

RIVER MORISTON SPECIAL AREA OF CONSERVATION (SAC)

CONSERVATION ADVICE PACKAGE



Site Details

Site name: River Moriston

Site map: <https://sitelink.nature.scot/site/8361>

Location: Highlands and Islands

Site code: UK0030259

Area (ha): 194.38

Date designated: 17 March 2005

Qualifying features

Qualifying feature	SCM assessed condition	SCM visit date	UK overall Conservation Status
Freshwater pearl mussel (Margaritifera margaritifera) [S1029]	Unfavourable No change	15 Jun 2003	Unfavourable - bad
Atlantic salmon (Salmo salar) [S1106]	Unfavourable No change	5 July 2011	Unfavourable- Inadequate

Notes:

Assessed condition refers to the condition of the SAC feature assessed at a site level as part of NatureScot's [Site Condition Monitoring \(SCM\)](#) programme.

Conservation status is the overall condition of the feature throughout its range within the UK as reported to the European Commission under Article 17 of the Habitats Directive in 2019.

Overlapping Protected Areas:

None

Key factors affecting the qualifying features

Freshwater pearl mussel

Freshwater pearl mussels are long-lived freshwater molluscs that live in the gravel beds of clear, unpolluted rivers. For part of their lifecycle they are dependent upon a healthy population of salmonids (young salmon or trout) which act as host species. The mussel larvae attach to the gills of salmonid fish in mid to late summer and drop off the following spring. When they detach from their hosts they must land in sandy or gravelly substrates to settle and grow to adulthood.

Freshwater mussel populations are vulnerable to changes to water quality (including pollution), hydrological alterations (including river engineering and abstractions), habitat degradation of river beds and banks, illegal pearl fishing and availability of host species.

The feature has been assessed through NatureScot's site condition monitoring programme as being in unfavourable condition at this SAC due to poor recruitment and the small size and aged status of the population, especially in the upper reaches of the river.

Atlantic salmon

Atlantic salmon live in both freshwater and marine environments as part of their lifecycle. They hatch and live in freshwater as juveniles and then migrate to sea as adults. After one year or more at sea the adults return to their natal river to spawn. This homing behaviour has resulted in the development of genetically distinct populations of Atlantic salmon between Scottish rivers and several populations may exist within the same river.

Since Atlantic salmon migrate up and down stream, any barriers to fish passage have important negative effects. There is one licenced in-stream structure that is known to be an influence on fish passage. Facilitating the access of Atlantic salmon to all areas of the catchment where they could expect to occur naturally is a key objective.

Atlantic salmon numbers have declined throughout their geographic range, including in Scottish rivers. They may be impacted by a range of pressures in the freshwater and marine phases of their lifecycle. In the River Moriston these pressures include a lack of sediment/gravel transport due to the presence of dams (hydropower) and locally non-native invasive species. There is a Marine Harvest fish hatchery near Torgoyle but this is not considered to be having a significant impact on Atlantic salmon. Agriculture, grazing, water management, water quality and forestry are also pressures. Hydropower can have effects through dams which minimise or prevent salmon movement and change the characteristics of the river downstream, intra-catchment water transfers, reduction in water flow, and un-natural flow patterns. Many of these factors are monitored by SEPA under the Water Framework Directive. Three Water Framework Directive water bodies representing a river length of 30 km are recognised as being present within the River Moriston SAC. All of these are heavily modified and classified as being at good ecological potential for Heavily Modified Waterbodies. All of the River Moriston water bodies are identified as such because of the presence of hydro power generation schemes. These are owned and managed by Scottish and Southern Energy. Water quality objectives for the River Moriston SAC are determined by those required for freshwater pearl mussel.

In Europe, Atlantic salmon SACs extend to the tidal limit of rivers only. However, the downstream limit of the River Moriston SAC does not extend to the tidal limit but is located at Roinn Inbhir on the shores of Loch Ness. Marine mortality, nevertheless, is however one of the key issues facing Atlantic salmon in Scotland, the River Moriston and elsewhere. Environmental factors, climate change, marine developments, enhanced sea lice burdens associated with aquaculture, by-catch in pelagic fisheries, over-exploitation, prey availability, pollution and predation are all key factors that could affect this species. However, the exact nature of these interactions is not fully understood.

The Ness District Salmon Fishery Board has a voluntary catch and release policy which is strongly promoted, with the need for mandatory catch and release reviewed annually.

Water is abstracted from the River Moriston through the Cluanie and Dundreggan dams.

Climate change may impact on salmon both at sea and on land. At sea, high levels of mortality are found where temperature uplift occurs. On land, water temperatures may impact on salmon, especially juvenile fish. Marine Scotland has been monitoring water temperature as part of the Scotland River Temperature Monitoring Network and data show the importance that shade from riparian trees may play a significant role in mitigating climate change impacts.

Two Invasive Non Native Species have been identified as potentially having some impact on Atlantic salmon in the River Moriston. These are European minnow (*Phoxinus* (L.)) and pike (*Esox Lucius* L.). Both are extensively distributed and common in the catchment and are thought to have a moderate impact on Atlantic salmon. No current management is in place. It is unlikely that it will be possible to remove minnows from the catchment, but efforts should be made to identify mechanisms that may allow fishery managers to contain the risk of spread where possible. Pink salmon (a Pacific salmonid now established in northern Russia) was recorded in the River Ness in 2017 and 2019 and may present a management issue in future years.

The feature has been assessed through NatureScot's site condition monitoring programme as being in unfavourable condition at this SAC due to low juvenile salmon population densities.

Further information about these species can be found on the [JNCC website](#).

Conservation Priorities

There are no priority qualifying features within the River Moriston SAC. There is unlikely to be any conflict between management of the freshwater pearl mussel and Atlantic salmon features, as both require similar environmental conditions and freshwater pearl mussels are dependent on salmon for part of their life cycle. However, the impact of any proposed management measure on all the qualifying features should first be considered as part of a Habitats Regulations Appraisal.

Overarching Conservation Objectives for all features

1. To ensure that the qualifying features of the River Moriston SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status

Favourable Conservation Status (FCS) is considered at a European biogeographic level. When determining whether management measures may be required to ensure that the conservation objectives for this site are achieved, the focus should be on maintaining or restoring the contribution that this site makes to FCS.

When carrying out appraisals of plans and projects against these conservation objectives, it is not necessary to understand the status of the feature in other SACs in this biogeographic region. The purpose of the appraisal should be to understand whether the integrity of the site (see objective 2) would be maintained. If this is the case then its contribution to FCS
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across the Atlantic Biogeographic Region will continue to be met. Further details on how these appraisals should be carried out in relation to maintaining site integrity is provided by objective 2 (including parts a, b, c – and for freshwater pearl mussel - d). If broader information on the feature is available then it should be used to provide context to the site-based appraisal.

Note that “appropriate” within this part of the conservation objectives is included to indicate that the contribution to FCS varies from site to site and feature to feature.

2. To ensure that the integrity of the River Moriston SAC is restored by meeting objectives 2a, 2b, 2c for each qualifying feature (and 2d for freshwater pearl mussel)

The aim at this SAC is to restore the qualifying species to a favourable condition as a contribution to their wider conservation status. Therefore any impacts to the objectives shown in 2a, 2b, 2c or 2d below must not persist so that they prevent the achievement of this overall aim. When carrying out appraisals of plans or projects the focus should be on restoring site integrity, specifically by meeting the objectives outlined in 2a, 2b, 2c and 2d. If these are met then site integrity will be restored. Note that not all of these will be relevant for every activity being considered. Any impacts on the objectives shown in 2a, 2b, 2c or 2d below must not persist so that they prevent the restoration of site integrity. Temporary impacts on these objectives resulting from plans or projects can only be permitted where they do not prevent the ability of a feature to recover and there is certainty that the features will be able to quickly recover.

This objective recognises that the qualifying species are exposed to a wide range of drivers of change. Some of these are natural (e.g. population fluctuations/ shifts or habitat changes resulting from natural processes) and are not a direct result of human influences. Such changes in the qualifying species' distribution and use of the site, which are brought about by natural processes, directly or indirectly, are normally considered compatible with the site's conservation objectives. An assessment of whether a change is natural or anthropogenic, or a combination of both, will need to be looked at on a case by case basis.

Conservation Objectives for freshwater pearl mussel (*Margaritifera margaritifera*)

2a. Restore the population of freshwater pearl mussel as a viable component of the site

The conditions for the species' long-term existence at the River Moriston should be restored. This includes encouraging and allowing the number and density of mussels to increase.

This conservation objective is considered to be met if the conditions for the species' long-term existence are in place. These conditions include:

- Avoiding effects that could lead to an inability of the population to successfully reproduce and recruit sufficient juveniles into the population (e.g. >20% of the population should be juvenile (<65mm long). Very young juveniles (<30mm long) should also be present).
- Avoiding effects that could lead to a permanent reduction in the density and number of freshwater pearl mussels in the population, or that prevent a recovery in density and numbers, through mortality, injury or impacts caused by disturbance. These effects could be caused by development, water pollution, river engineering, land-use change, abstractions, and wildlife crime. For a healthy mussel population the aim is to have at least 5 mussels per m² in appropriate habitat.
- Ensuring high quality habitat in river reaches that support freshwater pearl mussels (see conservation objective 2c)

- Allowing the species distribution within the site to be expanded (see conservation objective 2b)
- Restore the distribution and viability of the freshwater pearl mussel's host species - mostly Salmon in the River Moriston - and their supporting habitat (see conservation objective 2d).

However, freshwater pearl mussels are in unfavourable condition at this site. The focus of this objective will therefore be to stop the decline in population and subsequently promote its increase. Recovery of freshwater pearl mussel populations is notoriously difficult. This is partly due to their unusually long lifecycle and their requirement for both, very high water quality and the associated natural, habitat conditions, with particular regard to nutrient and oxygen levels, flow rates and sediment load. These conditions generally need to be provided for all of the time.

The early stages of the pearl mussels' lifecycle is also complex and delicate, as it relies on the presence of healthy, abundant, juvenile, native salmonids. It is therefore also important that the local salmonid population is robust and able to access all relevant areas of this SAC.

When assessing the effects of any plan or project consideration should be given to whether impacts outwith the SAC could affect achievement of this conservation objective.

2b. Restore the distribution of freshwater pearl mussel throughout the site

Conditions should allow for the distribution of freshwater pearl mussel to be expanded or at least restored to their previous known extent.

Freshwater pearl mussels are present in the main stem river only in the River Moriston SAC.

Distribution of mussels within the site can be affected by disturbance originating both within and outwith the site. Factors such as abstraction, water pollution, illegal pearl fishing, river engineering and intensification of land use can risk directly affecting freshwater pearl mussels.

The species can be directly affected, or the species' habitat quality reduced such that recruitment is unsuccessful, leading to a contraction in the species' distribution in the site. It is important that both up- and down-stream distribution is maintained within the site.

Plans and projects that cause disturbance, displacement and barrier effects to the host species can also affect mussel distribution (see conservation objective 2d).

2c. Restore the habitats supporting the freshwater pearl mussel within the site and availability of food

The distribution and extent of the species' habitat within the site, together with the structure, function and supporting processes of the habitat should be restored.

Freshwater pearl mussels are typically found in rivers with 'soft' high water quality conditions, combined with abundant gravel river beds. They feed by filtering fine organic particles from the water. In order to maintain the supporting freshwater pearl mussels' habitat it is important that the species' high quality habitat requirements are met.

High water quality and natural flow conditions should be in place to provide the necessary conditions for freshwater pearl mussel. The creation of native riparian woodlands and best practice management of commercial plantations in the catchment will reduce high sediment loads and lead to more sustainable river flow regimes. These land management practices will help to reduce the potential for damaging flood impacts and also create more sustainable

steady flows during droughts.

Freshwater pearl mussel populations are particularly vulnerable to nutrient enrichment and fine sediment increases, both of which can affect the juvenile mussels that predominantly live buried in river gravels. River engineering can also directly damage populations, as well as interrupt the supply of sediment that maintains habitat. Changes in land use and poaching of the river banks and channel by livestock have the potential to increase nutrient and fine sediment concentrations in the river. However land use changes, such as the establishment of native riparian woodlands and fencing off areas to livestock, have the potential to improve habitat by providing shade that can mitigate damaging peaks in summer temperature, stabilise river banks and reduce erosion.

Specific targets for some water quality parameters include:

- Nutrient concentrations should be near-natural. Soluble reactive phosphorus is particularly important (the annual mean should be $<0.005\text{mg/l}$).
- Mean Biochemical Oxygen Demand should be $<1\text{ mg/L}$. BOD measures the oxygen consumed by bacteria from the decomposition of organic matter (such as sewage or run-off from eroding land) in water. Unpolluted water has a low BOD (i.e., well oxygenated water with a low level of organic matter). Freshwater pearl mussels need river water to have some organic particles, as this is what they feed on. However pearl mussels can be harmed by excessive levels of organic particles, and associated low levels of oxygen in water.
- Filamentous algae should have $<5\%$ coverage of the river bed during the summer months (indicating that the river does not have excess nutrients).
- Excess fine sediment should be avoided in the river as this can smother freshwater pearl mussels or interfere with filter feeding.

The quality of the riverbed habitat is particularly important for freshwater pearl mussels, and is best assessed by measuring the 'redox potential' (a measure of how much oxygen there is in the water).

- There should be no pronounced difference in the redox potential between open water and interstitial (within sediment) water at 5cm depth (a typical depth for juvenile freshwater pearl mussels which are normally buried within the gravels).
- River flow rates should be natural throughout the site, avoiding high and low extremes. The flow regime in the furthest upstream reaches (above Ceannacroc where some of the pearl mussel population resides) is subject to continuous compensation flows. Management of flows through the Cluanie and Dundreggan dams should result in adequate volumes of water available and provide higher flow events and flow diversity.

2d. Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats

Sufficient salmonid fish hosts should be present to support juvenile mussel recruitment.

Salmonid fish (native salmon and trout) are an integral part of the freshwater pearl mussels' lifecycle and should be available in sufficient numbers to ensure continued recruitment of juvenile mussels to the population. It is important that juvenile host salmonids, including any range of genetic types, are present in all areas of the catchment to which they, and adult fish, have natural access and where freshwater pearl mussels have historically been present. It is important to note that, this can include naturally impassable waterfalls.

The host species can vary in different sites. At this site Atlantic salmon are the primary salmonid host known to be used by the local freshwater pearl mussel population. An abundance of > 0.1 native juvenile host salmonid per m^2 should ensure sufficient host species are available. More generally, the density of host juvenile salmonids should not

differ significantly from those expected for the river type/reach under conditions of high physical and chemical quality.

Freshwater pearl mussel population viability is dependent upon host salmonid population viability, so any threats to host species stocks should be avoided. Factors that can affect the viability of host species include those that affect freshwater pearl mussel, but potential barriers to fish migration, inappropriate fish stocking and biosecurity are also further increased risk factors. Factors that also affect the marine survival, and therefore viability, of Atlantic salmon and sea trout populations should also be considered.

Host species should be able to continue to use and access all areas of importance within the site. Plans and projects that cause disturbance, displacement and barrier effects to host species can affect their distribution and in turn the distribution of freshwater pearl mussels. Since 2013 there have been annual efforts by Ness and Beaully Fisheries Trust to encyst juvenile salmonids in the upper reaches with pearl mussel glochidia collected below the Dundreggan dam. This has been done in order to try and prevent the population dying out in the upper reaches. So far more than 1000 fish have been encysted, although it is still too soon to know if these efforts have been successful.

To ensure a viable population of host species is present supporting salmonid habitat should be maintained throughout the site. Atlantic salmon and trout, both require the presence of clean gravels for spawning. For Atlantic salmon and large trout, these typically occur at the tail-end of pools, although spawning may take place if suitable gravels and flows are present. On emergence, usually between March and early May, the young fry disperse and set up territories which they defend aggressively. Atlantic salmon fry prefer fast flows (>30 cm/s) in addition to a rough bed of pebble, cobble and gravel; favouring these areas which provide a surface turbulence (riffle habitat). Trout fry prefer areas of relatively low water velocity near the streambed. Cover from stones, plants and debris is essential for maintaining high fry densities.

Atlantic salmon that have survived their first winter (parr) prefer deeper water than fry (typically 15-40 cm) and a coarser substrate of pebbles, cobbles and boulders. Trout parr generally favour currents of relatively low speed, where cover is available. Juvenile trout are often to be found under bankside cover, within undercuts, among tree roots or in marginal vegetation. Cover remains important for adult trout and Atlantic salmon particularly in smaller streams. The shade from bushes next to the river or overhanging trees is likely to help to prevent fish from becoming stressed due to high water temperature combined with low water levels. Where the river is larger, this may be less important as deep water provides refuge.

Conservation Objectives for Atlantic salmon (*Salmo salar*)

2a. Restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site

The conditions for the species' long-term existence at the River Moriston should be restored. This includes encouraging the number of Atlantic Salmon to increase.

This conservation objective is considered to be met if the conditions for the species' long-term existence are in place. These conditions include:

- Effects should be avoided that could lead to a permanent reduction in the Atlantic salmon population or that prevent the population recovering, through mortality, injury, or impacts caused by disturbance or displacement. This includes for example the effects caused by the construction of in-stream barriers to migration, changes in water flow rates or water quality. Observed densities therefore need to be assessed in relation to the

expectation for the River Moriston overall and for each river reach, based on productivity and natural habitat character of the system. However, these should not differ significantly from those expected for the river type/reach under conditions of high physical and chemical quality.

- The numbers of returning Atlantic salmon should be sufficient to maintain the long-term viability of each life history type. All returning adults and emigrating smolts must have unhindered access between freshwater and marine habitats (see conservation objective 2b). All supporting freshwater habitats must be of sufficient quality and quantity to support both adult and juvenile fish (see conservation objective 2c). Different rivers have different seasonal patterns of adult migration associated with the environmental characteristics of the catchment and river system. Multi-sea winter fish are an important component of a natural Atlantic salmon run and the spring run component has declined considerably in recent years. The seasonal pattern of migration characteristic of the river and, in particular, the multi-sea-winter stock component should be restored.

However, Atlantic salmon were considered to be in unfavourable condition at this site when the last national Site Condition Monitoring assessment took place in 2011. Since then Marine Scotland have established a framework for assigning river gradings to each river, based on the probability of returning adult fish to achieve spawning targets. The latest assessment for the River Moriston SAC, which covers the five years between 2014-2018, is Grade 2. This means that there is a 60-80% chance that the river will achieve its Conservation Limit. These assessments are re-calculated in each year. A juvenile Atlantic salmon assessment tool has been developed through the National Electrofishing Programme for Scotland. Data collected from the River Moriston SAC during the 2018 and 2019 sampling season are currently being assessed by Marine Scotland Science.

The focus of this objective is to increase the number of Atlantic salmon smolts which are able to leave the river to continue on to the marine phase of their lifecycle, through increasing the number of adult salmon able to spawn in the river and maintaining access to spawning grounds. The river should not be stocked with young salmon, as they could compete with wild fish for food and be less adapted to life in the river, resulting in an overall reduction in the number of smolts able to go to sea.

When assessing the effects of any plan or project consideration should be given to whether impacts outwith the SAC could affect achievement of this conservation objective. The appraisal should also consider the life history traits of the species, including maintaining all genetic types of Atlantic salmon, and the scale and duration of the impact being assessed. Impacts resulting in the loss of genetically distinct populations of Atlantic salmon would not be considered temporary in nature as these adaptive traits may have evolved over generations and could not be recovered if lost.

2b. Restore the distribution of Atlantic salmon throughout the site

Conditions within the site should allow for the distribution of the species to be expanded or at least restored to their previous known extent.

Atlantic salmon distribution within the site should not be restricted by pollution or human activities.

Access to spawning sites, juvenile rearing sites and areas where adult Atlantic salmon may rest prior to spawning (some may be present within the river for a year prior to spawning), should all be *restored*. Juvenile Atlantic salmon should be present in all areas of the

catchment to which they, and adult fish, have natural access. This does not include areas above naturally impassable barriers, but areas where access has been limited by man-made obstructions. There is one licenced in-stream structure, the Ceannocroc Heck that is known to be an influence on fish passage. Facilitating the access of Atlantic salmon to all areas of the catchment where they could expect to occur naturally is a key objective.

The distribution of Atlantic salmon within the site may be affected by disturbance originating both within and outwith the site (including estuarine and coastal areas). Plans and projects that cause displacement and barrier effects to the species, for example by impeding access to spawning areas or downstream passage of smolts to the sea, can also affect species distribution. Examples may include: the provision of compensation flows which are inadequate to allow adult Atlantic salmon to reach known spawning areas; the presence of physical in-stream structures such as flow deflectors, coffer dams etc. which may increase flow velocity to that which is beyond the swimming capacity of migrating fish or sustained noise generation (such as that caused by piling) in places that cannot be avoided by migrating Atlantic salmon.

2c. Restore the habitats supporting Atlantic salmon within the site and availability of food

The distribution and extent of Atlantic salmon habitat within the site should be restored, together with the structure, function and supporting processes of the habitat.

Sufficiently high water quality and natural flow conditions should be in place to provide the necessary conditions for Atlantic salmon survival and recruitment.

Atlantic salmon spawn in late autumn and early winter, depositing their eggs in redds which they excavate in gravel and pebble beds. Eggs are often deposited in areas of accelerating flow, such as the tail-end of pools and glides, upstream from riffles. However, in upland streams eggs may be deposited in any areas of gravel that can be physically moved by the fish. A good supply of oxygen is essential for eggs to develop and this is facilitated by a flow of water through the gravel. Therefore, clogging these fine sediments with silt and fine sand can reduce the water and oxygen flow resulting in egg mortality. Egg survival is also affected by redd 'washout' during winter spates, resulting in the physical scouring out of eggs from the gravel. Substrate stability, the dynamics of water flow and the weather all influence the extent of siltation and scale of washouts.

After hatching the young fry remain in the gravel until March to early May, when they disperse and set up territories. Atlantic salmon fry prefer fast flows (>30 cm/s) and favour areas with surface turbulence (riffle habitat). They require a rough bed of pebble, cobble and gravel and water <20 cm deep. Good cover is essential for maintaining high fry densities, such as cover from stones, plants or debris.

Atlantic salmon that have survived their first winter (parr) prefer deeper water than fry (typically 20-40 cm) and a coarser substrate of pebbles, cobbles and boulders. Cover remains important for adult Atlantic salmon particularly in smaller streams and rivers. In larger rivers and lochs this type of cover may be less important.

Favoured habitat used by adult fish include pools of at least 1.5 m depth, with cover from features such as undercut banks, instream vegetation, submerged objects and even surface turbulence. Spawning habitat is defined as stable coarse substrate without an armoured layer, in the pebble to cobble size range (16-256 mm) but with the majority being <150 mm. Water depth during the spawning and incubation periods should be 15-75 cm. Coarse woody debris should be retained where appropriate as it plays a significant role in the formation of new gravel beds.

Juvenile Atlantic salmon (fry and parr) maintain feeding stations within rivers and defend these aggressively. The invertebrates which they feed upon are intercepted by juvenile fish as they drift downstream, and may be of aquatic or terrestrial origin.

At sea, adult Atlantic salmon feed on range of prey items, including marine amphipods, shrimps and squid and fish, such as sand eels, capelin and herring. Adults do not feed once they return to freshwater.

As a result of their life history Atlantic salmon stocks can be impacted in both freshwater and marine habitats. In freshwater, both water quality and water quantity are key issues. Salmonids require access to rivers with, unpolluted and well-oxygenated water with a habitat mosaic which comprises suitable spawning gravels, cobbles and boulders. In terms of water quality, these fish also require enough water to ensure access to and from spawning areas, as well as enough water to maintain an adequate level of juvenile habitat.

Over-exploitation, inappropriate stocking activities, riparian land management operations (such as those related to forestry and agriculture), in-stream engineering and alterations to natural water flow regimes (including those relating to hydropower development), invasive non-native species, physical barriers to migration (such as historic caulds and lades), pollution (direct and diffuse) and direct damage to spawning habitat (e.g. through mineral or gravel extraction) can all impact the quality of freshwater environments and their value to Atlantic salmon. Climate change, and the rises in water temperatures during summer, may also be a factor in determining the suitability of some waterbodies for Atlantic salmon. Therefore cover is important for Atlantic salmon, particularly in smaller streams. The shade from bushes next to the river or overhanging trees is likely to help to prevent fish from becoming stressed due to high water temperatures which often occur in combination with low water levels. Where the river is larger, this may be less important as deep water can provide cool refuge.

Water quality, hydrology, and habitat standards for Good Ecological Status (GES) under the Water Framework Directive should be met. These targets are intended to support a healthy, naturally functioning riverine ecosystem which protects the whole biological community and individual species to a degree characteristic of the river.

Conservation Measures

Current and recommended management for freshwater pearl mussel and Atlantic salmon

Issue	Measure	Responsible party
Low number and density of freshwater mussels present	Freshwater pearl mussels are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 as amended. Offences include intentionally or recklessly killing, injuring or taking from the wild a freshwater pearl mussel.	All
	Continue to monitor for signs of illegal freshwater pearl mussel fishing, report any findings to the Police and implement agreed actions to deter criminal activity.	All
Ongoing species	Legislation is in place to manage and	All

protection for salmon	protect Atlantic salmon in freshwater and at sea. This includes a statutory close season and catch & release period.	
	Develop an Atlantic salmon conservation plan for all rivers, or Atlantic salmon management units (if several small rivers are considered to be so close in terms of geography and stock size as to merit a single plan).	Marine Scotland Science Fishery managers NatureScot SEPA
	Voluntary catch and release policy for anglers.	Fishery managers, Ness District Salmon Fishery Board
Forest harvesting operations resulting in silt/nutrients entering the river – may affect freshwater pearl mussel and salmon spawning areas	Planning and implementation of forest harvesting operations should better identify high risk areas. Management should include improved pollution control, blocking of drains and careful harvesting in riparian areas.	Scottish Forestry, Forestry & Land Scotland, Forestry owners and managers
	Promote adherence to the Forest and Water Guidelines, and published best practice, during forest restructuring and highlight the need to strictly control fine sediment and other diffuse pollution release into the river. Forestry planting and harvesting in the catchment needs to be planned so that heavy rainfall and droughts are buffered by the forest rather than exacerbating high/low extremes in flow as both very high and very low river levels can damage freshwater pearl mussels.	Scottish Forestry, Forestry & Land Scotland, Forestry owners and managers
Sediment load in river from un-forested land – may affect freshwater pearl mussel and salmon	Ensure minimal poaching, tracking, or trampling by red deer, livestock, visitors and vehicles to prevent an unnatural sediment load from being washed into the river.	Land managers, NatureScot, SGRPID (GEAC)
	Cattle poaching may be locally significant and advice should be provided to land managers to fence off vulnerable areas and improve riparian management.	
Water quality	Implement and maintain monitoring of key water quality parameters.	NatureScot/SEPA
	Any development proposals in the catchment should include appropriate measures to minimise sediment run-off and prevent pollutants from entering the river.	Highland Council
Beneficial habitat management	Evaluation of diffuse pollution and morphological pressures through the river basin planning process and the implementation of restoration measures to maintain or improve habitat for both species.	SEPA
	Promotion of measures to increase resilience to climate change, particularly the	All

	<p>creation of native riparian woodland and improved connection with floodplains. Measures to promote coordinated, catchment-scale activity are particularly important. Native tree planting in appropriate locations would help improve the riparian habitat for both species.</p>	
	<p>Restore riparian and catchment habitats to reduce fine sediment concentrations, improve floodplain connectivity and restore more natural hydrological regime to benefit salmon and freshwater pearl mussel.</p>	All
Population size	<p>Encourage the natural processes of river flow and morphology through management of flows through the dams at the head of the river thereby improving freshwater pearl mussel and salmonid recruitment and survival.</p> <p>If river levels are particularly low, it may be appropriate to move pearl mussels to deeper pools if they would otherwise die due to their habitat drying out.</p>	All
	<p>Support ongoing efforts to increase salmonid encystment levels and improve pearl mussel recruitment.</p>	Ness and Beaully Fisheries Trust
Research – salmon	<p>Development and introduction of long-term monitoring protocols for juvenile Atlantic salmon in SACs.</p>	Marine Scotland Science
	<p>Develop and implement monitoring protocol to allow robust, catch independent, assessment of adult population size.</p>	Marine Scotland Science
	<p>Monitor the presence and distribution of aquatic non-native species which may adversely impact Atlantic salmon.</p>	SEPA, NatureScot
Marine survival - salmon	<p>Monitoring of post-smolt Atlantic salmon to determine their behaviour at sea and better understand the impact of enhanced sea lice burdens.</p>	Marine Scotland (Marine Scotland Science and Farmed Fish Health Inspectorate)
Invasive species	<p>All anglers and other water users (such as canoeists or researchers) should follow the Check, Clean, Dry biosecurity procedures to help prevent the spread of problem non-native species.</p> <p>It is unlikely that it will be possible to remove minnows from the catchment, but efforts should be made to identify mechanisms that may allow fishery managers to contain the risk of spread where possible.</p>	All

Water Flow	Manage abstraction and water transfers to ensure that access to essential habitats by Atlantic salmon is maintained and water flow is not lowered/raised in a way that would adversely affect the populations of freshwater pearl mussel.	SEPA, Nature Scot, Scottish Water
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Contact details: NatureScot
Fodderty Way
Dingwall Business Park
Dingwall
IV15 9XB
Tel: 01463 701610

Approved on 16 December 2019 by:

Greg Mudge
Principal Advisor
International Designations

Graham Neville
Area Manager
Northern Isles & North Highland