National Unit specification: general information

Unit title: Aquatic Environments and Water Use (SCQF level 4)

Unit code: H1SP 10

Superclass: MH

Publication date: July 2012

Source: Scottish Qualifications Authority

Version: 01

Summary

This purpose of this Unit is to develop the candidate's understanding of water characteristics within a range of aquatic environments and the influence of natural factors and human activities on the aquatic environment and water use. The candidate will develop the skills to identify the aquatic flora and fauna using identification keys.

The Unit is aimed primarily at young people between the ages of 15 and 18 but is open to all age groups. The Unit is a part of the National Progression Award in Angling and Fisheries Conservation at SCQF level 4. However it can also be undertaken as a free standing Unit. Candidates may progress to the National Progression Award in Aquaculture and Fish Husbandry at SCQF level 5.

Outcomes

1 Describe the natural and human influences on water quality.
2 Describe the requirements of water users and the possible impacts of water use on the aquatic environment.
3 Identify the aquatic flora of specified aquatic environments.
4 Identify the aquatic fauna of specified aquatic environments.

Recommended entry

Entry is at the discretion of the centre. No prior knowledge and skills are required.

General information (cont)

Unit title: Aquatic Environments and Water Use (SCQF level 4)

Credit points and level

1 National Unit credit at SCQF level 4: (6 SCQF credit points at SCQF level 4*)

**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.*

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes of this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

National Unit specification: statement of standards

Unit title: Aquatic Environments and Water Use (SCQF Level 4)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Outcome 1

Describe the natural and human influences on water characteristics.

Performance Criteria

(a) State the main natural influences on water characteristics within the hydrological cycle.
(b) State the main human influences on water characteristics within the hydrological cycle.
(c) Describe the main effects of a natural influence on water characteristics in a specified water catchment.
(d) Describe the main effects of a human influence on water characteristics in a specified water catchment.

Outcome 2

Describe the requirements of water users and the possible impacts of water use on the aquatic environment.

Performance Criteria

(a) State the main water users found in different aquatic environments.
(b) Describe the water characteristics required by each of the main water users.
(c) Predict the impact of water use on the aquatic environment and potential conflicts between different users.

Outcome 3

Identify the aquatic flora of specified aquatic environments.

Performance Criteria

(a) Identify macrophytes using identification keys.
(b) Identify phytoplankton using identification keys.

Outcome 4

Identify the aquatic fauna of specified aquatic environments.

Performance Criteria

(a) Identify zooplankton using identification keys.
(b) Identify invertebrates using identification keys.
(c) Identify vertebrates using identification aids.

National Unit specification: statement of standards (cont)

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Evidence Requirements for this Unit

Written and/or oral recorded evidence is required to show that candidates have achieved all Outcomes and Performance Criteria. Evidence will be generated in a supervised open-book exploration of specified aquatic areas and water users.

Outcome 1

Candidates must include:

- three natural influences on water characteristics, supported by information from one specified catchment
- three human influences on water characteristics with reference to information provided for a specified water catchment
- the possible effects of one natural and one human influence, on three water characteristics for a specified water catchment

Outcome 2

Candidates must include:

- the three main water users found in two different aquatic environments
- three water characteristics required by each water user, for three users
- the possible impact of three water users on one aquatic environment and three potential conflicts between different users

Outcome 3

Using simple keys and live specimens or high quality images, candidates must include:

- six freshwater macrophytes using their family names, including at least one from each of the following:
  - floating leaved
  - emergent
  - submerged plants
- four freshwater algae using their common names, including the following:
  - one diatom
  - two green algae

National Unit specification: statement of standards (cont)

Unit title: Aquatic Environments and Water Use (SCQF level 4)

Outcome 4

Using simple keys and live specimens or high quality images, candidates must include:

- three freshwater zooplankton using their family names including from at least two of the following groups:
  - copepod
  - cladocera
  - rotifer
- six freshwater invertebrates using their common names including:
  - two insect nymphs
  - one insect larva
  - one crustacean
  - one mollusc
- 12 vertebrates, associated with freshwater or marine environments, by their common names, including:
  - seven fish
  - three birds
  - two mammals

National Unit specification: support notes

Unit title: Aquatic Environments and Water Use (SCQF level 4)

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

The Unit is delivered in the context of British freshwaters to exemplify the typical natural characteristics of river and still water ecosystems, and the range of water users sharing each. The candidate should develop a basic understanding of the natural influences on water characteristics, including geology, topography, soil type and vegetation, before acknowledging the range of water users found from the headwaters to the estuary. The main users should include agriculture, forestry, nature conservation, recreational boaters and canoeists, anglers, fish farmers, domestic and industrial users.

A knowledge of the influence of water users on water characteristics in a catchment should be developed, and the causes of the main conflicts of interest between different users, established.

A wide range of aquatic flora and fauna will be identified using simple keys, developing the candidates' appreciation of the complexity of freshwater aquatic ecosystems with reference to aquatic food webs. Basic identification skills for a range of aquatic flora and fauna from microscopic plankton, macrophytes and invertebrates, progressing to encompass vertebrates, including fish, mammals and birds should be established.

Guidance on learning and teaching approaches for this Unit

Outcome 1: Water catchments and water characteristics

As an 'ice breaker', and introduction to the Unit, candidates could be asked to name all of the natural water sources that they are aware of, 'benchmarking' the initial knowledge of individuals and the group.

A graphical representation of the hydrological cycle could be used to demonstrate the location of the different water sources. The use of ICT based 'drag and drop' interactive depiction of the 'hydrological cycle' could assist the development of the candidates understanding of water movement between the atmosphere, rivers, still waters, ground water and the sea.

Maps, photographic images and graphic diagrams could be used to illustrate the different physical zones in river and still water environments, building on the candidate's basic understanding of the hydrological cycle.

For a river system, this should include:

- the torrential zone
- riffle and pool middle course
- the slow meandering lower course

For a still water the physical zones should include the:

- marsh
- littoral
- lentic
- benthic zones

illustrated through the use of cross sectional diagrams.

Variations in the natural catchment conditions, namely geology, topography, vegetation and land use, that influence the above water characteristics throughout a catchment, could be explored through carefully assisted interpretation of the maps, supported by summarised water data, describing the water characteristics at stated catchment locations.

A picture of the changes in water characteristics throughout a given catchment could be developed by candidates through learner centred study, supported by reference to maps, images and illustrations of physical conditions, and water data representing each of the main zones. Maps could be presented to candidates in hard paper copy or digital format. The catchment conditions from the headwaters to the estuary could be established through a structured study of a given catchment, relating variations in the catchment conditions to changing water characteristics.

It is recommended that the field work undertaken and described below is related to the catchment desk study above. Some of the natural and human influences on water characteristics and the distribution of aquatic flora and fauna could be illustrated by the field work.

Once the candidates appreciate how changeable and dynamic aquatic environments can be, a basic understanding of the significances of the following water characteristics to the general health of aquatic environments and dependant flora and fauna, should be established, through teacher led learning:

- flow rates
- water temperature
- turbidity
- dissolved oxygen (DO)
- pH
- nitrogenous wastes

Candidates should develop an appreciation of two concepts, of' tolerance limits; and 'optimum' conditions, by relating water data to information on biological tolerance limits and optimum conditions. This could be exemplified by a range of aquatic invertebrates of varying sensitivity, and a salmonid and cyprinid fish species, for the following key water parameters:

- dissolved oxygen (DO)
- pH
- nitrogenous wastes

National Unit specification: support notes (cont)

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A basic understanding of the dependency on dissolved oxygen of most aquatic fauna should be developed, and related to the role of plants within the regulation of oxygen levels in productive still waters. Candidates should be made aware of the relative tolerance limits of different aquatic invertebrates and common fish species to reductions in DO, and the common causes of DO fluctuations in freshwater systems.

This should include increased biological oxygen demand (BOD), resulting from human influences, namely:

- agriculture
- fish farming
- domestic and industrial waste

and the impact of plant activity, in particular photosynthesis.

Outcome 2 Water Use

Candidates could undertake a teacher led discussion to identify the main water users in British water catchments. Through question and answer within a group exercise, candidates could build up a picture of what each of the main users of water require, in terms of ideal water conditions. The knowledge of the water users requirements could be further developed through learner centred study from 'vetted' websites and other information provided, leading to a complete and accurate picture of requirements.

This could be followed by a teacher led exercise to establish the impact that each water user could have on the aquatic environment, and other water users.

The potential for water use conflicts could be teacher led and explored interactively, with reference to a graphical representation of a hypothetical water catchment, with the physical zones defined and described. Water users could be provided and placed in different locations within the catchment, requesting learners to determine the possible impact on the environment, and, the conflicts that may be caused. The learning activity could be run several times with a range of permutations, to illustrate common causes of conflict. The risk of pollution from one water user affecting another could be a recurring theme.

The hypothetical conflicts established in the exercise above, could be exemplified by reference to real conflicts that have occurred and are being remedied are being remedied within British water catchments.

Outcomes 3–4: Flora/fauna identification

It is advisable to introduce candidates to commonly occurring flora and fauna through access to diagrams and digital photographs, prior to practical field trips to familiarise them with the aquatic life they are likely to encounter.

Streams can be more safely accessed and sampled than rivers, using hand nets to collect 'invertebrate kick samples' which can be identified in the field, or taken back to a laboratory, allowing physical features including gills, and tail structures to be examined under microscopes.

National Unit specification: support notes (cont)

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Still waters should only be sampled under close supervision by some one familiar with the terrain, avoiding deep water and unstable substrates. Some still water flora and fauna, such as phytoplankton, zooplankton and small invertebrates, require specialised fine mesh nets for sample collection, and microscopes for the identification of live specimens. Where this is impractical, high quality digital photographs and diagrams can be used as an alternative.

The identification of aquatic flora and fauna can be assisted by reference to simple illustrative keys that emphasise the most obvious indicative features, but can lead candidates to naming the specimen at family level.

For aquatic macrophytes:

- leaf arrangement
- leaf shape
- growth habit

should be demonstrated to underpin identification.

Candidates should be familiarised with the basic anatomy of the main categories of Invertebrates before sampling still waters or rivers, including:

- insect larvae
- insect nymphs
- molluscs
- crustaceans
- worms
- beetles

Candidates should be familiarised with the external fish feature, including:

- fins
- scales
- the mouth parts

in preparation for species identification.

The use of a real fish is recommended to demonstrate the structure of external features, in the first instance. Reference should be made to fin shape and position, morphology, colouration, and mouth parts when demonstrating how to identify common fish species, to include the following freshwater species:

- pike
- salmon
- brown trout
- rainbow trout
- roach
- common bream
- tench
- carp
- eel
- chub

Candidates should be made familiar with the following marine species:

- cod
- bass
- mackerel
- bream
- thornback ray
- tope
- common skate

The identification of birds and mammals could be based on the recognition of key physical features. High quality photographs may be needed to complement the identification of real specimens, which are often unavailable, other than in a natural history museum.

Candidates should be made familiar with the following birds:

- heron
- kingfisher
- goosander
- cormorant
- dipper
- moorhen
- wagtail
- mallard

Candidates should be made familiar with the following mammals:

- otter
- mink
- common seal
- grey seal
- water vole

National Unit specification: support notes

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Essential skills

By adopting the above learning and teaching approaches and/or through the Outcomes and corresponding Evidence Requirements, the Unit should provide candidates with an opportunity to develop the following essential skill for life, learning and work:

Sustainability — the Unit could develop skills in sustainable development as it focuses on understanding the significances of maintaining the general health of aquatic environments and dependant flora and fauna for the use of future generations.

Guidance on approaches to assessment for this Unit

Outcome 1

The evidence could be provided as an open-book case study, based on a specified water catchment, supported by geological and land use maps.

Outcome 2

The evidence could be provided as a case study on water users, presented in two parts, one covering a specified river, the other a specified still water

Outcomes 3 and 4

The identification process should be supported by taxonomic keys, which allow identification down to family level. It is advisable for candidates to record each stage of the identification process so as tutors can more readily remediate.

Opportunities for the use of e-assessment

Elements of theory in all Outcomes may be available, eg as Powerpoints or lecture notes, which may be suitable for incorporation into a VLE.

Opportunities for developing Core Skills

In this Unit candidates will be develop knowledge of water characteristics within a range of aquatic environments and the influence of natural factors and human activities on the aquatic environment and water use.

Candidates will:

- Describe the natural and human influences on water quality; the requirements of water users and the possible impacts of water use on the aquatic environment
- Identify the aquatic flora and fauna of specified aquatic environments

This means that as candidates are doing this Unit they will be developing aspects of the Core Skills in *Communication* and *Working with Others* through field work conducted as a group activity and *Problem Solving* skills through the interpretation of simple keys in order to identify flora and fauna.

National Unit specification: support notes (cont)

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Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**

History of changes to Unit

Version	Description of change	Date