.

On completion of this Unit you should be able to:

- 1 Analyse the features of various aquatic ecosystems.

For each ecosystem you will study the factors which influence the ecosystem, examine relationships between different organisms study adaptations of various organisms, and evaluate data relating to relationships between organisms and abiotic factors.

- 2 Evaluate factors affecting biodiversity.

You will also study factors which have led to a reduction in the biodiversity of aquatic ecosystems, and the various measures which have been taken to increase biodiversity, including an evaluation of the effectiveness of these measures.

- 3 Carry out ecological investigations of aquatic ecosystems.

In this Outcome you will take part in investigations of aquatic ecosystems. In each investigation you will measure various abiotic features of the ecosystem, use appropriate techniques to sample organisms present, and identify them using biological keys. An important part of the investigation will be the report. This will involve presenting and analysing data in a clear and critical way in order to relate the distribution of organisms to various abiotic factors in the ecosystem.

Assessment

Outcomes 1 and 2 will be assessed by means of a single holistic closed-book assessment.

Outcome 3 will be assessed by one investigation and report of an aquatic ecosystem.