

RIVER SOUTH ESK SPECIAL AREA OF CONSERVATION (SAC)

CONSERVATION ADVICE PACKAGE



Atlantic salmon © Lorne Gill/NatureScot

Site Details

Site name: River South Esk

Site map: <https://sitelink.nature.scot/site/8364>

Location: Eastern Scotland

Site code: UK0030262

Area (ha): 471.85

Date designated: 17 March 2005

Qualifying features

| Qualifying feature | SCM assessed condition | SCM visit date | UK overall Conservation Status |
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| Freshwater pearl mussel (<i>Margaritifera margaritifera</i>) [S1029] | Unfavourable No change | 13 September 2009 | Unfavourable - bad |
| Atlantic salmon (<i>Salmo salar</i>) [S1106] | Unfavourable Recovering | 29 July 2011 | Unfavourable-Inadequate |

Notes:

Assessed condition refers to the condition of the SAC feature assessed at a site level as part of SNH'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.

Other overlapping Protected Areas:

Cairngorms Massif Special Protection Area (SPA).
Montrose Basin SPA, and Site of Special Scientific Interest (SSSI).

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.

In suitable conditions they can live for over 100 years. However 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 South Esk is one of SEPA's priority catchments. The main stem of the South Esk, where mussels are found, is at good status for its physical condition. Further details of the ecological status of the South Esk can be found on SEPA's Water Environment Hub.

The feature has been assessed through NatureScot's site condition monitoring programme as being in unfavourable condition due to the low number and density of freshwater pearl mussels present, low levels of juvenile recruitment, biological oxygen demand (fine sediments), and disturbance of mussel beds through largely historical illegal pearl fishing. Fines are also identified as being a potential issue for pearl mussels.

Further information about freshwater pearl mussels can be found [here](#).

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.

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. Whilst the main detrimental impacts are likely to be in the marine environment, within the River South Esk current significant pressures include: habitat degradation, morphological alteration, climate change-related changes to surface water temperature and hydrology, built development, particularly around Montrose Harbour, invasive non-native species, and direct and diffuse pollution. Historical over exploitation (coastal netting) occurred, but this has now ceased after coastal netting was bought out by the Esk Rivers and Fisheries Trust.

At the time of writing the River South Esk was classed as a 'Grade 2' river for salmon. 'Grade 2' means that exploitation could be lower within the river and so a catch and release policy is now being promoted. Over 90% of salmon caught on the South Esk are returned to the river. There has been some action to restore riparian and in stream habitat in the South Esk, for example through EU LIFE projects: Conservation of Atlantic Salmon in Scotland and the Pearls in Peril projects and by work carried out by the Esk Rivers and Fisheries Trust. However, much of this work is ongoing and there is scope for further enhancements of the water bodies that make up the South Esk. There are also ongoing projects to deal with invasive non-native species including Himalayan balsam, giant hogweed and Japanese knotweed. North American signal crayfish are known to be present on one watercourse in the South Esk catchment. Currently, no action is being taken to address this. As above, details on the ecological status of the South Esk can be found on SEPA's Water Environment Hub.

In Scotland Atlantic salmon SACs extend to the tidal limit of rivers only. Marine mortality is however one of the key issues facing Atlantic salmon in Scotland and elsewhere. Environmental factors in the marine environment, climate change, marine developments, 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 scope of this document covers only those measures that can be undertaken within the SAC

The feature has been assessed through NatureScot's Site Condition Monitoring programme as being in unfavourable condition at this SAC due to the reduced spring salmon component, however, an improvement in the trend indicates that this element of the salmon population is recovering.

Further information about Atlantic salmon can be found [here](#).

Conservation Priorities

There are no priority qualifying features within the River South Esk and no apparent management conflicts between the qualifying features.

All qualifying features rely on good water quality, and appropriate water levels and hydrological functioning.

There are overlapping protected areas (listed above) but there are no potential conflicts currently identified between management requirements for the features of the River South Esk and these sites, any management for the River South Esk SAC or assessment of plans or projects subject to a Habitats Regulations Appraisal, will also need to take account of these designations' features.

Conservation Objectives for all qualifying features

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| 1. To ensure that the qualifying features of the River South Esk SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status |
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| 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. |
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| 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 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. |
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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 South Esk 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 within the River South Esk SAC 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).
- Maintain the distribution and viability of the freshwater pearl mussel’s host (*Salmonid*

species), and their supporting habitat (see conservation objective 2d).

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 mussel populations is notoriously difficult. This is partly due to their unusually long lifecycle and their requirement for high quality freshwater conditions and riverine habitats, including low levels of nutrients and fine sediments. These conditions generally need to be provided all 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 the species to be expanded or at least restored to their previous known extent.

Distribution of mussels can be affected by disturbance originating both within and outwith the site. The South Esk is subject to water abstraction, water pollution, occasional illegal pearl fishing, occasional river engineering proposals and intensive surrounding land use in places. However, it is not clear whether or to what extent these factors are currently affecting the pearl mussel population.

Water quality on the main stem, where mussels are present, is moderate for around half its length and good or high status elsewhere. However, currently recruitment appears to be most successful within the area considered moderate for water quality. Water flows and levels, and physical condition are either good or high on the main stem. Recruitment is present but not widely successful in the South Esk and there appears to be a risk of contraction in the species' distribution in the site, particularly in the upper catchment. The cause of this is not clear but may be related to fine sediments being deposited in otherwise suitable habitat. It is important that both up and down stream distribution is maintained within the site. Freshwater pearl mussels are present in the main stem of the River South Esk. We are not aware of populations in any tributaries though in the recent past there was a large population in a mill lade which abstracts water from the main stem.

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 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. These generally match the objectives of the Water Framework Directive, particularly the requirement for morphology to be at least good status (see below for water quality).

Sufficiently high water quality and flow conditions should be in place to provide the

necessary conditions for freshwater pearl mussel. The main stem of the South Esk is at either good or high status for water flows.

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. Some changes in land use have the potential to increase nutrient and fine sediment concentrations in the river.

Continuation of work in the River South Esk which is improving the resource of native riparian woodland, and improving the buffer areas around agricultural land, will improve the habitat for freshwater pearl mussels within the river. These actions help to improve water quality, promote more sustainable river flow regimes, reduce the potential for damaging flood impacts and also create more sustainable steady flows during droughts.

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 <0.005mg/l). All waterbodies in the South Esk are at high status for reactive phosphorus.

- Mean Biochemical Oxygen Demand (BOD) should be <1 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). This was not monitored during the last site condition monitoring visits.

- 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). At present this has not been monitored but, experience from elsewhere shows, can provide very useful information on habitat suitability.

- 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 and should meet the WFD 'high status' as standard throughout the site. Flows in the main stem of the South Esk are at high status upstream of the confluence with the White Burn. Downstream of this the main stem is at good status, including around the hydro-electric scheme at Kinnaird.

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 sufficient numbers 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 the River South Esk, the primary host species is unknown. Research is required to identify whether this is salmon or trout. Knowing the host species is crucial for any species translocation and to ensure that habitat improvements take place in the correct location. An abundance of > 0.1 native juvenile host salmonid per m² in appropriate habitat 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. This data is not currently available but work is in progress to obtain it through the National Electrofishing Programme for Scotland (NEPS) by Marine Science Scotland.

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. There is a barrier to fish passage on the Burn of Inchmill in Glen Prosen which has been identified for removal (this is the only barrier identified on the National Marine Plan interactive tool). The hydro-electric scheme at Kinnaird has a fish pass that appears to function well.

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 undercut, 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 Atlantic salmon's long-term existence at the River South Esk 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 from recovering, through mortality, injury, or impacts caused by disturbance or displacement. For example, this could include 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 South Esk 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. At the time of writing this data was not currently available for the South Esk but work is in progress to obtain through the National Electrofishing Programme for Scotland (NEPS) by Marine Science Scotland.
- 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 the 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 characteristic seasonal pattern of migration within the river, in particular, the multi-sea-winter stock component, should be restored.

Atlantic salmon are in unfavourable condition at this site. The focus of this objective is therefore, to increase the number of salmon parr in the river through increasing the number of adult salmon able to spawn in the river and maintaining access to spawning grounds. Stocked with young salmon should be avoided, as stocked fish 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

Atlantic salmon distribution within the site should not be restricted by pollution or human activities. The boundary of the River South Esk SAC was drawn to reflect the distribution of salmon at the time of designation.

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 maintained, and restored where man-made obstructions have prevented or limited this, including at the Burn of Inchmill in Glen Prosen. 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.

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

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, the weather and surrounding land use, 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, 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 quantity, 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.

Continuation of work in the River South Esk to improve the resource of native riparian woodland, and improving agricultural buffer areas will improve the habitat for salmon in the catchment. These actions will help to improve water quality, promote more sustainable flow regimes, reduce potential for damaging flood impacts and also create more steady flows during droughts.

Restoring any areas of degraded peatland will reduce fine sediment concentrations, improve floodplain connectivity and restore more natural hydrological regime.

Conservation Measures

The River South Esk SAC overlaps slightly with the Montrose Basin Site of Special Scientific Interest (SSSI) and management changes described on the SSSI list of Operations Requiring Consent must have prior consent from NatureScot.

Current and recommended management

| Issue | Measure | Responsible party |
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| Low numbers and density of freshwater pearl 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. | Public, Police, Esk Rivers and Fisheries Trust, Land managers, NatureScot |
| | Research to better understand the reason for the low number and density of freshwater pearl mussels at the site and identify if Atlantic salmon and/or brown trout are the primary/salmonid host species, at the River South Esk SAC. | NatureScot |
| Ongoing species protection for salmon | Legislation is in place to manage and protect Atlantic salmon in freshwater and at sea. This includes a statutory close season and catch & release period. | All |
| | 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 Esk Rivers and Fisheries Trust, NatureScot SEPA |
| | Continuation of existing catch and release policy for anglers. | Esk Rivers and Fisheries Trust |
| Forest operations resulting in silt/nutrients entering the river – may affect 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 agents, owners and land managers. |
| | Promote adherence to the Forest and Water Guidelines, and published best practice, during forestry operations and highlight the need to strictly control fine sediment and other diffuse pollution. Forestry planting (including contour planting for flow management where this does not negatively impact other semi-natural habitats/species of interest) and harvesting | Scottish Forestry, Forestry & Land Scotland, forestry agents, owners and land managers. |

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| | within the catchment should be carefully planned. Heavy rainfall and droughts should be buffered by the forest rather than it exacerbating high/low extremes in flow as both can damage freshwater pearl mussels and adversely affect salmon. | |
| Agricultural land management | Land used for agriculture should be managed according to the Good Agriculture and Environmental Conditions (GAEC) to keep run off of silt and nutrients to a minimum e.g. by maintaining the appropriate buffer strips adjacent to water courses, fencing off livestock from water courses, retaining the stubble of the previous crop etc. | Land managers, NatureScot, SGRPID |
| Other land uses which may affect freshwater pearl mussel and salmon spawning areas through sediment load | Ensure minimal poaching, tracking, or trampling by red deer, livestock and vehicles to prevent an unnatural sediment load from being washed into the river. | Land managers, NatureScot |
| Development management in the catchment | Any development proposals within the catchment should include appropriate measures to minimise sediment run-off and prevent pollutants from entering the river. | Planning Authority, developer, SEPA |
| 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 reduce the populations of freshwater pearl mussel. | SEPA, NatureScot, Scottish Water |
| Water quality monitoring | Implement and maintain monitoring of key water quality parameters. | NatureScot/SEPA |
| Beneficial habitat management | Evaluation of diffuse pollution and morphological pressures through the river basin planning process and the implementation of restoration measures to improve the habitat for both species. | SEPA |
| | Promotion of measures to increase resilience from climate change, particularly the creation of native 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. Action to restore riparian and in stream habitat in the South Esk has been taken through both the Conservation of Atlantic Salmon in Scotland and the Pearls in Peril | All Esk Rivers and Fisheries Trust |

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| | life projects and by work carried out by the Esk Rivers and Fisheries Trust. However, there is scope for further enhancements of the water bodies that make up the South Esk | |
| | Identify and then restore, where required riparian and catchment peatlands to reduce fine sediment concentrations, improve floodplain connectivity and restore more natural hydrological regime to benefit salmon and freshwater pearl mussel. | All |
| | Removal of barrier to fish passage on the Burn of Inchmill in Glen Prosen (this is the only barrier identified on the National Marine Plan interactive tool.) | Land managers |
| | Encourage the natural processes of river flow and morphology through a policy of non-intervention and thereby improve freshwater pearl mussel and salmonid recruitment and survival. The only case where intervention is definitely beneficial is that when the river level is particularly low, it may be appropriate to move pearl mussels to deeper pools if they would otherwise die due to their habitat drying out. | All |
| Research – salmon | Development and introduction of long-term monitoring protocols for juvenile Atlantic salmon in SACs through the National Electrofishing Programme for Scotland (NEPS). | Marine Scotland Science |
| | Develop and implement monitoring protocol to allow robust, catch independent, assessment of adult population size. | Marine Scotland Science |
| | Monitor the presence and distribution of aquatic & terrestrial non-native species which may adversely impact Atlantic salmon. | SEPA, NatureScot & Esk Rivers and Fisheries Trust |
| Marine survival - salmon | Monitoring of post-smolt Atlantic salmon to determine their behaviour at sea and better understand the impact of enhanced sea lice burdens. | Marine Scotland (Marine Scotland Science and Farmed Fish Health Inspectorate) |
| Invasive species | 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. | All |
| | Action to control invasive non-native species, even on minor tributaries, or near to watercourses, should be implemented as soon as possible, subject to available resources/funding. | |

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