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ATLANTIC SALMON SPECIES ACTION PLAN

SPECIES PROFILE

Common Name: Atlantic salmon.
Scientific Name: *Salmo salar.*
UK Biodiversity Status: Conservation concern.
Relevant Priority Habitats: None.
Statutory Protection: Salmon and Freshwater (Protection) (Stirling Scotland) Act 1951, the Freshwater and Salmon Fisheries (Stirling Scotland) Act 1976 and the Salmon Act 1986. River Teith cSAC and Endrick Water SSSI and cSAC.

BIODIVERSITY CONTEXT

The Atlantic salmon is found on both sides of the north Atlantic Ocean. In Europe it formerly occurred in virtually all river systems entering the Atlantic Ocean and associated basins from the rivers of northern Portugal to the Arctic Ocean rivers of north west Russia.

Although still widely distributed in the rivers of Europe, adverse impacts of industrialisation and urbanisation over the period 1700 to 1950 caused its loss from a large part of the historical area of distribution. Most of Scotland is a salmon stronghold, with over 400 salmon river systems and nearly 40% of the EU population of Atlantic salmon.

Within-species diversity in salmon is important to preserve. Over time the fish populations from individual river systems have adapted to the conditions found there. These specific genetic types, which may prove to be very important in the future, may be lost if populations of fish from a river system become extinct or the population is mixed with stock from different catchments. Some of the rivers in our area, the upper Teith and the Dochart, are important for their spring spawning salmon (one example of within-species variation), which are currently under threat throughout their range.

There is no UK Biodiversity Action Plan for this species.

OBJECTIVES

Objective 1	**Maintain salmon populations above biologically safe levels.**
Target	By 2005, establish long-term monitoring system to estimate status of salmon populations in Stirling Council area.
Target	Estimate spawning requirements for area and as accurately as possible based on available resources.
Target	By 2005, based on spawning requirements, management plan generated for sustainable use and protection of wild salmon populations.

Target	Appropriate local actions are being implemented to safeguard wild salmon populations in Stirling Council area wherever funding allows.

Objective 2 Increase awareness and education opportunities regarding wild salmon resources and the aquatic ecosystem.

Target	Engage public at every opportunity whilst achieving targets 1a-d.
Target	Improved interpretation at key locations in Stirling Council area to raise the profile of these sites and raise awareness of salmon life histories.
Target	Establish a fisheries forum to encourage regular involvement and participation from stakeholders and public.
Target	Two demonstration events are held per year by partners in LBAP processes to educate public about aquatic ecosystems.

CURRENT STATUS AND DISTRIBUTION

Although there is an overall trend towards decline in salmon abundance throughout their range, naturally occurring cyclical fluctuations in populations make estimation of current status difficult. Only where a long time-series of reliable data exists can any comparison between current and historical status be accurately made. For the Forth catchment time-series data is only available as rod and net catches of adult fish: both notoriously difficult to interpret and subject to large errors. As a result, accurate information on current status of salmon populations in the Forth catchment is lacking. However, an indication of the trend in abundance can be given based on the available information (total declared catches of adult salmon): during the late 1990s (1995-1999) the adult catch was just 40% of that recorded during the same period 1952-1956.

Within the tidal areas of the Forth (up to the motorway bridge NS 776 954) the returning adult salmon's upstream progress is occasionally halted by naturally occuring periods of anoxia (very low dissolved oxygen) resulting from processes involved with the mixing of fresh and saltwater, high summer temperatures and the increased oxygen demand of microbes. Whilst this situation has been exacerbated by increased organic loading in the area as a result of human activities, these acute events appear to be occurring less frequently in recent years. Water quality in the freshwater streams and rivers in the Stirling Council area is generally very high and a number of improvements have been recorded in recent years eg. Rivers Allan, Carron, Avon, Almond. Physical barriers (man-made) and localised reductions in water quality can prevent access and survival of salmon in spawning and rearing grounds. Local exploitation of adult salmon (both legal and illegal) and annual variation in water levels can combine to contribute to the spatial use of the available spawning habitats in the Forth catchment from year to year.

The legislation covering the salmon is complex, tending to concentrate on the control of fishing activity rather than on the fish's habitat, or the ecological factors affecting water quality. However the Salmon (Fish passes and screens) (Scotland) Regulations 1994 does attempt to ensure that both salmon, sea trout *Salmo trutta* and other migratory fish species have physical access to their spawning rivers and burns.

ETYMOLOGY, CULTURE AND FOLKLORE

Salmon comes from the Old French *saumon,* from the Latin *salmo* meaning salmon.

The Latin name *Salmo salar* means "salmon trout".

The Gaelic for salmon is *Bradan*. A very appropriate Gaelic saying relating to this fish is "Cha 'n'eil bradan gun a leth-bhreac" which translates as, "there is no salmon without peer".

ECOLOGY AND MANAGEMENT

Atlantic salmon exhibit great flexibility in their life histories and are an extremely successful species as a result, distributed widely throughout cool, fast flowing streams in temperate latitudes. Like all salmonid fishes, they require high levels of oxygen saturation and low levels of particulates at every stage of their life cycle and as a result, they predominate in clean high gradient watercourses where their presence is used as an indicator of a healthy system. About the only constant in the Atlantic salmon's life history is the requirement for well oxygenated freshwater in which to hatch eggs, a requirement that necessitates their return to suitable areas to reproduce.

Most Atlantic salmon spend at least one half of their lives in freshwater as juveniles prior to migrating to sea where they typically spend 1 to 2 years and increase in size by some 95%. Eggs are laid in favoured gravel areas by adults in the autumn and spend the winter here prior to hatching in spring as alevins, complete with yolk sac. As this internal energy source diminishes, the alevins start to emerge from their gravel home under the cover of darkness to avoid predation, and establish feeding territories in fast moving areas of streams. Juvenile salmon are well adapted for life in these areas, with cryptic colouration, large pectoral fins to act as hydrofoils against a fast current and excellent vision to intercept drifting prey. Here they can stay for up to 7 years, feeding on drifting invertebrates. Growth is rapid during the spring and summer when food is plentiful. During winter however, low temperatures and scarce food lead the juveniles to change their behaviour, switching to slower deeper water areas, and hiding in streambed refuges during the daylight. Streams often appear devoid of fish during the winter days, as fish are hiding and emerging only under the cover of darkness to feed.

Juvenile salmon rely on the changing lengths of day and night to control their growth processes and during their second year in the streams, the vast majority of juveniles are triggered into a physiological change by the attainment of a certain size by midsummer. Those large enough at this time are likely to undertake a transformation to allow life in the sea and migrate downstream the following spring. This migration may begin in the autumn, but the physiological transformation necessary to allow life in saltwater occurs noticeably during the following spring when the fish lose their cryptic colours in favour of silver flanks and are known as smolts. The smolts congregate in pools in the river and drop back to the estuary, again mainly under the cover of darkness in an event known as the smolt-run. Most smolts exit the Forth system in April or May, in their third year of life.

The young salmon (now termed post-smolts) move away from the shore quickly and grow rapidly as they migrate out along the continental shelf in shoals, feeding on sandeel *Ammodytes tobianus*, shrimp Crustacea and other plankton. Salmon typically spend a minimum of 1 year at sea, taking advantage of the rich feeding opportunities, although some stay for 2 or 3 years. Those maturing and returning to their natal rivers after one

winter at sea are termed "grilse" and those returning after a minimum of 2 winters are termed "multi sea-winter salmon" and are highly prized by anglers.

Maturing adults navigate back to the estuary by using changes in the earth's magnetic field, and closer to shore, by smell. They can enter the estuary at any time and move in and out with the tide, often in large shoals. They are frequently hampered in their upstream migration by low freshwater flows during summer. Ebbing floodwaters encourage upstream migration and allow adults to negotiate waterfalls and reach their preferred spawning areas. Adult salmon are incapable of feeding during their entire migration back into freshwater and rely upon accumulated energy reserves, built up during their time at sea. Maturation continues during the upstream migration, and the typical silver flanks of sea-going salmon are once again replaced with more drab, mottled browns and reds. The females eggs swell and the male changes body shape, developing a hooked jaw (a kype) with which to fight other males during spawning. During November and December, females release their eggs over prepared excavations (known as redds), and males jostle for position to fertilise them as they settle into the gravel. One females' eggs might be fertilised by a number of males. Unlike their Pacific cousins, Atlantic salmon are not destined automatically to die following spawning, and some survive and make their way back to sea. These survivors (termed kelts), are frequently encountered by anglers during the first few months of the year. However, the majority of adults have such depleted energy reserves that they perish soon after spawning.

Salmon are an extremely adaptive animal and occupy a range of freshwater environments across a wide temperature range. Temperature, hydrological characteristics and chemical composition of the water in large catchments play an important role in establishing distinct strains of salmon. Within single river catchments strains of salmon have adapted to cope with very specific environmental conditions during their freshwater stages. As a result , the life history strategies often reflect environmental variation. Returning adult salmon often re-enter systems at discrete times of the year and home to distinct tributary areas. For example spring salmon are often slower-growing larger fish that appear to be homing to the upper Teith and Forth areas.

To the anglers these adaptations to temperature, chemical signature and stream hydrology can sometimes be seen in adult fish as alterations in body shape thought to show adaptation to the energy demands placed on them during their upstream migration. River Allan fish apparently differ in body shape from River Forth and Teith fish. These features although not completely understood, indicate the existence of a "safety net" of adaptive genes within stocks of salmon and illustrate important within-species diversity.

Indiscriminate stocking (although well-intentioned) with fish from various parts of a large catchment can lead to a break-down of this adaptation and is a serious threat.

In terms of local fisheries management the following actions can have an impact on the sustainability and viability of salmon populations:

- Maximising access to suitable spawning habitat and maintaining good water quality to ensure high egg survival rates.
- Ensuring adequate juvenile habitat and maximising the production of smolts.
- Protecting the smolt run during aggregation and passage.
- Protecting the adult spawning run during aggregation in the estuary, passage and spawning at the redds.

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FACTORS CAUSING LOSS OR DECLINE AND FUTURE THREATS

National and International Factors

The widespread decline in salmon stocks in Scotland and other parts of western Europe may involve several factors, although general agreement has been made that the most overwhelming current threat to the salmon currently occurs during the marine phase. Increased mortality at sea has been recorded in recent years and it is thought to be resulting from changes in sea surface temperature altering feeding opportunities, over-fishing of salmon and their prey species and pollution. Factors influencing marine survival of Atlantic salmon are outwith the scope of this Action Plan.

Local factors

- Obstructions to fish movement reducing access to spawning grounds and impeding migrations (both upstream and downstream).
- Loss and reductions in suitable spawning and rearing grounds resulting from habitat alteration via land-use practice and direct engineering works.
- Localised reductions in water quality and quantity exacerbated and occasionally resulting from land-use practices.
- Reduction in smolt output as a result of predation during migration.
- Over-exploitation of adult stocks (both legal and illegal).
- Well-intentioned but inapproriate fisheries management actions.
- Movement, by people, of fish from one river catchment to another e.g. ruffe *Gymnocephalus cernus*, signal crayfish *Pacifastacus leniusculus* altering the ecological balance of these catchments.

OPPORTUNITIES AND CURRENT ACTION

- The Rivers Teith and Endrick Water are both candidate Special Areas of Conservation. The River Endrick Water and Loch Lubnaig Marshes are Sites of Special Scientific Interest. These designations will lead to increased potential for funding to remedial actions to improve salmon access and juvenile habitats where appropriate.
- Salmon fisheries bill, giving District Salmon Fishery Boards greater control of land based fishing and possibly leading to more accurate estimation of adult salmon exploitation for use in management operations
- LIFE funded river conservation strategy on the Endrick Water.
- SNH/ SEPA/ WOSW/ ESW funded prototype Catchment Management Plan for Loch Lomond, leading to integrated positive catchment management on land and in-river.
- Rural Stewardship Scheme; includes management prescriptions for riparian habitat management and creation.
- Forestry restructuring, leading to removal of conifers from riparian zones. Leaving them unplanted or replanting with suitable broadleaved trees.
- Improved counter technology for monitoring fish presence.
- Establishment of the Forth Fishery Foundation.
- Continuing efforts to improve water quality in the upper catchment.

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