European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC)

Fourth Report by the United Kingdom under Article 17

on the implementation of the Directive
from January 2013 to December 2018

Supporting documentation for the
conservation status assessment for the species:

S1106 - Atlantic salmon (*Salmo salar*)

ENGLAND

IMPORTANT NOTE - PLEASE READ

- The information in this document is a country-level contribution to the UK Report on the conservation status of this species, submitted to the European Commission as part of the 2019 UK Reporting under Article 17 of the EU Habitats Directive.
- The 2019 Article 17 UK Approach document provides details on how this supporting information was used to produce the UK Report.
- The UK Report on the conservation status of this species is provided in a separate document.
- The reporting fields and options used are aligned to those set out in the European Commission guidance.
- Explanatory notes (where provided) by the country are included at the end. These provide an audit trail of relevant supporting information.
- Some of the reporting fields have been left blank because either: (i) there was insufficient information to complete the field; (ii) completion of the field was not obligatory; (iii) the field was not relevant to this species (section 12 Natura 2000 coverage for Annex II species) and/or (iv) the field was only relevant at UK-level (sections 9 Future prospects and 10 Conclusions).
- For technical reasons, the country-level future trends for Range, Population and Habitat for the species are only available in a separate spreadsheet that contains all the country-level supporting information.
- The country-level reporting information for all habitats and species is also available in spreadsheet format.

Visit the JNCC website, https://jncc.gov.uk/article17, for further information on UK Article 17 reporting.

Report on the main results of the surveillance under Article 11 for Annex II, IV and V species (Annex B)

NATIONAL LEVEL

1. General information

1.1 Member State	**UK (England information only)**
1.2 Species code	**1106**
1.3 Species scientific name	**Salmo salar**
1.4 Alternative species scientific name	
1.5 Common name (in national language)	Atlantic salmon

2. Maps

2.1 Sensitive species	No
2.2 Year or period	2013-2018
2.3 Distribution map	Yes
2.4 Distribution map Method used	Based mainly on extrapolation from a limited amount of data
2.5 Additional maps	No

3. Information related to Annex V Species (Art. 14)

3.1 Is the species taken in the wild/exploited?	Yes	
3.2 Which of the measures in Art. 14 have been taken?	a) regulations regarding access to property	Yes
	b) temporary or local prohibition of the taking of specimens in the wild and exploitation	Yes
	c) regulation of the periods and/or methods of taking specimens	Yes
	d) application of hunting and fishing rules which take account of the conservation of such populations	Yes
	e) establishment of a system of licences for taking specimens or of quotas	Yes
	f) regulation of the purchase, sale, offering for sale, keeping for sale or transport for sale of specimens	Yes
	g) breeding in captivity of animal species as well as artificial propagation of plant species	Yes
	h) other measures	Yes
	Restrictions to stocking to the wild.	

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3.3 Hunting bag or quantity taken in the wild for Mammals and Acipenseridae (Fish)	a) Unit number of adults (adults)

b) Statistics/ quantity taken	Provide statistics/quantity per hunting season or per year (where season is not used) over the reporting period					
	Season/ year 1	Season/ year 2	Season/ year 3	Season/ year 4	Season/ year 5	Season/ year 6
Min. (raw, ie. not rounded)	22577	14216	19076	22489		
Max. (raw, ie. not rounded)	22577	14216	19076	22489		
Unknown	No	No	No	No	Yes	Yes

3.4. Hunting bag or quantity taken in the wild Method used	Based mainly on extrapolation from a limited amount of data
3.5. Additional information	

BIOGEOGRAPHICAL LEVEL

4. Biogeographical and marine regions

4.1 Biogeographical or marine region where the species occurs

Atlantic (ATL)

4.2 Sources of information

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Holdich, D.M., James, J., Jackson, C. & Peay, S. 2014. The North American signal crayfish, with particular reference to its success as an invasive species in Great Britain. Ethology, Ecology & Evolution, 26, 232-262.
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5. Range

5.1 Surface area (km²)

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5.2 Short-term trend Period		
5.3 Short-term trend Direction	Stable (0)	
5.4 Short-term trend Magnitude	a) Minimum	b) Maximum
5.5 Short-term trend Method used		
5.6 Long-term trend Period		
5.7 Long-term trend Direction		
5.8 Long-term trend Magnitude	a) Minimum	b) Maximum
5.9 Long-term trend Method used		
5.10 Favourable reference range	a) Area (km²) b) Operator c) Unknown d) Method	
5.11 Change and reason for change in surface area of range	No change The change is mainly due to:	
5.12 Additional information		

6. Population

6.1 Year or period	2013-2017	
6.2 Population size (in reporting unit)	a) Unit	number of map 1x1 km grid cells (grids1x1)
	b) Minimum	
	c) Maximum	
	d) Best single value	1123
6.3 Type of estimate	Minimum	
6.4 Additional population size (using population unit other than reporting unit)	a) Unit	number of adults (adults)
	b) Minimum	49008
	c) Maximum	69865
	d) Best single value	
6.5 Type of estimate		
6.6 Population size Method used	Based mainly on extrapolation from a limited amount of data	
6.7 Short-term trend Period	2007-2017	
6.8 Short-term trend Direction	Decreasing (-)	
6.9 Short-term trend Magnitude	a) Minimum b) Maximum c) Confidence interval	
6.10 Short-term trend Method used	Based mainly on extrapolation from a limited amount of data	
6.11 Long-term trend Period	1994-2017	
6.12 Long-term trend Direction	Decreasing (-)	

6.13 Long-term trend Magnitude	a) Minimum b) Maximum c) Confidence interval
6.14 Long-term trend Method used	Based mainly on extrapolation from a limited amount of data
6.15 Favourable reference population (using the unit in 6.2 or 6.4)	a) Population size b) Operator c) Unknown d) Method
6.16 Change and reason for change in population size	Genuine change The change is mainly due to: Genuine change
6.17 Additional information	

7. Habitat for the species

7.1 Sufficiency of area and quality of occupied habitat	a) Are area and quality of occupied habitat sufficient (to maintain the species at FCS)?	No
	b) Is there a sufficiently large area of occupied AND unoccupied habitat of suitable quality (to maintain the species at FCS)?	No
7.2 Sufficiency of area and quality of occupied habitat Method used	Based mainly on expert opinion with very limited data	
7.3 Short-term trend Period	2007-2018	
7.4 Short-term trend Direction	Stable (0)	
7.5 Short-term trend Method used	Based mainly on expert opinion with very limited data	
7.6 Long-term trend Period		
7.7 Long-term trend Direction		
7.8 Long-term trend Method used		
7.9 Additional information		

8. Main pressures and threats

8.1 Characterisation of pressures/threats

Pressure	Ranking
Mixed source pollution to surface and ground waters (limnic and terrestrial) (J01)	H
Modification of hydrological flow (K04)	H
Physical alteration of water bodies (K05)	H
Hydropower (dams, weirs, run-off-the-river), including infrastructure (D02)	M
Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats (G03)	M
Freshwater fish and shellfish harvesting (recreational) (G06)	M

Invasive alien species of Union concern (I01)	M
Other invasive alien species (other then species of Union concern) (I02)	M

Threat	Ranking
Mixed source pollution to surface and ground waters (limnic and terrestrial) (J01)	H
Modification of hydrological flow (K04)	H
Physical alteration of water bodies (K05)	H
Hydropower (dams, weirs, run-off-the-river), including infrastructure (D02)	H
Wind, wave and tidal power, including infrastructure (D01)	M
Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats (G03)	M
Freshwater fish and shellfish harvesting (recreational) (G06)	M
Invasive alien species of Union concern (I01)	M
Other invasive alien species (other then species of Union concern) (I02)	M

8.2 Sources of information

8.3 Additional information

9. Conservation measures

9.1 Status of measures	a) Are measures needed?	Yes
	b) Indicate the status of measures	Measures identified and taken

9.2 Main purpose of the measures taken	Restore the habitat of the species (related to ‘Habitat for the species’)
9.3 Location of the measures taken	Both inside and outside Natura 2000
9.4 Response to the measures	Medium-term results (within the next two reporting periods, 2019-2030)

9.5 List of main conservation measures

Reduce impact of mixed source pollution (CJ01)

9.6 Additional information

10. Future prospects

10.1 Future prospects of parameters

a) Range
b) Population
c) Habitat of the species

10.2 Additional information

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11. Conclusions

11.1. Range	
11.2. Population	
11.3. Habitat for the species	
11.4. Future prospects	
11.5 Overall assessment of Conservation Status	
11.6 Overall trend in Conservation Status	
11.7 Change and reasons for change in conservation status and conservation status trend	a) Overall assessment of conservation status No change The change is mainly due to: b) Overall trend in conservation status No change The change is mainly due to:
11.8 Additional information	

12. Natura 2000 (pSCIs, SCIs and SACs) coverage for Annex II species

12.1 Population size inside the pSCIs, SCIs and SACs network (on the biogeographical/marine level including all sites where the species is present)	a) Unit	number of adults (adults)
	b) Minimum	
	c) Maximum	
	d) Best single value	8039
12.2 Type of estimate	Multi-year mean	
12.3 Population size inside the network Method used	Based mainly on extrapolation from a limited amount of data	
12.4 Short-term trend of population size within the network Direction	Decreasing (-)	
12.5 Short-term trend of population size within the network Method used	Based mainly on extrapolation from a limited amount of data	
12.6 Additional information		

13. Complementary information

13.1 Justification of % thresholds for trends	
13.2 Trans-boundary assessment	
13.3 Other relevant Information	

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Distribution Map

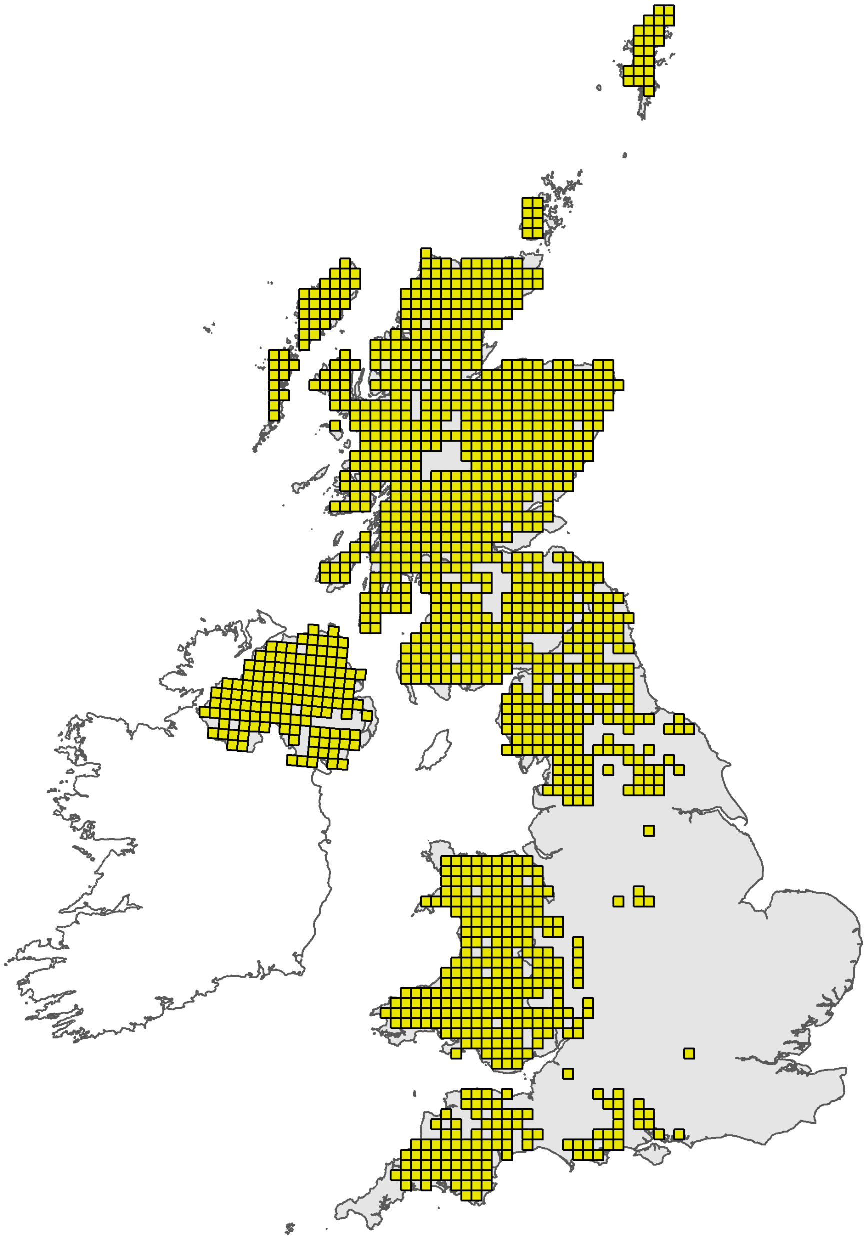

Figure 1: UK distribution map for S1106 - Atlantic salmon (*Salmo salar*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

The 10km grid square distribution map is based on available species records within the current reporting period. For further details see the 2019 Article 17 UK Approach document.

Range Map

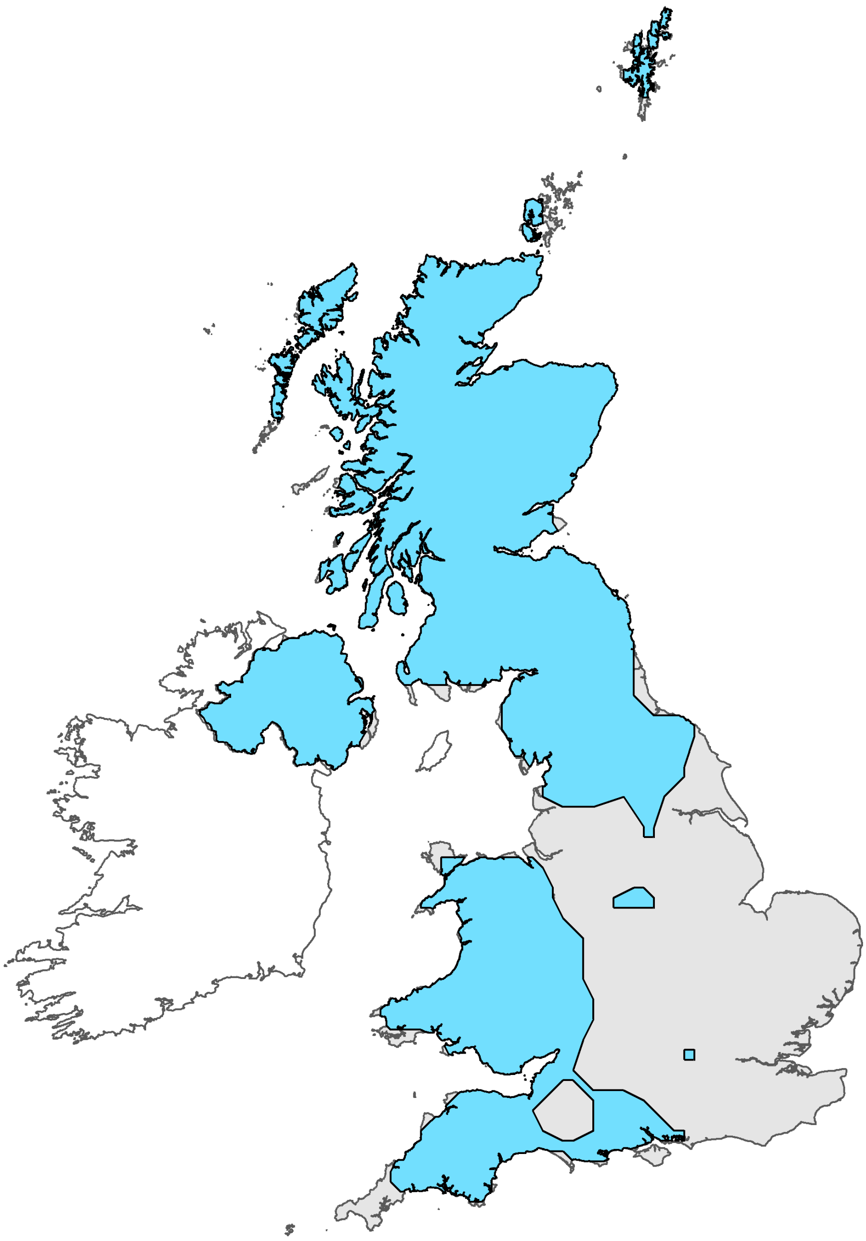

Figure 2: UK range map for S1106 - Atlantic salmon (*Salmo salar*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

The range map has been produced by applying a bespoke range mapping tool for Article 17 reporting (produced by JNCC) to the 10km grid square distribution map presented in Figure 1. The alpha value for this species was 25km. For further details see the 2019 Article 17 UK Approach document.

Explanatory Notes

Species name: Salmo salar (1106)

Field label	Note
2.4 Distribution map; Method used	Data contained within the Environment Agency Fish Population Database has been used to produce distribution maps for Atlantic salmon. This data has been collated from both routine and ad-hoc Environment Agency fish surveys.
3.1 Is the species take in the wild/ exploited	Atlantic salmon are exploited in both commercial net fisheries and by recreational angling.
3.2 Which of the measures in Art. 14 have been taken?	Salmon fisheries, wherever they occur in England, are subject to exploitation controls. The primary legislation for the regulation of salmon exploitation is the 'Salmon and Freshwater Fishery Act 1975' and the Marine and Coastal Access Act. Under this legislation the Environment Agency has powers to make Net Limitation Orders. Each order limits the number of licences for fishing with nets that may be issued in any specific fishery for up to 10 years. Fishery byelaws regulate when, where and how fishing can take place. In line with NASCO guidelines on protecting the weakest stock, mixed stock fisheries will be phased out for England. All retained net caught wild salmon must be carcass tagged and It is illegal to sell rod caught wild salmon in England. The EA are currently implementing the 'Salmon Five Point Approach' to conserve salmon stocks across England. As part of this approach exploitation pressure will be controlled and to help achieve this objective levels of catch and release for rod fisheries will be increased and net fishing effort reduced or removed.
3.4 Hunting bag or quantity take in the wild; Method used	The above data is gathered for catches taken by rod and net and fixed engine fisheries and is collated by the EA. Salmon and sea trout rod licence and commercial net and fixed engine licence holders are required to submit detailed catch returns each year, however, a percentage will fail to submit a return. For the 2016 season, the return rate was 55%. Assessment of rod catch data in 2015 and 2016 identified a decrease in the level of catch reporting. This is thought to be due to changes in catch reporting methods and a move to on-line catch recording. To compensate for this effect and allow comparability with previous years, a correction factor has been applied to 2015 and 2016 data. There has been a general reduction in fishing effort over the 6 year period. The number of salmon and sea trout licences issued in 2016 was a decrease of 2% when compared with 2015 and a 9% reduction when compared with the 5 year mean. For commercial net licences, 269 were issued in 2016, compared with 272 in 2015 and a 5 year mean of 292. Methodological details can be obtained from the Assessment of salmon stocks background report.

Species name: Salmo salar (1106) Region code: ATL

Field label	Note
5.11 Change and reason for change in surface area of range	Data contained within the Environment Agency Fish Population Database has been used to produce distribution maps for Atlantic salmon. This data has been collated from both routine and ad-hoc Environment Agency fish surveys.

6.2 Population size	This estimate is for adult spawning salmon (after exploitation) rather than numbers of fish returning to rivers. This estimate relates directly to the annual egg deposition figures used in assessing compliance with the river-specific conservation limits (CLs). Estimates of adult spawner numbers are based on a number of fixed values, specifically, the proportion of fish of different sea-ages in the returns, the proportion of female fish and their fecundity. These values were 'set' at the time that CLs were established in the 1990s. However, it is accepted that there have been changes in these values over time. For example, there has been an increase in the proportion of older multi-sea-winter salmon among the returns in recent years, and these fish tend to contain a higher proportion of females. Such changes have not been factored into the estimates.
6.6 Population size; Method used	Stock assessments for England are evaluated annually for reporting to ICES. From this data estimated numbers of adult salmon returning to English rivers are calculated using a combination of absolute counts using fish counters and traps, combined with estimates derived from rod angler catch returns. A correction factor is then applied to account for salmon which enter the freshwater environment but do not survive to spawn due to exploitation pressures. Full details of the methodologies used can be gained from the Assessment of salmon stocks and fisheries in England and Wales. Standing report on methods, approaches and wider stock conservation and management considerations. 2017.
6.10 Short term trend; Method used	Stock assessments for England are evaluated annually for reporting to ICES. From this data estimated numbers of adult salmon returning to English rivers are calculated using a combination of absolute counts using fish counters and traps, combined with estimates derived from rod angler catch returns. A correction factor is then applied to account for salmon which enter the freshwater environment but do not survive to spawn due to exploitation pressures. Full details of the methodologies used can be gained from the Assessment of salmon stocks and fisheries in England and Wales. Standing report on methods, approaches and wider stock conservation and management considerations. 2017.
6.12 Long term trend; Direction	Low levels of marine survival have persisted from 1994 to present. Although there has been a recent increase in MSW fish, there has been a decline in grilse numbers. Therefore if marine survival of MSW fish continues to decline it may threaten the sustainability of of future salmon stocks. Juvenile salmon assessments have recorded very low numbers of fry in many catchements across England. Of the 42 principle salmon rivers, none are considered not at risk and only 4 are considered probably not at risk of reaching their management objective. The majority of salmon stocks in England are catagorised as either At risk or probably at risk. There has been a marked decline in net catches in England since 1994, partly as a result of regulatory controls but also as a result of declining salmon stocks. Some of this decline across much of England has been masked by the strength of the north-east net fishery which accounted for 93% of the total catch in England and Wales for 2016. Rod catches declined from 1994 to a low in 2000, with an improvement between 2004 and 2011, to a further fall to some of the lowest recorded levels, remaining approximately 25% below the 5 year average.

6.14 Long term trend; Method used	Stock assessments for England are evaluated annually for reporting to ICES. From this data estimated numbers of adult salmon returning to English rivers are calculated using a combination of absolute counts using fish counters and traps, combined with estimates derived from rod angler catch returns. A correction factor is then applied to account for salmon which enter the freshwater environment but do not survive to spawn due to exploitation pressures. Returning stock estimates provide the most reliable estimates available on adult returns, and on index rivers are combined with biological information (e.g. on the age and size composition of stocks) and other details (e.g. estimates of smolt output) to explore changes in the structure and dynamics of populations over the whole life cycle. RSEs are also used to assess spawning escapement and egg deposition levels for comparison with river specific Conservation Limits (CL). Conservation Limits (and associated Management Targets) have been derived for all principal salmon rivers in England in line with national and international (ICES and NASCO) requirements, and have been used to assess stocks on an annual basis since 1996. Where RSEs are not available (the great majority of rivers), reliance is placed on rod catch based estimates of spawning escapement for CL compliance assessment. The Conservation Limits set in England reflect the modelled smolt production capacity of individual catchments and indicate the minimum desirable spawning stock level below which further reductions in spawner numbers are likely to result in significant reductions in the number of juvenile fish produced in the next generation. Conservation Limit compliance procedures are designed to manage stocks at a more precautionary level some way above the Conservation Limit. This level equates to the Management Target and represents the average number of spawners required to ensure that stocks remain at or above their Conservation Limit for at least 4 years out of 5. Full details of the methodologies used can be gained from the Assessment of salmon stocks and fisheries in England and Wales. Standing report on methods, approaches and wider stock conservation and management considerations. 2016.
6.16 Change and reason for change in population size	There has been a marked reduction in pre-fishery abundance of 1 sea winter salmon in the last 6 years within UK waters. Although a small number of rivers, such as the Tyne, have shown a substantial improvement in salmon numbers a greater number have declined. There has also been an overall decline in the estimated numbers of salmon returning to English rivers, however, this is not as marked as may be expected due to the recent reduction in exploitation in distant water net fisheries. The estimated numbers of returning fish and the numbers of fish surviving to spawn has remained fairly consistent due to the reduction of fish taken by inshore nets and a greater uptake of angler catch and release. In 2007 approximately 15% of the 42 principle salmon rivers in England were considered not at risk of failing their management objective, with approximately 30% probably not at risk. In 2016 there were no rivers considered not at risk and less than 10% probably not at risk.

7.1 Sufficiency of area and quality of occupied habitat	Atlantic salmon populations are reduced across England when compared with their natural/unimpacted reference condition. This decline is generally attributed to historical reductions in habitat quality due to poor water quality which are still on-going, and the historical introduction of physical barriers which stop Atlantic salmon reaching their spawning grounds and which are only now starting to be addressed. Although widely distributed, the salmon is a species of cool, swift-flowing, gravel-bed streams and rivers, with good water quality, clean gravels, physical habitat complexity that provides shallow water and flow refuges for juveniles and deeper water for adults, and unimpeded access along the river for adult and smolt migrations. Access restrictions (due to physical barriers) to historical river habitat combined with poor water quality is thought to have been responsible for the low numbers of Atlantic salmon within English rivers. It is likely that there would be an interaction between polluting inputs to the river/estuary and the presence of barriers, such as weirs, which may have compounded the impacts of individual stressors on the species. An example of this would be impoundments behind in-channel structures leading to increased deposition of fine sediment. This reduces the mosaic of habitats which characterise a naturally functioning riverine environment and provide the range of microhabitats utilised by Atlantic salmon at different stages of their lifecycle. The extent to which poor water quality has affected salmon populations is uncertain, however, excessive fine sediment may smother spawning gravels and nutrient enrichment may stimulate increased algal growth in these areas. Salmon bury their eggs in redds within the gravel, therefore, the eggs are suceptible to deoygenation effects related to gravel clogging. It is likely that the effects of water quality and physical habitat degredation are highly variable across the range of salmon. The current barriers to migration are likely to limit access to some areas of habitat which would be of suitable quality to maintain a viable salmon population, however, without further improvements in both water quality and habitat quality, there is unlikley to be a sufficient area of currently unoccupied high quality habitat to maintain the species at FCS.
7.4 Short term trend; Direction	Salmon have complex habitat requirements as their eggs are laid in well oxygenated gravels and migratory passage must be maintained for adults. In addition, the habitat required during the marine phase of their lifecycle is poorly understood. These factors, combined with sporadic survey effort and the widespread distribution of salmon within England, make a detailed assessment of habitat quality trends impossible at the present time. However, progress has been made with reducing physical barriers, nutrient and organic pollution levels in many rivers across England within the short-term trend period, which may have a beneficial effect on migration and the quality of spawning substrates. Water quality improvements in a number of rivers and estuaries are also likely to facilitate passage to spawning grounds. However, issues of siltation of spawning gravels, remaining physical barriers to migration and physical habitat degradation are still significant stressors for salmon populations within England. The increased focus on run of river hydropower schemes may result in man-made barriers to salmon migration being perpetuated for the foreseeable future as technical fish passage solutions may be inefficient, delaying salmon migration and/or increasing predation rates. In addition climate change effects may be changing the temperature envelope available to salmon in England. Increased warming of southerly rivers may be leading to a northerly shift in available habitat. This factor may cancel out the gains made in habitat availability due to improved water quality and barrier removal.

8.1 Characterisation of pressures/ threats	Pressures: J01 - Diffuse agricultural pollution has increased the input of fine sediment, phosphate and nitrate to rivers leading to eutrophication issues such as increased algal production in spawning areas and smothering of spawning gravels. Urbanization and industrialization have resulted in discharges of both raw and treated sewage, industrial effluents and diffuse urban pollution. These discharges may prove acutely toxic to salmon or produce lethal effects due to deoxygenation of the water column. In areas where the geological buffering capacity of the watershed is poor, acid precipitation may reduce the pH levels of aquatic environments to toxic levels. In addition, this may mobilise metals, such as aluminium, releasing them into water bodies. A wide variety of other chemicals, including pesticides and endocrine disrupters, have been released into the aquatic environment. These may result in obvious lethal effects, however, a wide variety of sub-lethal effects, such as reduced fertility or osmoregulatory difficulties during the transition from the freshwater to the marine environment, may affect the overall fitness of the salmon. Due to the diverse array of sources and impacts, the severity and contribution of each individual stressor on the population as a whole is unknown. K04 - Salmon require clean, well oxygenated gravels for spawning. Changes to the hydrological regime may increase deposition rates of fine sediment on gravels, increase the resistance of structures to passage by salmon and lead to stranding of parr and smolt during low flows. In addition river engineering works may increase the velocity of spate flows within the catchment which may result in both adult and juvenile salmon being washed out of areas of favourable habitat within the river system. If low flows are maintained over long periods of time, elevated water temperatures, deoxygenation, siltation and bed armouring may become evident. Conversely very high flows may scour gravel spawning beds and deposited eggs. K05 - Structures such as dams, weirs, fords and culverts may form barriers to the upstream spawning migration of adult salmon and for downstream juvenile migration. The Environment Agency established a geographic database of obstructions across England and Wales. It identifies 18,000 manmade obstructions on a river network length of 300,000kms. These range from large dams, which may have been built for navigation and or milling to smaller structures, for example, for irrigating water meadows. However, on some rivers the frequency of obstructions can be much greater. For example, on the River Yealm, in south Devon, which is a short moorland spate river, there are over 30 man-made obstructions to migration over a distance of ~18kms. In many cases, obstructions are considered the major cause of Atlantic salmon population decline in England. Riparian land use change due to urbanization, agriculture, forestry and other human activities impacting on riverbanks may reduce riparian vegetation, increase the speed of run-off to the river and alter the river planform. Gravel composition is of vital importance to eggs and alevins. Consequently, gravel extraction and river engineering works may alter flood dynamics and natural gravel deposits. Erosion and siltation can be influenced by forestry, agriculture, mining and other human activity. Increased siltation may clog spawning gravels or act directly on the fish by clogging of the gills and reducing foraging efficiency. D02 - Hydro-electric schemes often form major obstructions as salmonid populations are denied passage over spillways, through turbines and impoundments. Impounding structures may disrupt sediment movement down river, deepen and stabilise water levels, reduce hydraulic scour and increase siltation behind the structure. They may restrict the free movement of salmon up and down the river. Designs may require the abstraction of water out of the channel through an off-line turbine, leaving a depleted reach. Other designs divert water within the channel through the turbine which may create current velocities that attract migrating fish. Bank reinforcements affect riparian habitats, whilst turbine arrangements without suitable screening can entrain fish, generating injuries and mortalities. Turbine offtakes may attract migratory fish resulting in delays to migration and increased predation. D01 - N/A there are no tidal barrages in place affecting English salmon populations at the present time. N09 - Temperature influences both the period of incubation of eggs and thus the time of emergence, the subsequent development

rate of alevins and the survival of migrating smolt and adult salmon. Increases in temperature may produce synergistic effects with other environmental stresses such as increased toxicity of pollutants and more rapid deoxygenation. High winter water temperatures during the winter of 2015/16 may be linked to very poor juvenile numbers in many English rivers during this period. G03/G06 - English populations of Atlantic salmon have historically been heavily exploited on marine feeding grounds, in coastal areas during spawning migration, and in their up-river migrations. Exploitation pressure includes both commercial net and recreational rod fisheries. Atlantic salmon have been artificially reared and released into the wild for a variety of reasons including conservation, augmentation, compensation, re-establishment and increased angler catch. This may increase competition between released and wild fish, leading to a displacement of wild fish. Hatchery reared fish demonstrate poorer survival rates but may have a substantial impact if released in large numbers. If releases are based on local populations, the genetic impacts relate to inbreeding and domestication in the artificially propagated stock. If releases are based on non-native fish, in addition to loss of variability in the hatchery, local adaptations through interbreeding and erosion of the genetic structure of the species may result. I01/I02 - Non-native salmonid species, such as Rainbow trout, are known to compete with native European salmonids, and will suppress Atlantic salmon populations where they establish self-sustaining populations. Even if they do not establish such populations, escaped (or stocked) Rainbow trout may compete with native Atlantic salmon in rivers and in estuaries. Locally absent fish species, such as roach, may be introduced to catchments by anglers and although not well adapted to many of the salmonid habitats will nevertheless exert a competitive pressure. Non-native crayfish species may predate salmon redds, greatly reducing recruitment success. Species such as the signal crayfish (Pacifastacus leniusculus) often achieve a higher biomass than the native white-claw crayfish (Austropotamobius pallipes) and tolerate a wider range of environmental conditions, increasing their potential predation pressure. Threats: J01 - While great improvements have been made in water quality across England, particularly relating to point source inputs of gross organic pollution, diffuse rural sources of nutrients and sediment emanating from agricultural land use are likely to continue to be a stress on the aquatic environment. K05 - Although new barriers are unlikely to be built within river systems used by salmon, the modification of existing structures by the addition of fish passes to facilitate the passage of salmon may hinder the removal / decommissioning of these structures. Such investment will allow the impact of these structures on river habitats and associated impacts on salmon to be perpetuated. K04 - Increased pressure on water supplies for drinking water and agricultural irrigation may lead to increased abstraction and lower flows within the channel. Increased channel engineering and flow modification for flood risk management may continue to degrade the complex habitat mosaic required for salmon to complete their lifecycle. D02 - The potential for an expansion of hydropower development across England may lead to a continuation of barriers to salmon migration. While fish passage must be considered by these developments, pass designs may continue to degrade physical river habitat. D01 - Plans are being developed for a potential tidal barrage / lagoons within the Severn Estuary. This has the potential to affect salmon populations in the estuary and associated river catchments. N09 - Changes in the marine environment may affect both the survival and growth of Atlantic salmon and lead to a northern shift in range. Increased water temperatures associated with climate change may be particularly pronounced in the southern extent of the English Atlantic salmon range. If the expected northward movement of the thermal niche of anadromous salmonids occurs, decreased production and population extinction in the southern part of the distribution area may result in a loss of salmon from southern chalk streams draining to the south coast. Future climate scenarios for the northern hemisphere suggest precipitation is expected to increase so that winter runoff will increase markedly, while the summer will decrease. Milder, wetter winters will result in changes to spring floods and increased winter water temperatures. Hatching of salmon eggs will be accelerated in the southern portion of salmon range, and juveniles will need to start feeding earlier in spring. It is likely that food organisms will be available, as they will also develop more rapidly at higher water temperatures. However, altered flood regimes may present a harsher environment to juvenile salmon. Growth conditions in northern rivers are likely to improve, and so will the production of salmon smolts. In contrast, rivers in the southern part of the distribution range are likely to present salmon juveniles with warmer water at a lower runoff, which may reduce productivity. Altered flow regimes are likely to influence the timing of smolt migration and adult return. I01/I02 - Signal crayfish, together with other INNS crayfish species, continue to increase their range and populations in many English river and lake catchments. There are no effective control measures for INNS crayfish and their range is expected to continue to expand in river and lake networks for the foreseeable future. In Norway, catastrophic losses of Atlantic salmon occured following the introduction of Gyrodactylus salaris to the country in the 1970s. By 2002, 44 Norwegian rivers had been infected, and their salmon populations decimated. Fishery losses due to the parasite have been estimated at over 40% of total reported catch of wild salmon. In an attempt to eradicate G. salaris, the Norwegian government is carrying out an extensive programme to treat infected rivers with rotenone, killing all fish able to harbour the parasite. Salmon transported from Scottish rivers to Norway and exposed to G. Salaris were shown to be highly susceptible, and therefore at risk should the parasite ever be introduced to the UK. Movements of live fish from an infected area represent a high risk to salmon in England with additional risks associated with material from infected waters such as angling equipment and canoes allowing the spread of the parasite to English rivers. Pink salmon (Oncorhynchus gorbuscha) have been recorded in very low numbers in UK waters for 65 years, however, In 2017 much greater numbers of fish were recorded in UK rivers, including England. These fish are thought to have originated from introductions into the White Sea basin. Pink salmon have a strict two year lifecycle with 'even' and 'Odd year' populations. 'Odd year' Pink salmon, which spawn earlier and are able to withstand colder water temperatures. In 2017 pink salmon were demonstrated to have spawned successfully in Scottish rivers. Competition for food in freshwater may be limited but nothing is known about how large numbers of post-smolts may impact native salmon in estuarine and near coastal waters. Aggressive behaviour may influence habitat use by Atlantic salmon. Disease and parasite transmission is poorly understood at the present time and the risk to English salmon not determined. Pink salmon may attract piscivorous predators to new areas or to habitats which may not have been subject to significant predation pressure in the past. A more detailed assessment of the threat to Atlantic salmon may be possible if pink salmon numbers continue to increase in 2019.

9.5 List of main conservation measures	CJ01 - Work has continued to reduce discharges to both the Natura and wider river network. Major infrastructure projects to improve sewerage, such as removal or upgrade of combined sewer overflows and improved phosphorus removal from treated sewage effluent, has been funded via the water industry's programme of strategic improvements such as AMP and PR rounds. However, further investigations are needed into the application of new best available technology for phosphorus removal and the increased availability of mains sewerage for rural populations. The England Catchment Sensitive Farming Initiative is continuing to promote a range of best agricultural practices to reduce pollution loads to priority aquatic sites. A combination of Natura 2000, SSSI and Water Framework objectives continues to drive improvements in water quality with diffuse water pollution prevention plans developed for many sites. CJ02/CJ03 - Abstraction management - Improvements have been achieved with limiting abstraction volumes and improving flow regimes by altering compensation flows from water company assets via AMP and PR rounds. However, further improvements are required to naturalise flows at many sites. As part of the on-going abstraction reform process, abstraction licences will become environmental permits and a greater emphasis will be given to environmental considerations. By 2022 all previously exempt abstractions will be permitted. CJ02/CJ03 - Physical habitat restoration - A major programme of physical restoration has been implemented on the designated river network, involving the development of a long-term strategic plan for each river and its programmed implementation. These plans address key issues such as dams and weirs, floodplain reconnection, channel modifications, lack of riparian habitat, lack of riparian trees and lack of woody debris in the channel. Outside of the designated site network, river restoration schemes have focused on addressing channel modifications and the many weirs and dams on the river network in England. A further driver for river restoration has been the increased prominence of natural flood management. If properly implemented, NFM has the potential to enable widespread improvements in many previously degraded riverine habitats. CC04 - In recent years the rapid increase in the installation of run-of-river hydropower schemes has led to concerns over their impacts on migratory fish such as salmon. Research has been undertaken on the safety of various turbine designs but this has mainly focused on fish strike by turbine blades and their associated screening requirements. The effects of these installations on fish behaviour and the associated delays to migration, energy costs to fish and increased predation rates are less well understood. Many of the studies have assessed individual installations. While each individual installation may have a relatively low impact on fish, where multiple schemes have been planned on a river, their in-combination effects on salmon have not been fully taken into account. In addition, fish passage mitigations at these installations take no account of the loss of geomorphological processes / impact on river habitats within the river and often lead to the barrier and its associated impoundment being perpetuated when opportunities for its complete removal and restoration of river processes may have been available. However, in the case of strong swimming fish species such as salmon, the requirement for fish passage enhancements associated with these installations has led to increased connectivity between marine feeding grounds and riverine spawning habitat at some sites. CC02/CC03 - Detailed assessments must be made of the potential risks to salmon due to abstractions, discharges and potential barrier effects from new energy infrastructure. Any developments must be fully assessed and mitigation measures developed pre-construction phase. Continuous post construction monitoring must be undertaken and operational procedures modified if required. Tidal lagoon / barrage developments are in their infancy and detailed plans to protect salmon will be required as part of the feasibility and development phase. CGO1/CG02 - Salmon fisheries in all rivers are subject to exploitation controls. Salmon are listed in Annexes II and V of the EC Habitats Directive. Annex II requires that Special Areas of Conservation are designated for salmon and that Member States should ensure the appropriate management of these and other sites where they are known to occur so that the favourable conservation

status of the species can be secured. The primary legislation for the regulation of salmon exploitation is the 'Salmon and Freshwater Fishery Act 1975'. Under this legislation the Environment Agency has powers to make Net Limitation Orders. Each order limits the number of licences for fishing with nets that may be issued in any specific fishery for up to 10 years. Fishery byelaws regulate when, where and how fishing can take place. In line with NASCO guidelines on protecting the weakest stock, mixed stock fisheries will be phased out for England. All retained net caught wild salmon must be carcass tagged and It is illegal to sell rod caught wild salmon in England. The EA are currently implementing the 'Salmon Five Point Approach' to conserve salmon stocks across England. As part of this approach exploitation pressure will be controlled and to help achieve this objective levels of catch and release for rod fisheries will be increased and net fishing effort reduced or removed. CI03 - Section 14 of the Wildlife and Countryside Act (WCA) prohibits the introduction into the wild of any animal of a kind which is not ordinarily resident in, and is not a regular visitor to, Great Britain in a wild state, or any species of animal or plant listed in Schedule 9 to the Act. Schedule 9 lists non-native species that are already established in the wild, but which continue to pose a threat to native biodiversity and habitats such that further releases should be regulated. The EU Invasive Alien Species (IAS) Regulation (1143/2014) came into force on 1 January 2015. The Regulation imposes restrictions on species 'of Union concern'. These are species whose potential adverse impacts across the European Union are such that concerted action across Europe is required. Under the Water Framework Directive (WFD) invasive non-native species (INNS) have been classified as high, moderate, low or unknown impact. Their presence prevents a site reaching high ecological status. They may also affect the ability of waterbodies to reach the default objective of good ecological status, or may cause a deterioration of status away from good status. The presence of viable populations of high impact non-native species constitutes a reason for unfavourable condition of SSSIs and SACs notified for their freshwater habitat. The presence of any non-native species may constitute a reason for unfavourable condition of SSSIs and SACs notified for either their freshwater habitat or particularly freshwater species, depending on the nature of the effect. The Live Fish Movement Scheme (LFMS) enacts the Keeping and Introducing Fish Act 2015 (KIFA). It lists Invasive non-native fish species (Annex 1 species) which cannot be kept in water bodies without a licence. There are a number of strategies in England aimed at limiting the spread of invasive species. Examples include the development of pathway action plans such as the 'angling pathway action plan' and the 'boating pathway action plan' which are required under the IAS regulations, the implementation of the Great Britain Invasive Non-Native Species Strategy and publicity via stakeholders surrounding the importance of biosecurity protocols. CN01 - The rationale behind restoring river habitat in England is the restoration of natural riverine processes, which creates characteristic habitats and provides for individual species to an extent dependent on the natural character of the river. This rationale is also the main adaptation response for combatting climate change. Some aspects of restoring natural function are also seen as climate change mitigation measures, such as the re-establishment of natural tree cover and riparian vegetation which is being implemented as part of many river restoration schemes and agri-environment schemes. These interventions may result in moderated extremes of flow, reductions in water temperature and increased water quality.

12.1 Population size inside the pSCIs, SCIs and SACs network	These estimates are based on the total number of spawning adults in the following rivers, all of which are SACs. Rivers that are shared with Wales (the Rivers Wye and Dee SACs) and Scotland (the River Tweed/Till SAC) are not included (the Wye and Dee are included in the report for Wales). The River Axe SAC is not included as the SAC only covers the lower section of the river. The headwater streams of Dartmoor SAC are also not included as it is unclear what proportion of the adult population of the River Dart spawn in the headwaters. Figures are the minimum, maximum and mean values from the years 2013 - 2017. Considering the widespread nature of the species in England, the river SAC network contains a substantial component of the English population. River (Hampshire) Avon = min 788 (2014) max 1785 (2016) Mean 1286 River Camel = min 256 (2015) max 461 (2013) Mean 319 River Derwent = min 926 (2015) max 2600 (2017) Mean 1723 River Ehen = min 243 (2015) max 902 (2013) Mean 525 River Eden = min 2242 (2014) max 4938 (2016) Mean 3667 River Itchen = min 269 (2016) max 751 (2015) Mean 519 Mean (2013-2017) total for SAC network = 8039
12.4 Short term trend of the population size within the network; Direction	When spawner numbers are totalled for the SAC network in England (Rivers Avon, Camel, Derwent, Ehen, Eden and Itchen) a decreasing trend in stock is recorded. When the rivers across the network are considered individually, the Itchen and Avon show an increasing stock trend, with the Camel, Derwent, Ehen and Eden showing a decrease.