

# Atlantic salmon

*(comprehensive revision of SAP in 2004)*

## 1. A Definition

The Atlantic salmon (*Salmo salar*) is the largest European member of its family, and in Devon waters males may reach 10 kg in weight (females are slightly smaller on average). The biggest ever recorded in Devon was a fish of 28 kilos, caught in the River Exe estuary in 1924.



The salmon has fascinating migratory habits, uses most of Devon's rivers in which to spawn, and also occurs in our estuaries and other coastal waters during its migratory phase.

This life-cycle, in which fish return from their time far out at sea to the same river in which they were hatched, has imbued the Atlantic salmon with an almost mystical quality, and is as much an important part of our folklore as it is our natural heritage.

Detailed descriptions of the salmon, its ecology and status can be found at the Life in UK Rivers project website: [www.riverlife.org.uk](http://www.riverlife.org.uk).

## 2. Why an Action Plan?

The salmon is an indicator of very high river quality and thus may be seen as a potent symbol of what we aspire to achieve for our rivers.

Devon has a significant proportion of the salmon rivers in southern England. Certain of Devon's rivers have far fewer salmon than they used to, and spring-run fish are presently at an all time low. Some of the factors responsible for these declines are the result of natural fluctuations of the environment, but there are many ways in which we can safeguard the salmon returning to our rivers and coastal waters.

The presence of salmon contributes to the economic as well as the spiritual health of the County, and its fishery has the potential, given sympathetic management, to be economically *and* ecologically sustainable. This can only happen with sustained efforts to maintain and enhance the water and habitat quality of Devon's rivers and coasts.

### 3. Relevant ecology

The salmon is a migratory species. It spends time as a juvenile in fresh waters, grows to adulthood at sea, returns to coastal waters in the spring and summer, moves upstream into our rivers throughout the year, and spawns during the winter months.

The name and appearance of the salmon change with each stage of its life-cycle. The young hatch as *alevins*, but once their yolk-sac is absorbed they become *fry*, developing into *parr* at the end of their first summer. After two years in the river most *parr* become *smolts*, when they turn silvery and migrate downstream to the sea. Some travel thousands of miles, even as far as Greenland in search of suitable feeding areas. After a period of between one to five years they return as adults to the same river in which they hatched. Those that return after only one winter out at sea are known as *grilse*; those returning after more than one winter are termed *multi-seawinter* fish, or *spring* or *summer salmon*, depending on the time of year that they return to freshwater. The adults then travel far upstream to spawn in gravel beds, laying their eggs in nests known as redds. After spawning, most die, but some salmon return to the sea as *kelts*, returning to breed again in later years.

Water quality is of paramount importance to salmonid fish, both in the rivers and in the brackish waters of estuaries and saline water of the sea. Salmon require abundant supplies of clean water, to ensure that food requirements for juveniles are met, that eggs, fry and parr survive, and that migration of smolts and adults can take place. Water temperature is important also. When it rises above 20-21 °C, the survival of juveniles becomes threatened. Salmon are able to tolerate such temperatures for short periods only; sustained exposure adversely affects survival.

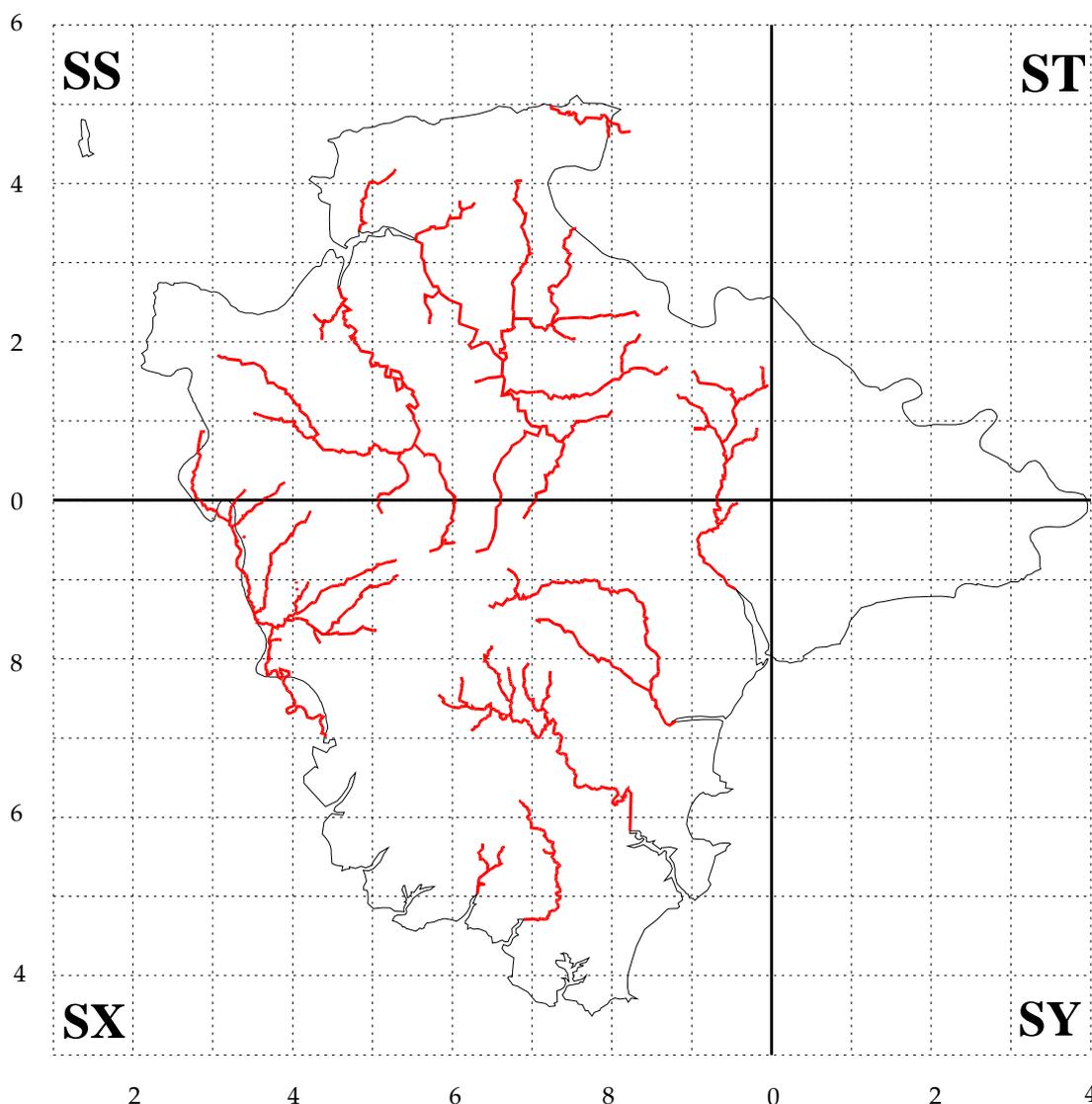
Salmon require a negotiable path up and downstream in freshwater and to and from the sea if they are to breed successfully.

Salmon require un-compacted gravels in which to lay their eggs. If fine sediment accretes on the redd after the eggs have been laid, the permeability to water of the gravel is reduced, which has a deleterious affect on the survival of young salmon by reducing the level of dissolved oxygen available to the embryos. Although salmon will clean muddy or silty gravels prior to laying by vigorously agitating the gravels of the redd, research has indicated that after laying siltation of the redd may occur from sediment deposited from the water column. Research has also shown that for successful incubation of ova and

emergence of newly-hatched salmon (alevins), sediments with a diameter of less than 2 mm should make up no more than 15% of gravels. Since salmon bury their eggs to depths of 15-30 cm of gravel, this quality of substrate is required at least up to this depth.

In terms of other habitat requirements, adult and juvenile salmon need a degree of bank-side cover for shelter. There needs to be variation in the extent and density of cover as this creates a diversity of feeding and resting opportunities for the fish. Very dense "tunnel-like" cover gives too much shade, whilst too little shade may be a problem where shallow water affords little cover. Adults require deep pools, as these provide a stable temperature of water, to buffer against fluctuations during particularly hot or cold periods of weather.

#### 4. Distribution of Atlantic salmon in Devon



Rivers currently holding Atlantic salmon

(Data supplied by Environment Agency)

## 5. Current population

The salmon currently is found in the following river catchments: Exe, Teign, Dart, Avon, Erme, Plym, Tavy, Tamar, Torridge, Taw and Lyn. Salmon populations in the River Axe are showing signs of a sustained recovery from a position close to extinction, as a result of stocking by the Environment Agency in recent years.

The current population is difficult to quantify accurately. Only the Tamar possesses a fish counter (the Tamar is, consequently, an indicator river, used to assess the status of stocks in the South West). Estimates can be gained from catch data and electric fishing survey results. Data on fishing effort has been collected from rod fisheries since 1993 and from net fisheries since 1997. Linked with figures from fish counters, this information has helped to make catch data more useful in estimating the strength of the spawning stock.

Conservation Limits have been set for Devon's salmon rivers based on spawning targets derived from the existing data. Of the thirteen identified salmon rivers in the county, only the Exe and the Lyn are currently (2003) meeting this target level.

The declared catches of salmon and grilse for 2003 are as follows:

- Nets = 1017
- Rods = 1004

## 6. Current problems for Atlantic salmon in Devon

- Water quality: Both acute and chronic pollution can adversely affect salmon. Specific pollution incidents are known to cause fish kills (such as spillages of agricultural wastes into water courses), but relatively low level contamination, from diffuse agricultural run-off (fertilisers, pesticides) and organic contamination from treated sewage effluent are known to adversely affect salmon survival.
- Water quantity is of vital importance to salmon, for several reasons. Firstly, water quantity is closely associated with dilution of any pollutants, and therefore is a determinant of water quality. Ample supplies of water in a river or stream moderates water temperature and also enables fish passage up and down stream. Flow rates in normal years are adequate to allow migration upstream to headwater spawning gravels, but in dry years naturally reduced flows, possibly further restricted by river abstractions, can be a problem. A principle cause of mortality of juvenile salmon is competition for riffle areas (shallow, moderately turbulent stretches of river), their preferred habitat. At times of low river flow the area of riffles can be markedly reduced, resulting in crowding of young salmon into small patches of remaining habitat. This increases the intensity of competition

and limits the carrying capacity of the river for juvenile salmon.

- Physical barriers within rivers restrict movement and migration of salmon.
- Exploitation becomes an issue where populations are in decline. Measures to manage both net and rod catches are underway in all catchments. In all populations sustainable exploitation is required to ensure no detrimental impact on salmon populations. Illegal exploitation is potentially a threat to salmon in Devon waters. Drift nets used to catch bass and mullet in estuaries and other coastal waters also catch returning adults as they congregate in estuaries before moving into freshwater to spawn. Poaching by netting, poisoning, snaring, gaffing and spearing, particularly of spawning fish, is a problem in certain catchments. There is concern that resources are insufficient for proper implementation of legislation aimed to reduce illegal exploitation. The proportion of salmon that have spent more than one winter at sea and return before June – spring salmon - has markedly declined during the past few decades. It is thought that environmental factors and over-exploitation at sea, as well as factors operating nearer to home, have contributed to this decline.

Salmon stocks from Devon are exploited to varying degrees in a number of high-seas fisheries that are outside the direct control of English law and management. Key amongst these are the West Greenland fishery, the Faeroese fishery and the Irish coastal fishery. Whilst the impact of these fisheries has declined in the past decade as a result of quota impositions and voluntary quota buy-out, they still exert influence on the numbers of salmon surviving to return to Devon's rivers. Particularly, the impact of the Irish fishery on Devon's salmon remains a source of concern.

- Siltation of redds leads to reduced juvenile survival, by starving buried eggs of oxygen. A programme of rehabilitation of gravels that have become infiltrated by sediments is targeted at the most important areas within each catchment. However, unless the factors causing siltation are established and controlled any benefits will be temporary. The problem of accretion of silt once eggs have been laid can only be addressed by reducing the source of silt. Factors leading to over-silting include sediment rich run-off from land poached by stock, from ploughed fields and other land-use practices. An additional problem resulting from siltation is that it encourages water plants to dominate the river bed, thereby modifying habitat for other aquatic life.
- Poor management of riparian vegetation can also lead to problems for fish, including salmonids. If bank-side vegetation is removed water temperatures tend to be increased and the amount of shelter for young fish is reduced.
- Invasive alien weeds, such as Japanese knotweed, have a tendency to dominate other plants and leave river banks prone to erosion when they die back in the autumn.
- Fish farms and other abstractions can create problems for migratory fish

with complete barrier weirs and stretches of river with low flows between abstraction and discharge points. Escapes of rainbow trout into the wild may affect salmon, through competition for food, as well as by direct predation of juveniles.

- Many anglers believe that there has been an increase in the extent of predation by fish eating birds such as cormorants and saw bill ducks on freshwater fisheries, with the presence of large numbers of cormorants on the Exe and Taw causing particular concern. The impact of such predation on salmon populations is not clearly understood.
- There has been concern over the impact on salmon of the disease called Ulcerative Dermal Necrosis (UDN), particularly on Spring salmon and especially on the River Exe. More recently *Gyrodactylus salaris*, a parasite of salmon originating in the Baltic, has become a potential threat to salmon in the UK, as it can be transmitted on the fishing tackle and footwear of fishermen who have fished in the area of origin. The parasite is now present in all Atlantic salmon populations except those of the Kola peninsula of Russia, North Eastern USA, and the UK and Ireland.

## 7. Recent changes in population

Numbers of salmon and grilse, as indicated by rod and net catches in Devon's rivers and estuaries are given below:

	1987	88	89	90	91	92	93	94	95	96	97
<b>Nets</b>	12910	9783	9574	5074	2557	4847	4267	5709	2806	4546	2197
<b>Rods</b>	2177	3478	1450	1225	1011	2877	3021	4163	1843	1759	1814
	1998	99	2000	01	02	03					
<b>Nets</b>	1427	1411	1793	1479	1093	1017					
<b>Rods</b>	2294	1402	1914	873	987	1004					

Salmon catches in most of Devon's rivers and estuaries have undergone a substantial decline since 1994, suggesting that populations in the South West are declining.

In relation to longer term trends, the salmon population has undergone a substantial decline since the 1960s and the current population levels, although subject to fluctuations, appear to have been low for the last two or three decades. For example, the River Axe was once a 'classic' salmon river, but declines in the 1970s reduced the population to virtual extinction, although annual stocking, installation of fish passes and improvements to water quality since 1990 have led to a small but sustained recovery. Another example of long-term decline of stocks is that seen on the River Torridge as a result of water quality problems.

Analysis of current and historical (1956-2003) catch returns from rivers across the country has shown a marked decline in the numbers of fish entering rivers between 1 January and 31 March. The River Exe catchment is no exception where the recent average rod catches of these 'spring fish' have declined to as little as 9% of historical levels.

## 8. Current protection

- Listed on Annex II of the EC Habitats Directive.
- Regulated by the Salmon and Freshwater Fisheries Act 1975 (as modified by the Water Act 1989, the Water Resources Act 1991 and the Environment Act 1995) and the Salmon Act 1986, in conjunction with byelaws made under these pieces of legislation.

## 9. Current positive initiatives for Atlantic salmon in Devon

- *A Strategy for the management of Salmon in England and Wales* was produced by the Environment Agency in 1996 and responsibility for its implementation lies largely with the Agency. The Strategy has four objectives: Optimise recruitment in home water fisheries; Maintain and improve the diversity and fitness of stocks; Optimise the total economic value of exploited fish whilst allowing for social equity considerations; Meet the necessary costs of managing the resource. This national strategy introduced the concept of catchment-based Salmon Action Plans (SAPs), which have now been produced for all Devon catchments with significant salmon runs.

These plans cover all aspects of salmon management in each catchment, detail the present status, uses and issues relating to salmon and set targets for improvements and enhancements over a five year period. SAPs set Conservation Limits (CL) and Management Targets (MT) for each catchment, salmon stock.

- Conservation Limits indicate the minimum desirable spawning stock levels below which stocks should not be allowed to fall. The CL is set at a stock size below which further reductions in spawning numbers are likely to result in significant reductions in the number of juvenile fish produced in the next generation. The Management Target is a spawning stock level for managers to aim at, to ensure that the objective of exceeding the CL is met four years out of five in the long run (i.e. 80% of the time).
- The North Atlantic Salmon Fund (NASF) was set up in 1989 to help halt

decline of stocks of Multi Sea Winter salmon by securing closure of high seas salmon fisheries off Greenland and the Faeroes. North Atlantic salmon producing nations have the challenge of finding annual compensation payments for these countries to abstain from fully exploiting their quotas. In 1991 an agreement was reached to keep the Faeroes fishery closed and for Greenland to operate a local 'subsistence' catch. In 1993 the UK branch of NASF was established to raise the UK contribution to the cost of buying out these fisheries as there was no government financial support to start the process. Buyouts have continued successfully during the 90s. A further 5 year agreement was negotiated in the Greenland fishery in 2002. Buyouts have not been in operation in the Faeroes fishery since 1998. Instead, the Faeroes government has been managing the fishery in a precautionary manner. There have been no reported landings of salmon here since 2000.

- Taw/Torridge fishery regulations were introduced in 1998 to limit net and rod catches in these catchments. Further restrictions were introduced into the net fishery in 2002, when a Net Limitation Order of zero was made. Of the fourteen licence holders operating in the fishery, eleven agreed to relinquish their right to continue fishing, following a buyout funded by the Migratory Salmon Foundation. Three nets-men continue to fish.
- Regulations in the Tamar and Tavy net fishery have been introduced which will mean the cessation of net fishing for a period of ten years, from 2004 to 2013, inclusive.
- Voluntary measures to regulate rod catches of salmon have been introduced by the Dart Angling Association and the Tamar and Tributaries Fisheries Association.
- National Salmon byelaws were introduced by the Environment Agency in April 1999 to protect spring salmon. Rod fishermen are restricted to using artificial fly or lure only before the 16 June in each year and must practice catch and release up to this date. Nets-men cannot fish before the 1 June, although netting for sea trout is permitted before this date on the Dart and Teign, where any salmon caught must be returned alive.
- Continued promotion of Catch and Release to fishermen.
- Habitat improvement, including provision of buffer zones and gravel rehabilitation on many rivers throughout the county.
- Environment Agency R&D Programme includes studies into many aspects of management relevant to salmonids. Refer to EA *Annual Research and Development Review*.
- Environment Agency's Upper Torridge Project, aimed at improving water quality in the catchment through the uptake and implementation of whole farm management plans, modifying farming activities which impact on the aquatic environment.

- Inclusion of Atlantic salmon as an interest feature in the Dartmoor cSAC.
- Completion of a fish pass on the River Otter at Otterton in 1999, allowing the entrance of salmon into this river for the first time since 1888.
- Buyout in 2003, by the Environment Agency, of the rights to operate the fixed engine on the River Lyn, a trap which caught salmon as they about to enter this river from the sea.

## 10. Biodiversity planning context

### National BAP Context

#### Species of principal importance in England:

- Atlantic salmon

Current national BAP targets can be viewed on the [Biodiversity Action Reporting System](#) (BARS).

#### Associated Action Plans within the Devon BAP:

- Rivers, streams, floodplains and fluvial processes
- Estuaries
- White-clawed crayfish
- Freshwater pearl-mussel
- Water vole
- Otter

## 11. Biodiversity objectives and targets for Atlantic salmon in Devon

### Objective 1

Reverse the decline in Atlantic salmon populations in Devon.

#### Targets:

- Achieve Management Targets, as defined in Salmon Action Plans, for salmon rivers in Devon by 2008 (not the River Axe).
- Achieve a self-sustaining salmon population in the River Axe.

## Objective 2

Protect the gene pool of Atlantic salmon in Devon's rivers.

Target:

- Continue to protect catchment gene pools by allowing, where feasible, stocking only to be undertaken using salmon originating from the river to be stocked.

## Objective 3

Ensure that the salmon fishery in Devon's rivers and estuaries is sustainable.

Target:

- Regulate Devon's salmon fisheries to allow sustainable exploitation without compromising catchment management targets by 2008.

## Objective 4

Foster increased awareness and understanding of the importance of Devon's rivers and coastal waters for salmon, the threats to it and its habitat, and methods for its conservation and enhancement.

Targets:

- Use the Atlantic salmon as a flagship species to promote clean rivers with ample water supply and varied wildlife habitats. Ongoing, from 1998.
- Work with partners to achieve the programme of actions outlined in Salmon Action Plans by 2008.

## 12. Wider benefits from pursuing these objectives

The pursuit of the objectives set out in this plan will not only benefit Atlantic salmon. Conservation has wider benefits and advantages for society, by providing a resource which is the basis of many aspects of the local economy, and by adding to the quality of life of the people of Devon in ways which are beyond financial measure. Thus enhancing the interests of biodiversity enhances the interests of society as a whole.

The salmon fishery in Devon is of great economic importance to the County, to the fishery owners, the anglers and to the nets-men. A great many anglers from outside the County are attracted to fish in Devon's salmon rivers, thereby providing trade to local hotels and other accommodation and associated services.

There are also other values of having wild Atlantic salmon in our rivers and coastal waters to which a monetary value should not be apportioned. For many of the inhabitants of Devon, having salmon present in their rivers is a source of great pride, and a powerful indicator of a river's general health, to all forms of biodiversity.

### 13. Priority or indicative actions for Atlantic salmon in Devon

Action	Key Partners
1. Seek to ensure that water quality is protected in salmon rivers through agri-environment schemes, forestry schemes, whole farm management plans, pesticide buffer zones and sewage treatment.	DEFRA; SWWSL; EA; FA; DWT; FWAG; CLA; WRT; NFU; Riparian owners
2. Raise awareness of the threats and ecological needs of salmon to the public and advise riparian owners, planning authorities, advisory bodies and anglers accordingly.	EA; DWT; FWAG; WRT; SWWSL; SWRA; NPAs; LAs
3. Monitor salmon populations and spawning.	EA; Riparian owners
4. Ensure that the salmon fishery is sustainable and maintain effective policing of poaching.	Riparian owners; Net Fishermen; EA; DEFRA; DSFC
5. Continue to rehabilitate spawning and juvenile habitat and work with riparian owners and farmers to ensure that and management activities do not impact on the quality of this habitat.	EA; Riparian owners
6. Ensure that development proposals take due consideration of their impacts on salmon.	LAs; EA; DWT; EN
7. Continue to evaluate and improve river obstructions that may restrict salmon migration.	EA; Riparian owners

Atlantic Salmon Action Plan Champion - Environment Agency

Abbreviations used in text and table

- BAP Biodiversity Action Plan
- CLA Country Land & Business Association
- DEFRA Department of Environment, Food and Rural affairs
- DSFC Devon Sea Fisheries Committee
- DWT Devon Wildlife Trust
- EA Environment Agency
- EN English Nature
- FA Forestry Authority
- FWAG Farming and Wildlife Advisory Group
- LAs Local Authorities
- NASF North Atlantic Salmon Fund
- NFU National Farmers Union

NPA's National Park Authorities  
SWRA South West Rivers Association  
SWWSL South West Water Services Limited  
WRT West County Rivers Trust