

# Aquaculture & Sports Fisheries

## Module Aquatic Ecosystems



**EQF  
Level  
5**

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# Aquatic Ecosystems

**EQF Level 5:**  
**Credit value: 10**

## **Unit abstract**

There is a need to improve the management of aquatic ecosystems as environmental awareness and the demand for managed sport fisheries has developed. The purpose of this unit is to equip learners with an underpinning scientific knowledge of aquatic ecosystems and apply their understanding to the interrelationships between living organisms and their environments, prior to their progression in to the aquatic management, sport fisheries and fish farming industries.

Across Europe there is a wealth of freshwater habitats and many species of concern to conservationists depend either entirely or partially on these habitats. Therefore the management of freshwater habitats is a crucial part of any nature conservation strategy. Learners will have the opportunity to investigate a range of different habitat types practically and use their understanding to predict how these may change.

This unit provides learners with a detailed overview of ecological principles within freshwater ecosystems and also investigates the methods used to survey aquatic populations and environments, thus enabling learners to maintain and manage aquatic populations more effectively. The factors controlling the distribution of and changes in populations are also considered and related to habitat formation and management.

## **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand basic ecological principles
- 2 Understand the fundamental dynamics and ecological characteristics of lentic ecosystems
- 3 Understand the fundamental dynamics and ecological characteristics of lotic ecosystems
- 4 Be able to survey aquatic populations and environments.

## Unit content

### 1 Understand basic ecological principles:

*Ecological principles:* biogeochemical cycles; nutrient cycles; energy in ecological systems; limiting factors; the ecosystem concept; the community concept; the species concept; evolution of the ecosystem

### 2 Understand the fundamental dynamics and ecological characteristics of lentic ecosystems

*Natural and manmade habitats:*

*Distribution and formation:* influence of geology on formation; regional differences; manmade

*Classification:* nutrient status; influence on biology; use of biotic indices

*Processes:* stratification

*Physical characteristics:* morphology; temperature; drawdown zone; turbidity; catchment influences

*Chemical characteristics:* pH, dissolved O<sub>2</sub>, conductivity, ammonia, nitrates, phosphates, Biochemical Oxygen Demand

*Biological characteristics:* effects of temperature, oxygen, pH and suspended solids on aquatic life; anthropogenic impacts on lentic ecosystems

*Biological factors:* competition; predation; tolerance ranges of stenotopic and eurytopic organisms; acclimation; adaptation; physiological and behavioural homeostasis

*Biological distributions:* geographic; zonation; regular; random; clumped; temporal communities

*Dynamics:* life tables; age distributions; demographics; geometric and logistic growth curves; carrying capacity; *r* and *K* strategies; natural regulation

### 3 Understand the fundamental dynamics and ecological characteristics of lotic ecosystems

*Catchments:* definition of catchment area; importance of holistic landscape-scale approach to managing freshwater systems; effects of land use on catchment hydrology

*Catchment processes:* hydrological cycle; fundamental functions

*Drainage systems:* springs; upland headwaters/tributaries and their attributes

*Mature channels/rivers:* attributes; channel morphology

*In-stream features:* types; morphology

*Riparian zone:* characteristics; vegetation; buffer zones

*Floodplain features:* connectivity between floodplain and channel; importance of alluvial deposition and nutrients; importance of flood/drought events; latitudinal and longitudinal complexity

*Classification methodology:* use of annotated mapping; classification using physical characteristics and biotic indices

*Lotic ecosystems:* general classification of rivers according to their fish species and physical characteristics; effects of temperature, oxygen, pH and suspended solids on aquatic life; anthropogenic impacts on lotic ecosystems

*Biological factors:* competition; predation; tolerance ranges of stenotopic and eurytopic organisms; acclimation; adaptation; physiological and behavioural homeostasis

*Biological distributions:* geographic; zonation; regular; random; clumped; temporal communities

*Dynamics:* life tables; age distributions; demographics; geometric and logistic growth curves; carrying capacity; *r* and *K* strategies; natural regulation

#### **4 Be able to survey aquatic populations and environments**

*Aims:* general purpose; production of baseline data; monitoring; compliance with biodiversity action plans; comparison with similar sites

*Factors:* seasonality and weather; behaviour patterns; resource considerations; legislation; licence requirements from statutory authorities; health and safety considerations

*Survey error:* types and causes; techniques to reduce survey error

*Methods used to survey aquatic populations and environments:* methods used to sample water and survey physical features of water bodies; methods used to measure basic water chemistry; methods used to survey aquatic plants, micro-organisms, invertebrates and fish; methods used to analyse collected data from aquatic environments; use of biotic indices and chemical analysis to identify status of aquatic ecosystems

*Lentic survey and monitoring:* associated methodology; possible causes of error

*Lotic survey and monitoring:* associated methodology; possible causes of error

*Established techniques:* equipment: plankton nets, drift nets, baited funnel traps, electrofishing tools, sweep sampling; kick sampling, transects, removal sampling; Simpson's Diversity Index, Lincoln Index, abundance scales

*Animal taxa:* aquatic invertebrates; fish; mammals; birds; reptiles; amphibians

Learning outcomes and assessment criteria

<b>Learning outcomes</b>  <b>On successful completion of this unit a learner will:</b>	<b>Assessment criteria for pass</b>  <b>The learner can:</b>
<p>LO1 Understand basic ecological principles</p>	<p>1.1 explain the factors influencing a range of biogeochemical cycles</p> <p>1.2 explain the energy cycle in an aquatic ecosystem</p> <p>1.3 evaluate the ecosystem concept, the community concept and the species concept</p> <p>1.4 analyse how an ecosystem evolves over time</p>
<p>LO2 Understand the fundamental dynamics and ecological characteristics of lentic ecosystems</p>	<p>2.1 examine and describe a selected lentic ecosystem in terms of its flora, fauna and physical characteristics</p> <p>2.2 explain the factors influencing the distribution of named plant and animal species and populations in a selected lentic ecosystem</p>
<p>LO3 Understand the fundamental dynamics and ecological characteristics of lotic ecosystems</p>	<p>3.1 examine and describe a selected lotic ecosystem in terms of its flora, fauna and physical characteristics</p> <p>3.2 explain the factors influencing the distribution of named plant and animal species and populations in a selected lotic ecosystem</p>

## **Guidance for tutors**

### **Delivery**

Tutors delivering this unit have opportunities to use as wide a range of techniques as possible. Lectures, discussions, seminar presentations, site visits, supervised aquatic ecology practicals, research using the internet and/or library resources and the use of personal and/or industrial experience would all be suitable. Whichever delivery methods are used, it is essential that tutors stress the importance of animal welfare, sound environment management and the need to manage the resource using legal methods.

A strong emphasis should be placed on visiting a wide range of freshwater habitats in order to give learners first-hand experience of freshwater habitats and to observe management and wildlife in context. 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. Appropriate personal protective equipment (PPE) must be used during practical work.

Tutors should consider integrating the delivery, private study and assessment relating to this unit with any other relevant units and assessment instruments learners may also be taking as part of their programme of study.

### **Essential requirements**

Learners must have access to a range of habitats to investigate and contrast, in particular, study visits will enable more detailed investigations. Simulated appropriate aquaria could be used to facilitate the learning. In addition, biological surveying equipment and suitable identification keys should be available for learners to use. Learners will need access to library resources, and a number of multimedia resources should be available to support ecological study.

An appropriate first-aid kit should be carried and appropriate PPE such as waterproof clothing and boots should be used. Lifejackets and throw ropes will also be needed for working in and around water.

### **Employer engagement and vocational contexts**

Learners could be introduced to a variety of professionals, either as guest speakers or on off-site visits to different establishments. This will broaden their depth of knowledge, enhance and contextualise their learning experience. Relating the unit content to the work of organisations such as wildlife trusts (the County Trusts in England and Wales and the Scottish Wildlife Trust), the Royal Society for the Protection of Birds (RSPB) and the Worldwide Fund for Nature (WWF) will strengthen the vocational relevance.

This unit presents opportunities to demonstrate higher-level skills in application of number, communication, information and communication technology, improving own learning and performance, problem solving and working with others.