Rivers and lochs

Scotland's freshwaters provide a range of habitats for plants and animals. Overall, freshwater habitats and species are in good condition. However, while some individual habitats and species are improving, others are still under pressure.

Summary

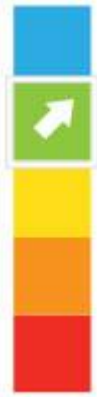
Key messages

- Scotland has significant freshwater resources: 125,000 km of rivers, 27,000 lochs, 198,000 ponds and 220 km of canals.
- This provides a range of habitats for wildlife, such as otters and freshwater pearl mussels.
- Overall, the habitat of wildlife in Scottish rivers and lochs is considered to be in a good condition, although large numbers of ponds have been lost in the past.
- Freshwater wildlife is largely in a good condition, but a number of individual species are declining.
- Some high-profile species are still struggling (e.g. pearl mussels), although others are recovering well (e.g. otters).
- New statutory controls and other approaches have been introduced to protect and restore wildlife.
- The predicted impacts of climate change pose significant challenges.

State and trend

State: Good - high agreement, high evidence

Trend: Improving/stable - high agreement, high evidence



There is an explanation of the diagram and further information on how we carried out the assessments on the summary pages.

- These assessments are of the current "average condition"; some aspects are in a worse condition, and others are in a better one. Equally, some wildlife is declining, while other wildlife is improving.
- Making any overall assessment is necessarily a simplification.
- We have taken account of the scale of any damage to the environment in these assessments; impacts can be locally damaging, but may have little effect on a national scale.
- The condition of freshwater wildlife is improving, but considering the likely scale of future risks and challenges, the assessment is 'improving/stable'.

- We have stated how confident we are in the assessments based on the level of agreement between the specialists involved, and the quality and quantity of the supporting evidence.

Overview

Scotland has significant freshwater resources: 125,000 km of rivers, 27,000 lochs, 198,000 ponds and 220 km of canals.

We receive many benefits from freshwater ecosystems, habitats and wildlife. Freshwater is used for drinking, irrigation, transport and food processing. Freshwater habitats can help control flooding, naturally treat or break down human and industrial waste, and support plant and animal life.

Rivers, lochs, canals and ponds

Rivers, lochs, canals and ponds cover about 2% of our land area. Together, they make up around 70% of the total surface area of freshwater in the UK, and contain 90% of the volume of freshwater in the UK.

When in a good condition, rivers, lochs, canals and ponds can support a wide range of plants and animals, many of which are important enough to be listed in the UK Biodiversity Action Plan. Our freshwater includes:

- a considerable number of relatively unmodified and unpolluted river systems with natural physical, chemical and biological diversity;
- many deep, unpolluted lochs, with wildlife that lives in nutrient-poor waters;
- a large proportion of the world's blanket-bog pools and lochans, which are rare elsewhere;
- unique groupings of freshwater plants, which naturally include species found in both North America and Europe;
- several internationally rare invertebrate species, including some of the world's largest surviving populations of freshwater pearl mussel.

The importance of Scotland's freshwater environment is described in the topics on water. Freshwater wildlife makes its own distinctive contribution to the benefits from nature provided by Scotland's natural resources, which were valued at between £21.5 and £23 billion a year[1] in 2010.

Lochs alone were estimated to contribute between around £1.4 and £1.5 billion a year to Scotland's economy.

Reference

[1]*Williams, E. (2010). Preliminary exploration of the use of ecosystem services values in a regulatory context. Environmental and Resource Economics Project Report for the Scottish Environment Protection Agency (SEPA).*

State

The overall ecological condition of Scottish rivers is generally good, with healthy populations of many mammal, bird, fish, invertebrate and plant species. The condition has improved over the last few decades, but some problems remain. Our freshwater wildlife is affected by high levels of nutrients, water abstraction (removal), physical modification of freshwater habitats, invasive non-native species, and climate change.

Despite improvements in water quality over several decades, some habitats and species are still affected. For example, water vole and freshwater pearl mussel populations continue to decline, and high nutrient concentrations threaten plants like river jelly lichen and slender naiad. Some habitats and species are affected by river engineering (for example, dams and flood defences) and water abstraction, and climate change and invasive non-native species have introduced new challenges.

Rivers

Habitats

Just over half of our rivers are in good condition or better, as assessed by the Water Framework Directive, with many being less affected by human activity than most rivers elsewhere in the UK and Europe. Many rivers have been affected by changes to physical habitat, such as straightening, dredging and loss of natural vegetation.

In 2011 only half of the 12 habitat features of designated river and stream habitats were found to be in 'favourable or recovering condition'.

Animals

Most monitoring information is available for larger animals, such as mammals and birds.

In Scotland, otters are found in many rivers, lochs, coasts and estuaries. Otters need good-quality water environments with plenty of food, and they are good indicators of healthy freshwater habitats.

In 2011 all the sites protected for otters were in favourable condition. The data shows that otters have greatly increased their spread since 1979, with otters now found even in urban rivers.

Water voles live in burrows near freshwater. They are one of Scotland's most threatened mammal species; their numbers fell dramatically in the second half of the 20th century due to habitat loss and the introduction of the predator, the American mink. Water voles in Scotland are now mainly restricted to smaller upland watercourses, although they can also be found in patches of undeveloped land in large urban areas, notably Glasgow.

Scotland's rivers support a diverse range of birds, including waterfowl, waders and songbirds. Their populations fluctuate; for example, the reed bunting population increased by 58% between 1995 and 2008. Meanwhile, although found in many areas, dipper numbers are falling.

Scotland's rivers naturally support a lower diversity of native fish species than rivers in southern Britain. Annual statistics on the catches of Atlantic salmon and sea trout provide the only long-term national report on freshwater fish populations in Scotland.

The total rod catch (retained and released) in 2012 was similar to the previous five-year average. Since 1952, when records began, annual rod catch has increased and is currently at the high end of the ranges that have been observed. Although several factors affect fish populations, this could be evidence of the numbers of fish entering freshwater increasing and, given the high levels of reported catch and release, escaping to spawn.

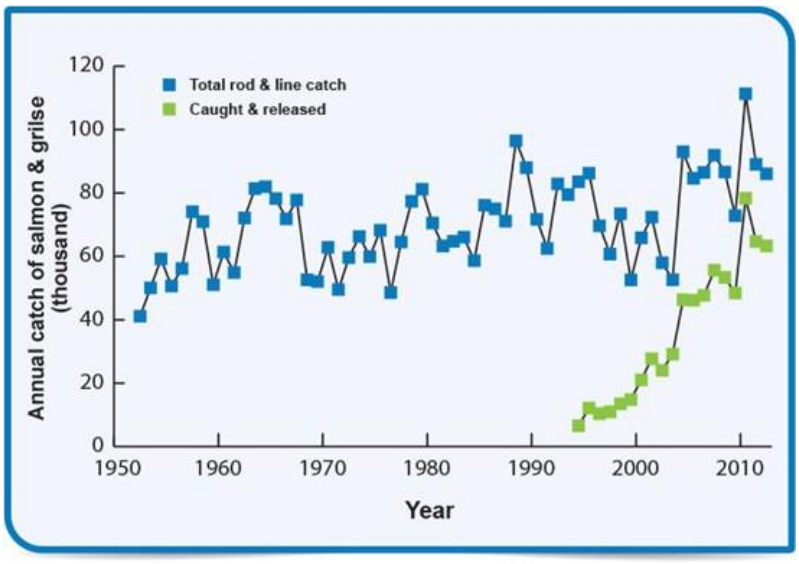


Figure 1: Total number of salmon reported to have been caught by rod-and-line fisheries in Scotland 1952-2012

Like salmon, sea trout migrate between the freshwater and the sea. The total reported sea-trout catch (retained and released) in Scotland as a whole in 2012 was 22,051.

Catches have declined over much of the period since 1952; the total reported catch in 2012 was 3% lower than the previous five-year average and was the fifth lowest in 61 years.

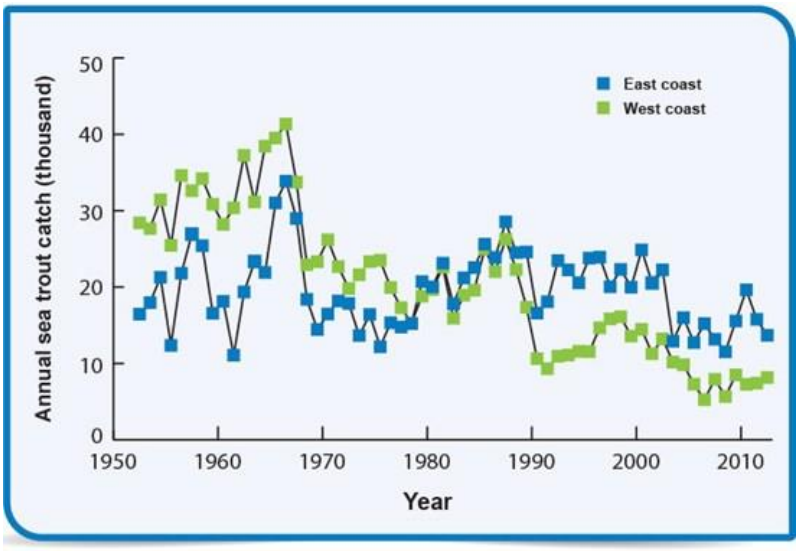


Figure 2: Annual reported catches of sea trout by rod-and-line fisheries in Scotland 1952-2012

Invertebrates sensitive to water quality changes are monitored at least twice a year (in spring and autumn) at a network of over 250 river sites. The average number of species varies between years but increased between 1981 and 2008.

Many Scottish rivers and burns are designated for protection because they are home to important populations of rare and declining species. In 2010, mixed fortunes were reported for designated river species (Table 1).

The main issue causing sites to be in poor condition was poor water quality.

Table 1: Summary of the condition of features for four protected river species

Species	Number of features assessed	Features assessed in favourable or recovering condition, 2005 (%)	Features assessed in favourable or recovering condition, 2011 (%)
European otter	27	100	100
Atlantic salmon	19	95	100
Lampreys (brook, river and sea)	16	67	68
Freshwater pearl mussel	24	33	33

Scotland has internationally important populations of freshwater pearl mussel, and has many of the world's remaining populations of this rare mollusc. However, in 2006 only 62 of 106 Scottish populations were assessed as viable (i.e. producing enough young mussels to be likely to keep the population going in the future).

In 2005 and 2011, there were concerns about freshwater pearl mussel populations in designated sites, as there were low densities of adult mussels and poor populations of juveniles. Licensed pearl fishing in the past, and recent, illegal, pearl fishing was assessed as a negative influence on 21 of the 24 sites designated for freshwater pearl mussels.

Scottish rivers support a range of submerged and emergent plants: flowering plants and simpler algae, mosses and lichens. Some particularly important species have been given protected status, such as water crowfoot in the River Tweed.

Nutrient levels in Scotland's rivers usually naturally increase as they flow downstream. Consequently, the lower reaches tend to support a higher abundance of aquatic plants.

Riverbank plants are important to the ecology of rivers, as they provide an important habitat and are a source of shade, cover and nutrients for the river. The variety of species of streamside plants was 12% lower in 2007 than in 1998. Since 1990, riverside vegetation has changed to include more tall species, with more woody plants. This increase in bushes and trees is partly the result of widespread efforts to prevent livestock from entering rivers, which helps to reduce the effects of diffuse pollution in rivers and lochs.

Lochs

Habitats

In March 2010 Scottish Natural Heritage (SNH) reported that, of 203 lochs monitored, 164 (81%) were in a favourable condition or were regarded as recovering, which is an improvement from the 2005 figure of 75%.

The 2012 Water Framework Directive classification found that of the 334 assessed, 64% were in good or better condition.

Animals

Many lochs in Scotland are important bird habitats that are protected. In 2011 70 out of 86 freshwater breeding bird features (81%) were in favourable or recovering condition. Most of the sites in unfavourable condition were designated for the black-throated diver and Slavonian grebe.

Scottish lochs are home to a number of fish species, some of which are rare or threatened (e.g. Arctic charr, powan and vendace). Species of coarse fish, such as pike and perch, have been introduced to a number of Scottish lochs, a practice which is now illegal without a licence.

Designated features for protected loch-fish species were reported generally to be in favourable condition in March 2010 – only one Arctic charr population was reported as being in unfavourable condition.

A small trial reintroduction of the European beaver, formerly extinct in Scotland, is underway in lochs in Knapdale in mid-Argyll to assess the feasibility and effects of reintroduction.

Several rare invertebrate species are recorded in Scottish lochs, including the medicinal leech, found in a few shallow, weedy, nutrient-rich lochs.

Plants

Scotland's lochs support a wide range of flowering plants, mosses, algae and lichens, but no overall assessment of the state of loch plants has been undertaken. The slender naiad is the only loch plant species protected under the designation of Special Areas of Conservation. Only three out of six sites protected for slender naiad were in favourable condition in March 2011.

Based on the water quality of lochs and the reported condition of designated site features, the condition of animals and plants in Scottish lochs is generally good and, in many remote lochs, is likely to be relatively undisturbed by human activity.

Ponds

Although very small, ponds can support a surprising diversity of wildlife, and are particularly good habitats for amphibians (frogs, toads and newts), and invertebrates, such as dragonflies, snails and water beetles. They are also known to support rare plant species, such as the aquatic fern pillwort.

Animals

Some animals are particularly associated with ponds, and some, such as the great crested newt and natterjack toad, are given legal protection wherever they occur in Scotland, with a number of sites specifically designated for them. In 2011, 10 out of 11 features for amphibians in Scottish designated sites (90.9%) were either in favourable condition or recovering from unfavourable condition.

Invertebrates are an important part of Scottish pond life. Not enough is known, however, to assess their state or the trend in their condition.

Plants

In 2007 Scotland's ponds had an average of 10 wetland plant species each. Overall 10% of the ponds surveyed were of high enough quality to meet the UK Biodiversity Action Plan's 'Priority Habitat' status, based on the number of plant species. Across all 81 ponds surveyed in 2007, 137 different plant species were recorded.

Canals

Scotland's canals provide an important habitat for plants and animals, with 22 Sites of Special Scientific Interest (SSSIs) on or within 500 m of our canals. An abundance of invertebrates, fish, birds and plants as well as a range of amphibians and mammals is found, including bats.

Pressures affecting rivers and loch wildlife

Nutrient enrichment

Nutrient input (e.g. nitrogen and phosphorus) to freshwater can lead to a change in the species found as well as the population numbers of animals and plants. Excessive inputs of nutrients can result in extreme events such as algal blooms. These can deprive the native plants of light and oxygen, and can be toxic, resulting in decline or loss of fish species.

Extensive studies have been undertaken over several decades into the effects of, and more recent recovery from, nutrient enrichment in Loch Leven in Perth and Kinross.

Acidification

Acid rain affected populations of plants and animals in and around many freshwaters in the 1970s and 1980s. Invertebrates living in rivers and lochs were affected by the more acidic water, and the reduced numbers of invertebrates had a knock-on effect on animals that depend on them for food, such as the dipper, causing their numbers to fall, too. Many areas affected are now recovering, although some sites still show the impacts of acidification.

Water use and physical modification of habitats

Abstraction of too much water can be a problem for river and loch wildlife. Changing water levels too rapidly or too often through removing and then returning water can destroy shallow water habitats for plants and animals. In extreme cases, riverbeds can dry up. Dams and weirs, which modify or regulate river flows, often built to support water abstraction, can also cause problems. In addition, the dams may restrict or prevent fish migrating to breeding areas.

Aquatic habitats are often modified physically by engineering; for example, installing flood defences or agricultural drainage schemes. These can directly remove or destroy habitats or can affect them indirectly by changing the natural flow or sediment in freshwaters.

Invasive non-native species

There are many non-native species in Scotland, but only a small number of these have spread, causing damage to the environment, the economy, our health and the way we live – these are called invasive non-native species (INNS).

The threat from INNS is growing, and is made worse by increased global movement of people and goods; the UK National Ecosystem Assessment identifies INNS as one of the most important direct causes of biodiversity loss. that INNS cost the Scottish economy almost £245 million each year. Examples of INNS affecting Scottish freshwaters include rhododendron, American mink and New Zealand pygmy weed.

Climate change

By the 2080s, Scotland is likely to be several degrees warmer than it is today, especially in summer, and with less snow, wetter winters and drier summers. These changes, along with increased flooding, will affect the wildlife of freshwaters, with some long-term changes in rivers and lochs already being observed. The winter flow in the River Teith has increased by 91% over the last 40 years, while the average spring temperature in Loch Leven increased by 1.5 ºC between 1970 and the year 2000.

Wildlife in rivers can be negatively affected by rising temperature, low water levels, changed flows and flash floods, making conditions less hospitable. The timing of some seasonal events has already changed significantly: since the 1970s dippers have been laying eggs 3 days earlier each decade, on average (or four days earlier for every rise in temperature of 1 ºC).

What is being done

Practical implementation of regulation, and the development of best practice guidance, is helping to address pressures on freshwater wildlife.

Policy and legislation

The main mechanism for controlling development, Town and Country Planning legislation, was not designed to provide the specialised protection required for freshwaters. Consequently, many barriers to fish migration have been installed (bridges, weirs, etc.) as part of developments. Conservation legislation controls some impacts by licensing operations likely to damage designated conservation sites.

A policy response to the pressures on freshwater in Scotland was provided through the Water Framework Directive (WFD). The Water Environment and Water Services (Scotland) Act 2003, and its Controlled Activity Regulations (CAR) regime, regulates physical modification of, and water abstraction from, rivers, canals and lochs.

Under the WFD, river-basin management plans (RBMPs) were published for Scotland and the Solway Tweed River Basin Districts in 2009. These plans will ensure that public-sector organisations, businesses and individuals co-ordinate the way water is managed to make sure a balance is found between protecting our water environment and wildlife, and the interests of other water users.

The Wildlife and Countryside Act 1981 has been amended (by the Wildlife and Natural Environment (Scotland) Act 2011) to introduce more consistent and preventative legislation on INNS, and a Non-Native Species Code of Practice, including a framework of responsibilities for certain bodies (SNH, SEPA, the Forestry Commission Scotland and Marine Scotland) has been put in place.

Sustainable management

In general, pollution levels in Scottish freshwaters have been falling over time, and conditions have improved for wildlife following significant investment in better treatment of waste along with strengthened regulation. Sometimes, however, specific action is required to protect the environment from pollution. For example, during the 1960s and 1970s, when acidification of Loch Doon in south-west Scotland threatened the loch's unique population of Arctic charr, Loch Doon Arctic charr were moved to two reservoirs elsewhere in the Scottish Borders where acidification was not a problem.

When wildlife is threatened by diffuse pollution, action must sometimes be taken at a catchment level. In response to a threat from nutrient enrichment to rare loch plants in Tayside, SEPA initiated a lochs partnership, with funding from the Tayside Biodiversity Fund for measures to protect the plants. The project included an audit of farms in the catchment, soil nutrient budgets, advice to land managers, and funding to create buffer strips around lochs to trap nutrients.

Public funding is available for work that aims to restore water bodies to good ecological status, in line with the aims of the WFD RBMPs.

Invasive non-native species (INNS)

The is working with a range of partners to minimise the risk of invasion and damage caused by INNS in Scotland, following the principles set out in the INNS Framework Strategy for Great Britain. Two popular campaigns give advice on good practice relating to biosecurity – Be Plant Wise (for plants) and Check, Clean & Dry (for water sports). The Rivers and Fisheries Trusts of Scotland are leading on biosecurity in many Scottish river catchments, eradicating species such as Japanese knotweed, giant hogweed, Himalayan balsam and rhododendron. The Scottish Mink Initiative aims to protect nationally significant populations of water voles, salmonids, ground-nesting birds and other native riparian wildlife from mink.

Climate change

As part of its policy response to climate change, the Scottish Government has developed a Climate Change Adaptation Framework with sector action plans to help make Scotland more resilient to the unavoidable consequences of a changing climate. The Biodiversity and Ecosystem Resilience Sector Action Plan sets out what action is being taken to adapt, and what this sector can do to help other sectors and our wider society adapt.