Environment Agency

Appendix 5: The current state of salmon stocks

Contents

1.0 Introduction

1.1 This document sets out the current state of salmon stocks (using data up to and including 2016) in English principal salmon rivers and the Border Esk. It has been produced to support the development of options to further reduce the exploitation of salmon by the net and fixed engine fisheries and rod fisheries that target them. Evidence is provided on how the two main salmon stock components (grilse and multi sea winter salmon) that return to these rivers are preforming in the marine environment, at a national level and on each of the 42 principal salmon rivers in England. The following data sources have been used to do this:

- the data used by the International Council for the Exploration of the Seas to assess the pre-fisheries abundance of national salmon stocks (Section 2)
- marine survival estimates for individual salmon “index” rivers where such assessments are possible (Section 3)
- estimates of the upstream run of adult salmon from traps and counters (Section 4)
- juvenile electric fishing survey data from sampled principal salmon rivers in England (Section 5)
- stock assessments for each principal salmon river in England (Section 6)
- net and fixed engine salmon catches from fisheries in England (Section 7)
- rod catches from principal salmon rivers (Section 8)

1.2 A summary of the available evidence presented is provided at the end of each of the above sections. At the end of the document, these summaries have been drawn together to provide an overall assessment of the current state of English and Border Esk salmon stocks.

2.0 Pre-Fisheries Abundance

2.1 Each year an assessment is made by the International Council for the Exploration of the Seas (ICES) Working Group on North Atlantic Salmon of the status of the salmon stocks in the north-east Atlantic. This is used by ICES as a basis for advising fisheries managers and providing catch advice to NASCO to inform the management of distant water fisheries. A key part of this assessment is the estimation of the Pre-Fisheries Abundance (PFA) of the various national stocks from north-east Atlantic countries. For this purpose, a combined PFA estimate is generated for England and Wales by the Centre for Environment Fisheries and Aquaculture Science (Cefas). The PFA is defined as the number of fish alive in the sea on 1 January in their first sea winter. The estimate is split between:

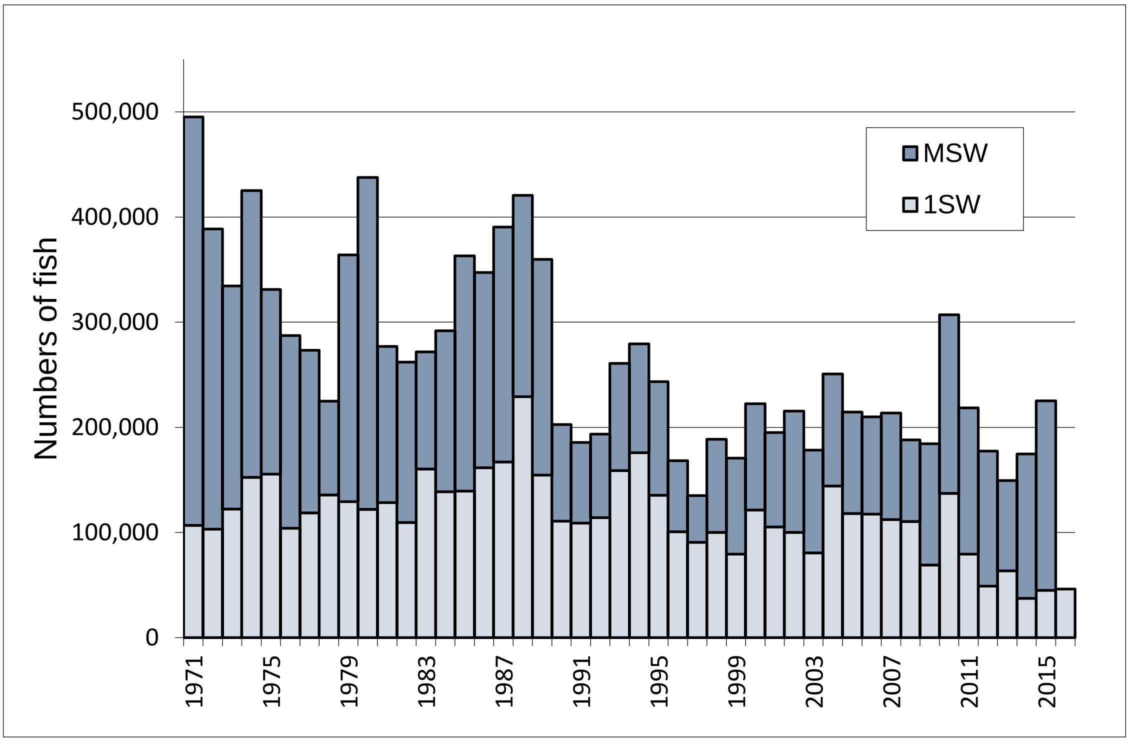
- maturing salmon i.e. potential grilse/one sea winter fish (1SW)
- non-maturing salmon i.e. potential multi sea winter fish (MSW)

2.2 The PFA estimates are initially based on catches in home water net and rod fisheries. These data are raised to take account of non-reported catches and exploitation rates, and then further raised to take account of catches in the distant water fisheries and natural mortality between the PFA date (1 January) and the timing of return to home waters. The PFA estimates calculated by Cefas provide the best available assessment of the status of total national stocks over the past 4 to 5 decades.

2.3 Figure 1 shows the estimated PFA of all English and Welsh stocks, prior to any exploitation of them by net, fixed engine or rod fisheries in high seas or home water fisheries over a 46-year period (1971-2016).

Further details on the methods used for estimating PFA, are available in Annex 5 of: 'Assessment of salmon stocks and fisheries in England and Wales - standing report on methods, approaches and wider stock management considerations'. (https://www.gov.uk/government/publications/salmon-stocks-and-fisheries-in-england-and-wales-in-2015)

Figure 1: Estimated Pre-Fishery Abundance (PFA) of salmon from England and Wales, 1971 – 2016, as derived from the ICES-NEAC PFA model, 2016.



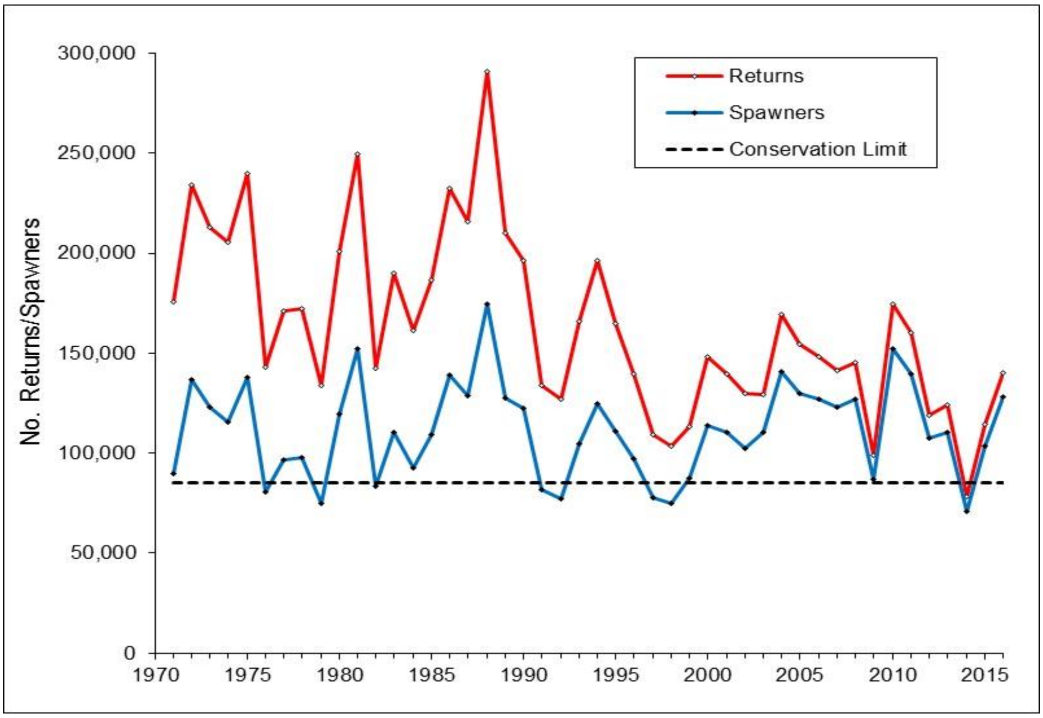
Note: The model cannot provide an estimate of PFA of potential multi sea winter (MSW) fish for the most recent year, as this relies on an assessment of the returns to home waters of these fish, which will not occur until the subsequent year.

2.4 The PFA estimates indicate that:

- The estimated total PFA of salmon from England and Wales has declined by around 50% from the early 1970s (around 400,000 fish) to the present time (around 200,000 fish).
- For much of the period, the decrease has been greater for the non-maturing (i.e. potential multi sea winter) component of the PFA than the maturing (potential grilse) component.
- However, there has been a marked reduction in the PFA of grilse (1SW) salmon in the last six years, and the decline in PFA between the start and the end of the time series is now greater for grilse (~60%) than for multi sea winter salmon (~50%).
- There was a particularly marked decline in total numbers around 1990, which is consistent with the general perception of a decrease in the marine survival for many stocks around the north-east Atlantic at about this time.
- The trends in PFA mask conflicting changes in individual river stocks. Many rivers have experienced more serious declines but these are obscured by the very substantial improvements and recovery of several others. For example the River Tyne, which has undergone a large recovery from very low stock levels and now makes up a sizeable percentage of the total English salmon stock (in 2016 it was provisionally estimated to be 16% of the total salmon stock of the 42 English principal salmon rivers).

2.5 The estimated numbers of salmon returning to rivers in England and Wales (prior to exploitation in homewater fisheries) and the numbers surviving to spawn are also derived from the ICES national assessment. The estimated numbers of returning salmon (Figure 2) show a similar downward trend to the Pre-Fishery Abundance (Figure 1), although the decrease is less marked due to the reduction in net exploitation in distant water fisheries between the time the PFA is estimated and when the fish return. The difference between the estimated numbers of returning fish and those surviving to spawn has reduced progressively over the time series and the numbers estimated surviving to spawn have remained reasonably consistent over the period (Figure 2). This reflects the marked reduction in levels of exploitation in homewater net and rod fisheries, including the increasing adoption of catch and release practices.

Figure 2: Estimated numbers of returning and spawning salmon from England & Wales as derived from the ICES PFA model, 2016, together with the national Conservation Limit (CL) (derived from the sum of river-specific CLs).



2.6 In summary, the abundance of salmon from stocks in England and Wales has reduced by around 50% over the last 4 to 5 decades. The relative proportions of grilse and multi sea winter salmon have fluctuated over time. Importantly, there has been a marked decline in the abundance of grilse in recent years and an increase in numbers of multi sea winter fish. The performance of the national salmon stock for England and Wales above the national conservation limit is principally as a result of a small number of rivers exceeding their individual river conservation limit (e.g. the River Tyne). An increase in multi sea winter spawner numbers, as shown in Figure 1, will be expected to have a disproportionate effect on egg deposition, given the substantially higher number of eggs carried by these larger fish. This poses risks to the sustainability of salmon stocks in the future, as even relatively modest reductions in multi sea winter salmon in future years would result in proportionally greater reductions in egg deposition

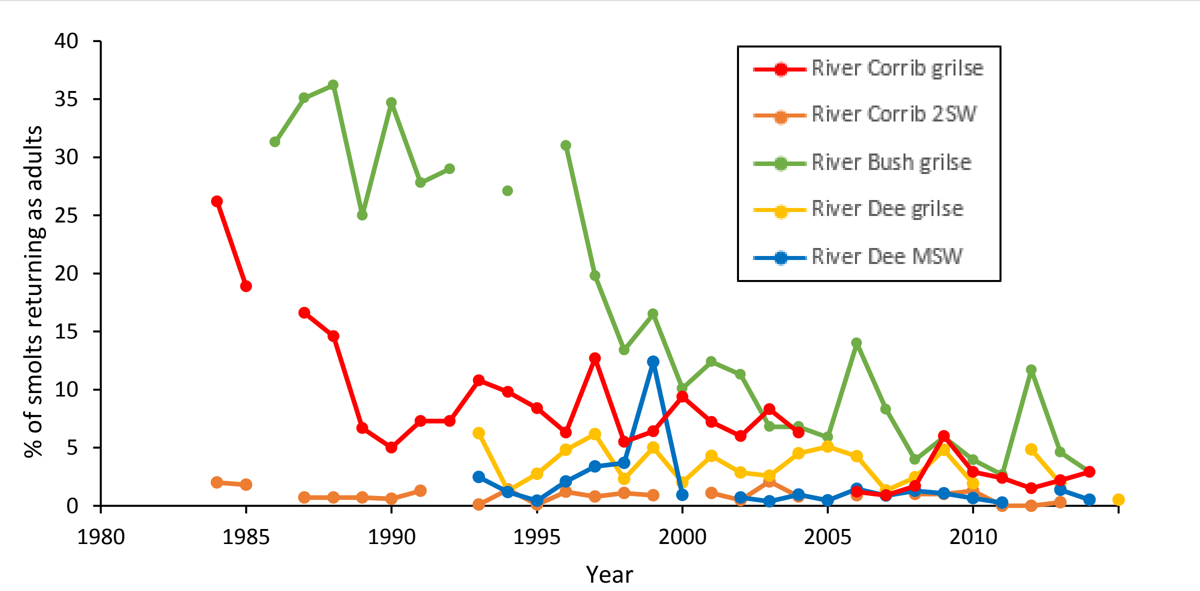
3.0 Marine survival

3.1 There are a small number of rivers around the north-east Atlantic (referred to as "index" rivers) where monitoring facilities enable estimates to be made of adult salmon return rates (i.e. the proportion of out-migrating smolts which survive to return to their native river). These estimates are typically based on tagging studies and are used as indicators of the survival of salmon during the marine phase of their life-cycle.

Such marine survival estimates are shown in Figure 3 for the River Bush (Northern Ireland), River Corrib (Ireland) and River Dee (Wales) (ICES, 2017). These Irish and Welsh data are presented here as they provide relatively long-term data sets for stocks that share the same broad geographic location as English salmon stocks in the marine environment. They are therefore likely to be affected by the same marine pressures as those from England.

More recent data (post 2002) are available for the English Rivers Tamar and Frome, these are presented in Figure 4.

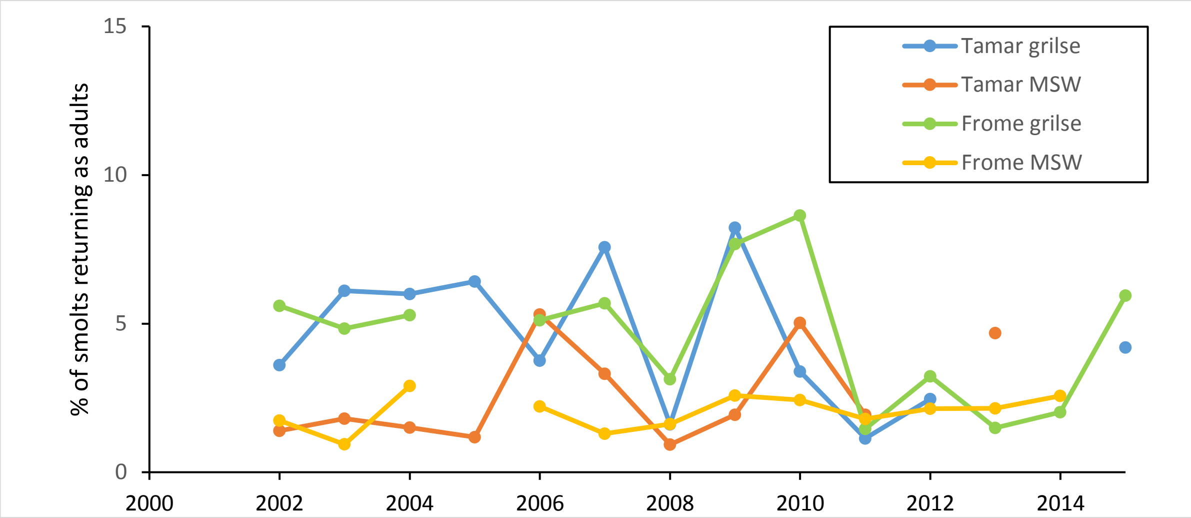
Figure 3: Estimated percentage of smolts returning as adults, in different age classes, for the River Corrib, Bush and Welsh Dee (from ICES, 2017) for 1984 to 2014 smolt year classes.



3.2 Figure 4 presents the shorter time series of data available from the River Tamar and Frome in England. When compared to Figure 3:

- Grilse return rates are in a similar range to those seen in Figure 3, with values of 1.1 - 8.2% for the River Tamar ranges and 1.5 – 8.6% on the River Frome.
- The multi sea winter (MSW) return rates show a larger degree of variation than those on Figure 3.
- Highest multi sea winter values of 5.3% for the Tamar and 2.6% for the Frome are above any values recorded in Figure 3 over the same time series.
- The lowest multi sea winter values of 0.9% for both the Tamar and Frome are in line with those described from the other rivers.
- This data post-dates the large declines shown in Figure 3 and therefore the same changes in marine survival would not be expected to be evident on this time scale.

Figure 4: Estimated marine survival of wild smolts (%) for the River Tamar and Frome (from ICES, 2017) for 2002 to 2015 smolt year classes.



3.3 In summary, the available estimates of marine survival for stocks in the UK and Ireland are consistent with the PFA in showing a marked decline in marine survival around 1990 and persistent low levels of marine survival since, albeit with some inter-annual variability. Similar patterns of reduced levels of marine survival in the last 20-30 years are evident for stocks throughout the north-east Atlantic.

The reduction in the survival rate of salmon in the north-east Atlantic means that the same number of smolts leaving English rivers now will produce far less returning adults than would have been the case in the 1980s.

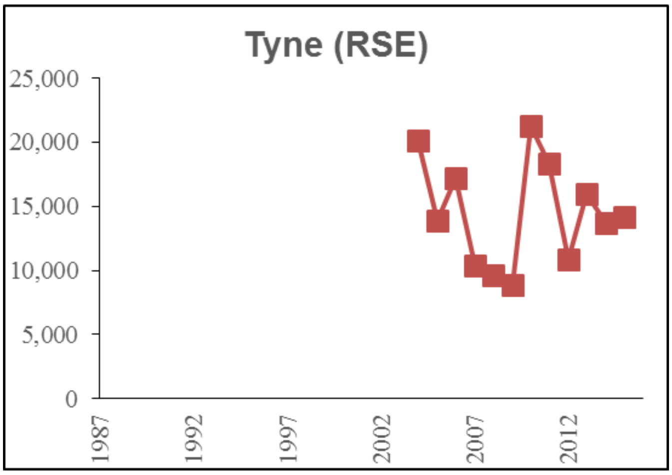
4.0 Counters and traps

4.1 Electronic fish counters or upstream traps are operated on a number of river catchments throughout England and Wales to provide estimates of the numbers of adult salmon returning. The data derived from this network of counting facilities is independent of fishing effort and therefore provides an alternative means of understanding salmon stock performance to rod catch returns. The geographical spread of the rivers with counting facilities enables us to have an understanding of salmon stock performance for a broad range of river types.

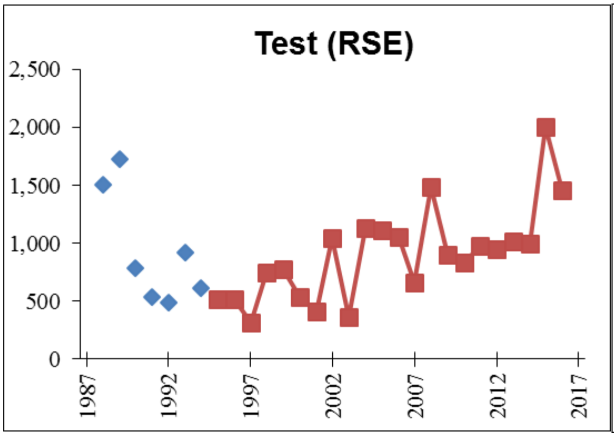
4.2 Available time series of data from 11 counters and traps in England and Wales that have been operational within the last 5 years are presented in Figure 5, on a river by river basis.

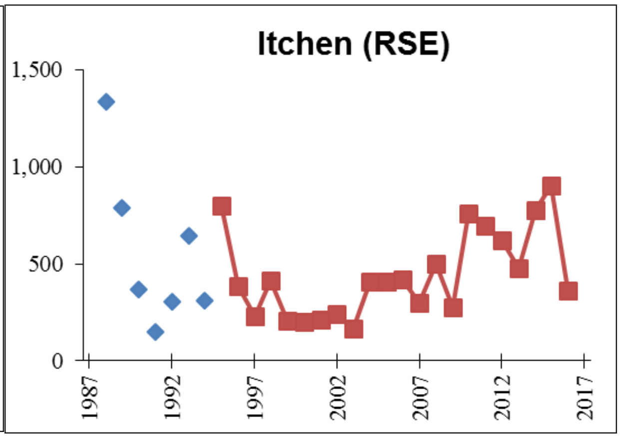
Figure 5: Salmon counts from electronic fish counters (c) and monitoring traps (T), and returning stock estimates (RSE) (based on trapping and tagging, or validated counts plus catch below counter) presented by geographical area for selected salmon stocks in England and Wales, 1988 – 2016. Regression lines are indicative only and based on data from 1995 onwards (red squares); earlier data for some rivers indicated as blue diamonds. Note that y-axes scales differ.

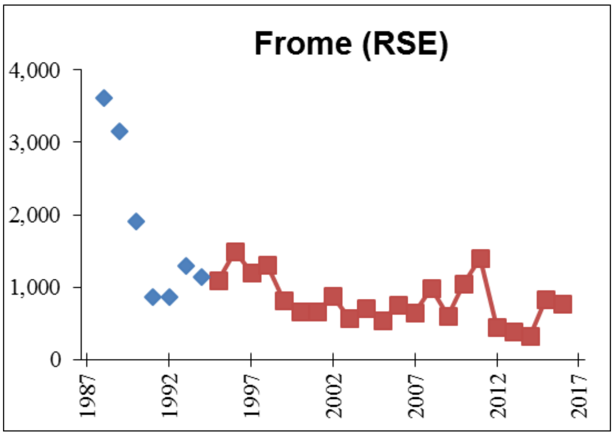
North-east England

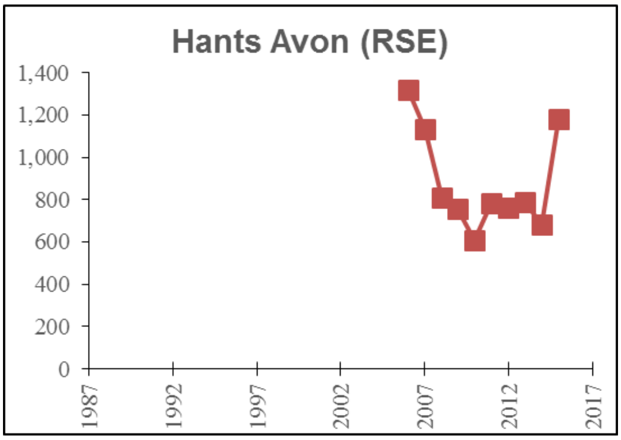


Southern chalk streams

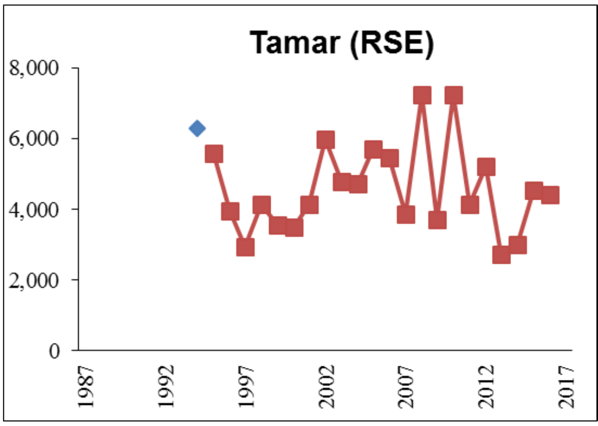


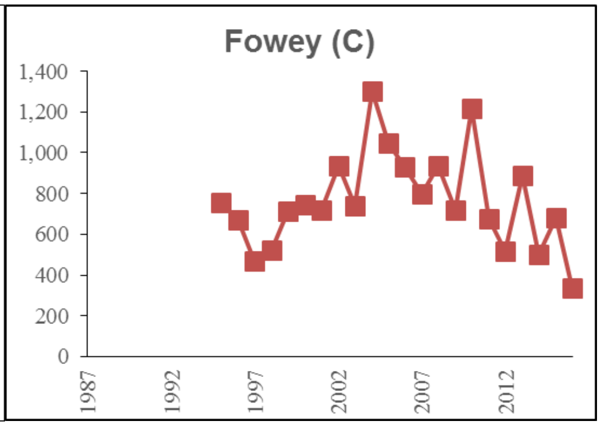




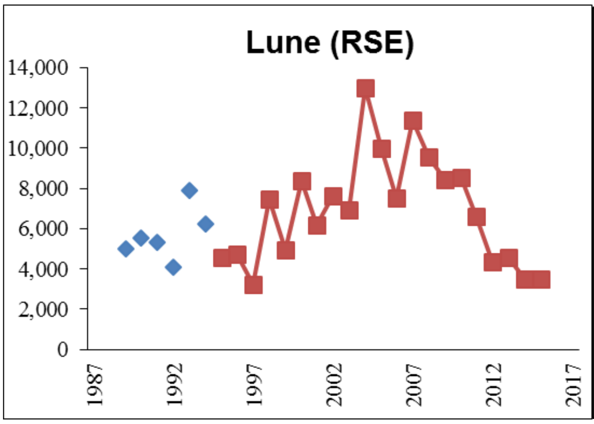


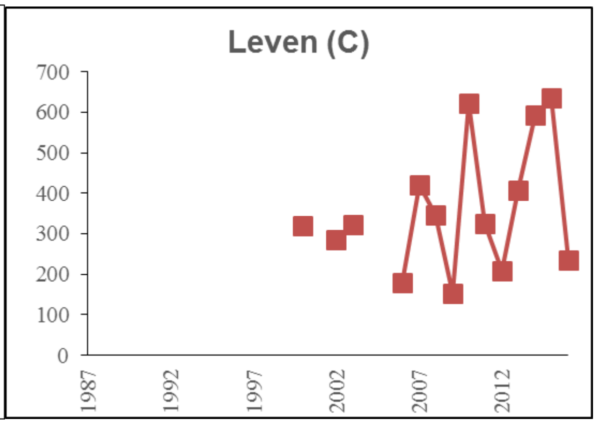
South-west England

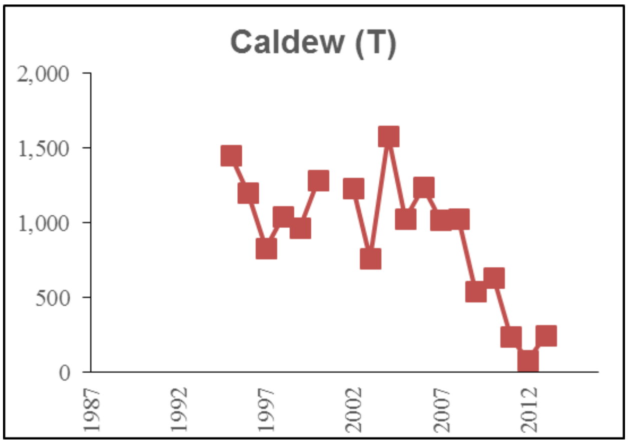




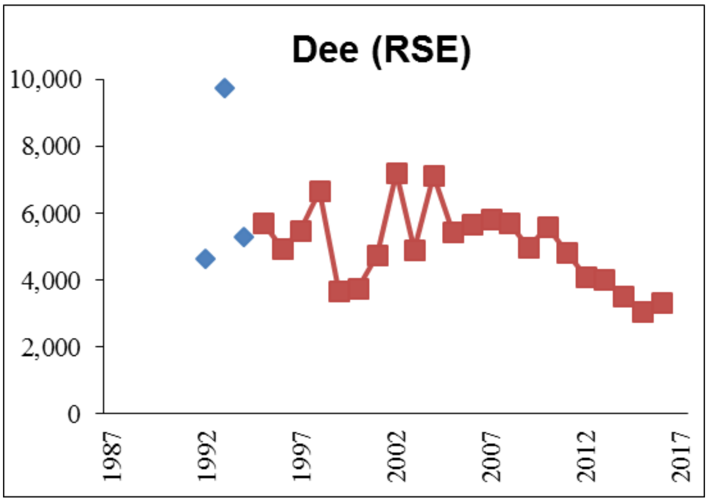
North-west England







Wales



4.3 The counts and returning stock estimates from these English and Welsh rivers indicate some differing patterns over time. Some rivers (e.g. Test & Itchen) indicate an increasing trend over recent years. The nearby Frome suggests a gradual longer term decline. However, for a number of catchments, and particularly some of those in the south-west, north-west and north Wales, there have been marked declines in the last decade. In others, runs have varied considerably year on year without any strong discernible trend (e.g. Tyne and Leven).

4.4 The electronic fish counter on the River Tamar has a co-located upstream fish trap, which is used throughout the year to gather detailed information from returning salmon (such as scales and exact weight and length data). After this data is collected the salmon are released back to the river. Data from this facility is provided in Figures 6, 7, 8 and 9 to demonstrate how the River Tamar's salmon stock has changed between 2004 and 2016.

Figure 6: Mean annual fork length of grilse (with linear trend line) and two sea winter salmon (2SW) caught in the River Tamar fish trap between 2004 and 2016.

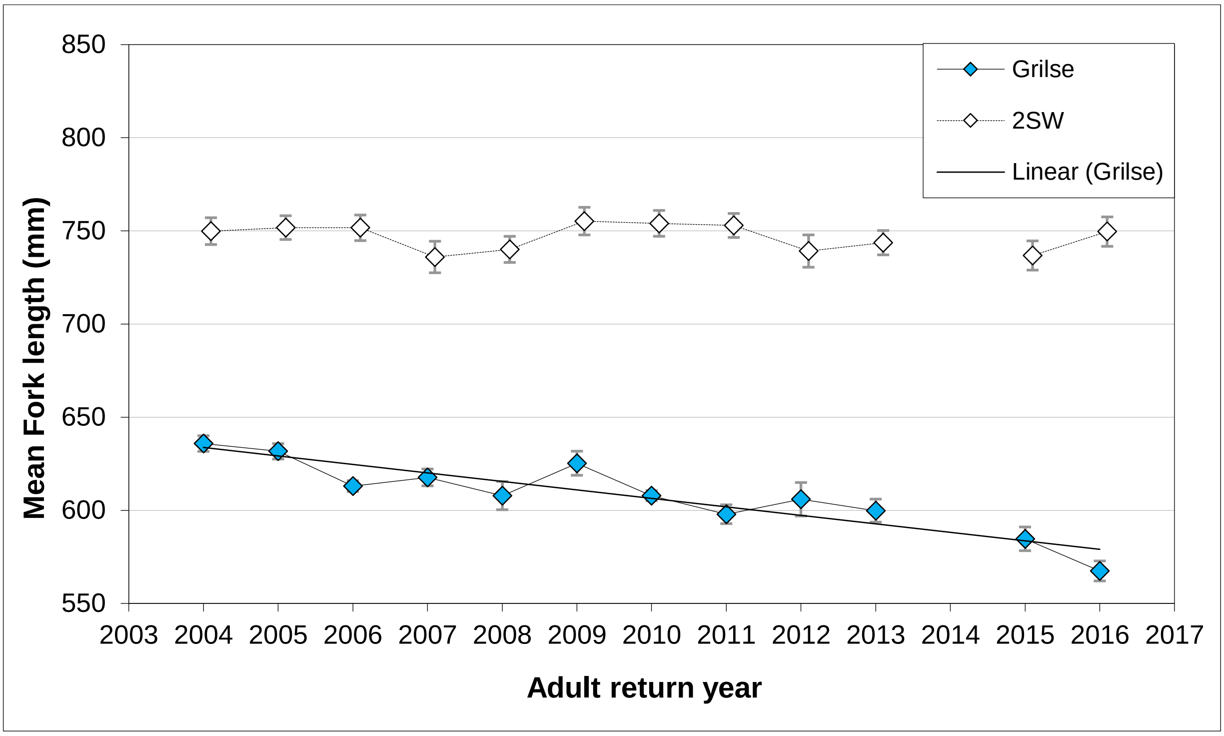
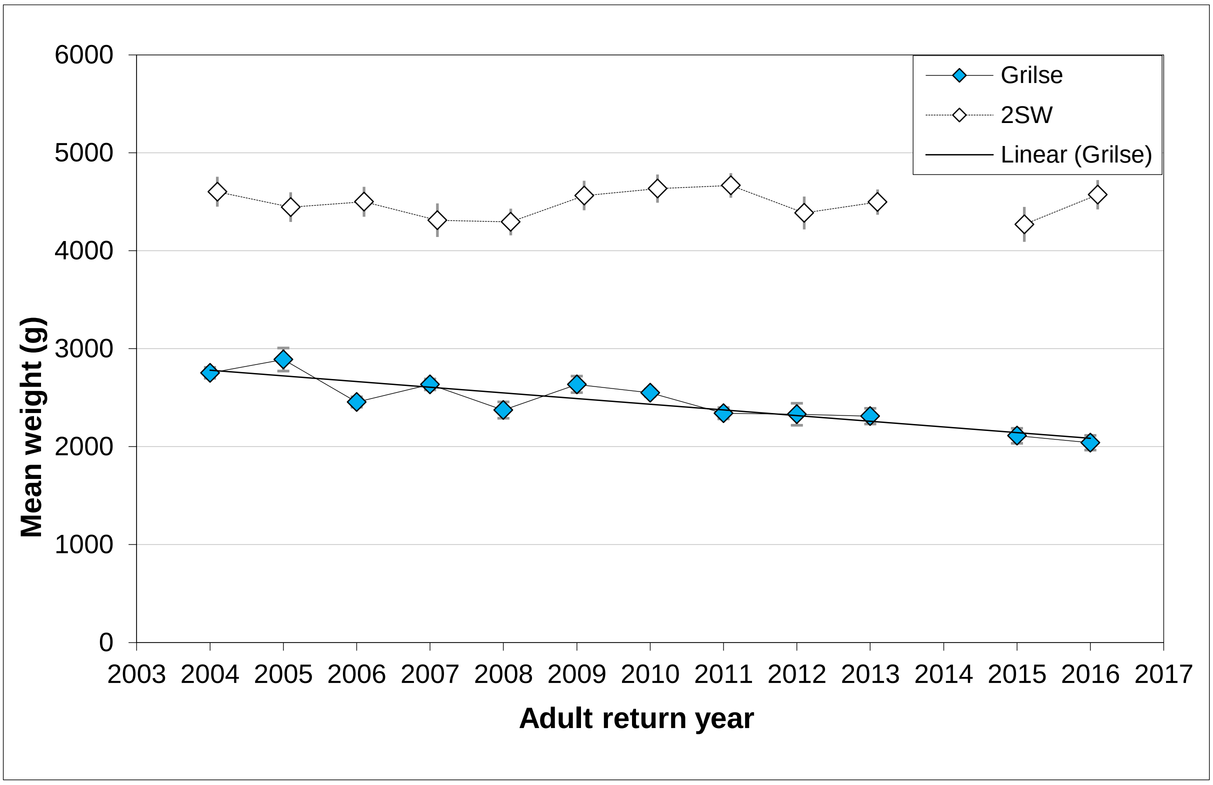


Figure 7: Mean annual weight of grilse (with liner trend line) and two sea winter salmon (2SW) caught in the River Tamar fish trap between 2004 and 2016.



4.5 Figures 6 and 7 show a reduction in both the length and weight of grilse returning to the River Tamar between 2004 and 2016. Over the same period the data shows no substantial increase or decrease in either the length or weight of multi sea winter salmon.

Figure 8: Percentage of the total annual grilse run that passed the River Tamar salmon counter prior to 1 August in a given year, with linear trend line. Based on data from 2004 to 2016.

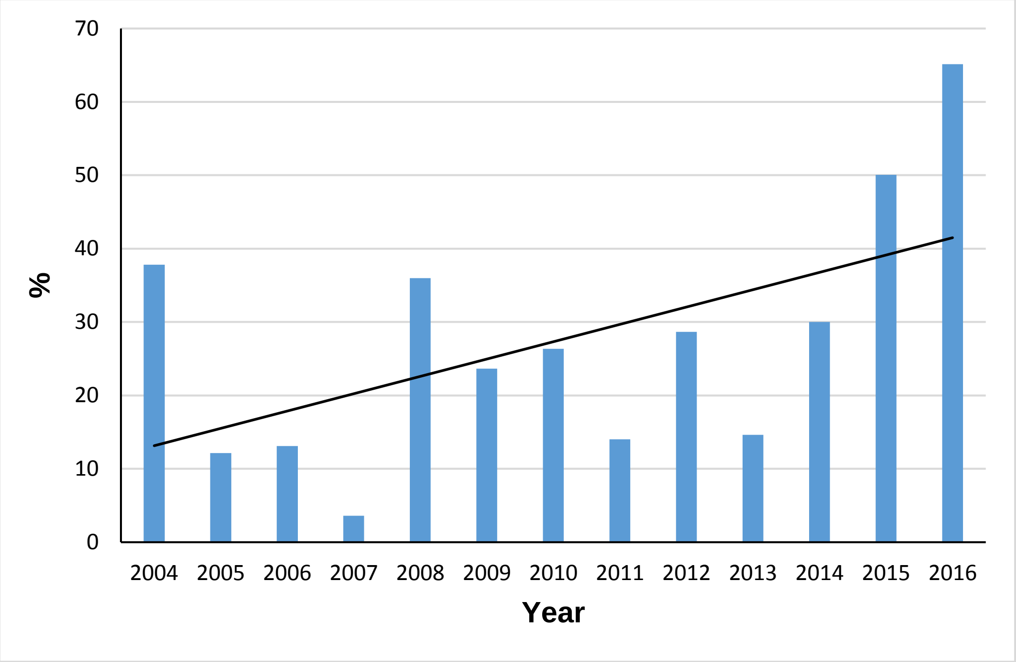
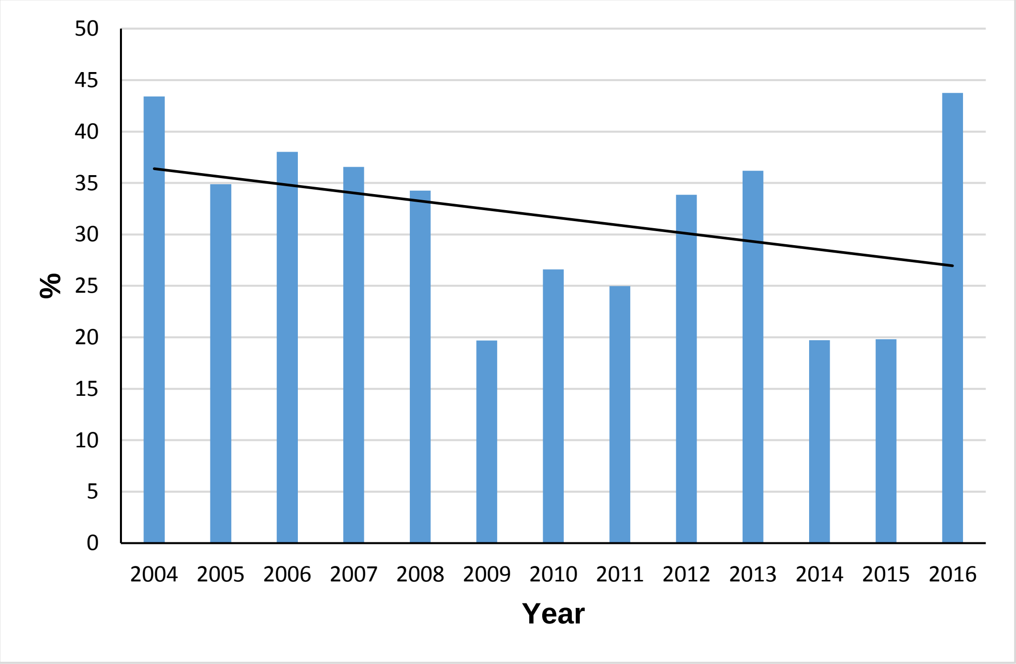


Figure 9: Percentage of the total annual 2 sea winter salmon run that passed the River Tamar salmon counter prior to 1 June in a given year, with linear trend line. Based on data from 2004 to 2016.



4.6 Figure 8 shows an increasing trend in the percentage of grilse that pass the River Tamar salmon counter prior to 1 August, meaning that a greater proportion of the grilse run are returning earlier in the year.

4.7 Figure 9 shows a decreasing trend in the percentage of multi sea winter salmon passing the River Tamar salmon counter prior to the 1 June, meaning that a smaller proportion of 2 sea winter salmon are returning early in the year.

4.8 In summary, the counts and trends in returning stock estimates vary considerably between different English and Welsh rivers. Some rivers show signs of recovery from the very low salmon stock numbers of the mid-late 1990s. However other catchments show long term declines in salmon numbers, with a number displaying reductions in returning adult salmon numbers in recent years.

The counter and trap data from the River Tamar shows a reduction in the size returning grilse. The falling size of these salmon is significant as smaller fish produce fewer eggs. This, if seen across the whole salmon stock, will have a compounding effect on the lower egg numbers produced by the reducing grilse run shown in Figure 1. This means that the future sustainability of the salmon stock is further reliant on multi sea winter fish successful spawning and providing recruitment to the next generation.

Data also shows a changing trend in grilse and 2 sea winter salmon run timings on the River Tamar, with an increasing percentage of grilse entering the river earlier in the year and a reducing early running 2 sea winter salmon. This means that a smaller proportion of the multi sea winter run is protected by the existing National Salmon Byelaws (described in more detail in Section 9) than was previously the case.

5.0 Juvenile data

5.1 An annual programme of electric fishing surveys is carried out by the Environment Agency to:

- identify trends in the juvenile population
- provide an overview of the status of the population in a catchment
- identify those parts of the system that are under-performing

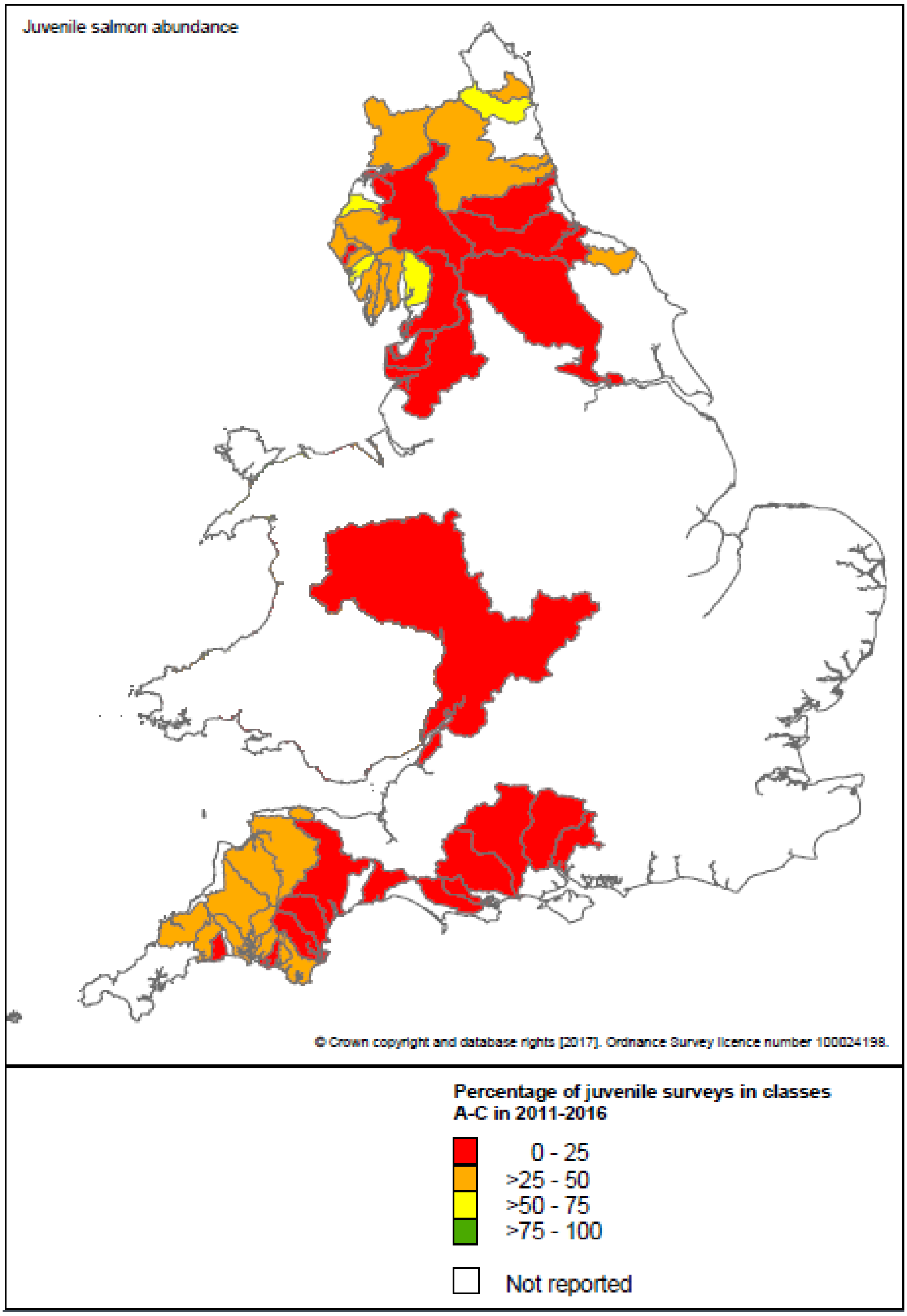
Full details on the juvenile monitoring programme are provided in Section 7 of: 'Assessment of salmon stocks and fisheries in England and Wales - standing report on methods, approaches and wider stock management considerations'.

5.2 One output from the monitoring programme, is an assessment based on a classification scheme that produces a combined salmon fry and parr density score for each site, using average values for the early 1990s as a baseline (Mainstone *et al*., 1994). The scheme enables the proportion of sites falling into different salmon abundance classes (A to F) to be determined. This provides a measure of the health of the juvenile salmon populations for each river. Sites are typically grouped into those that are at or above average (Classes A to C), below average (Class D) and well below average or fishless (Classes E or F).

5.3 Figure 10 presents the proportion of juvenile salmon survey sites in each catchment where the most recent survey falls into the top three classification classes (A to C) over the period 2011 to 2016 (inclusive). The data shows:

- in the majority of catchments less than half the juvenile salmon survey sites were classified in class A – C
- more catchments had less than 25% of survey sites in classes A – C than any other grouping
- no river catchments in England had greater than 75% of the juvenile surveys in classes A – C

Figure 10: The proportion of sites in each catchment that fall into the top three (Classes A to C) of the five classification categories over the period 2011 to 2016 inclusive.



5.4 Following reports of particularly low numbers of juvenile salmonids in surveys in 2016, the Environment Agency undertook further analysis of the data to investigate both the reported low abundance and what factors may be causing this low abundance. An overview of the findings of this investigation is given below, with changes in juvenile salmon density across England shown in Figure 11. A more in-depth analysis is available in Section 10 of the 2016 annual assessment report (Cefas, EA & NRW, 2017) and is also included in the report of the ICES North Atlantic Salmon Working Group (ICES, 2017).

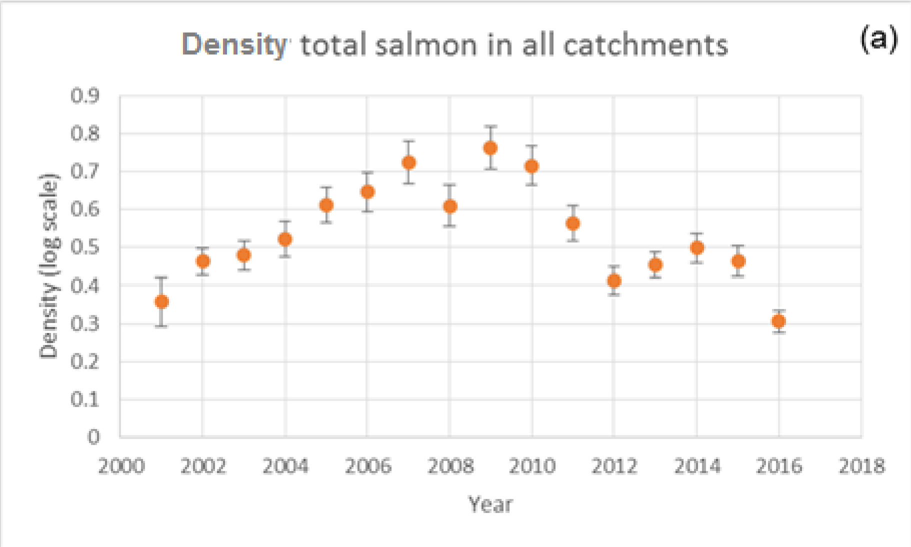
5.5 Figure 11(a) shows the density of all juvenile salmon recorded during the juvenile salmonid monitoring programme in England in a given year. The data shows:

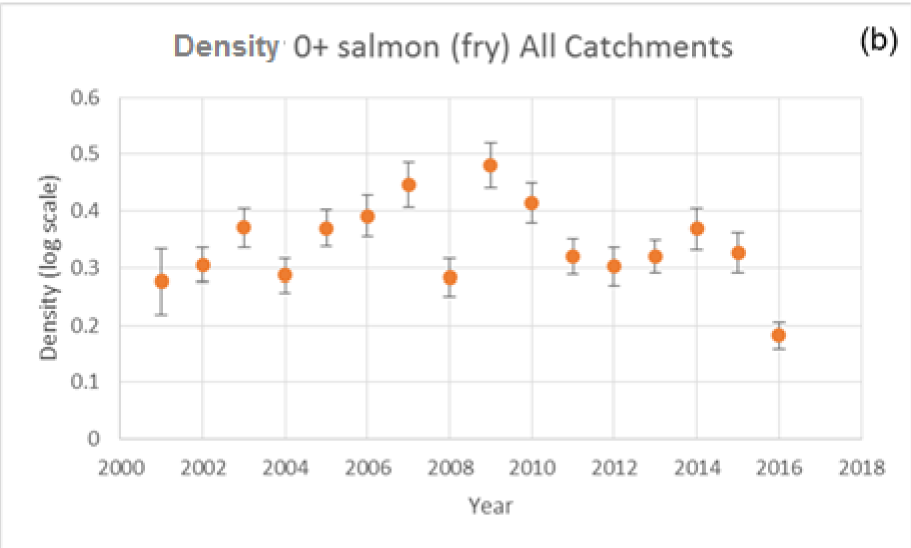
- juvenile salmon density rises to a peak in 2009
- juvenile salmon density then shows a marked decline since 2009
- surveys in 2016 recorded the lowest density of juvenile salmon in the time series

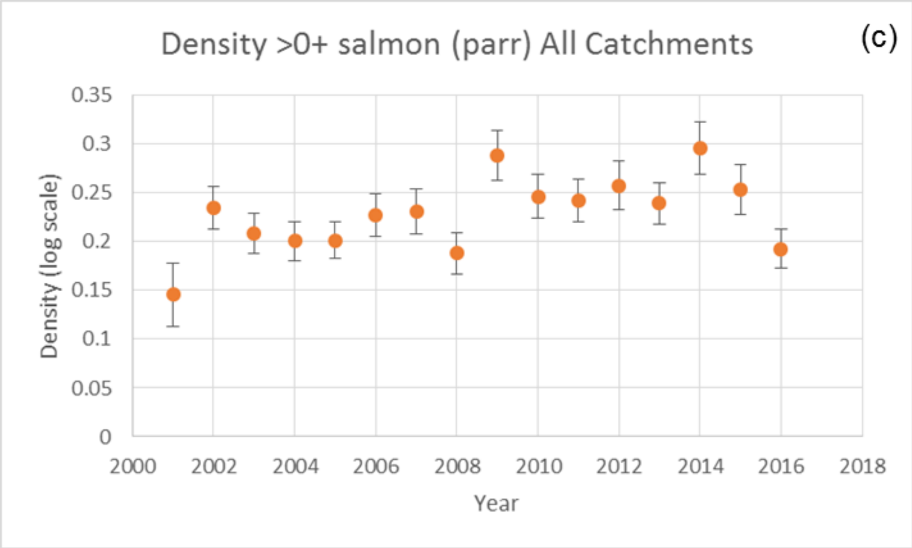
5.6 Figures 11(b) and 11(c) show the density of two different age classes of salmon; data for juvenile salmon under one year old (referred to as fry) are shown in Figure 11(b) and data for juvenile salmon older than one year (referred to as parr) are shown in Figure 11(c). The data shows:

- a decline in density was observed for both fry (Figure 11b) and parr (Figure 11c) in 2016
- the decline in the density of fry since 2009 is particularly notable
- fry densities recorded in 2016 are the lowest on record

Figure 11: The density of juvenile salmon in all catchments in England (2001-2016): (a) for all ages classes, (b) for 0+ fish (fry), (c) >0+ fish (parr).







5.7 To examine changes in juvenile abundance at a catchment level, long term monitoring data from a range of catchments from around the country were selected and analysed. Figure 12 (page 19) provides a time series of juvenile densities (numbers per 100m^2) for selected river catchments in England, where the same survey sites have been consistently sampled over the period. Results from 2016 are indicated with a red arrow and in the majority of catchments the 2016 juvenile salmon densities were the lowest in the time series.

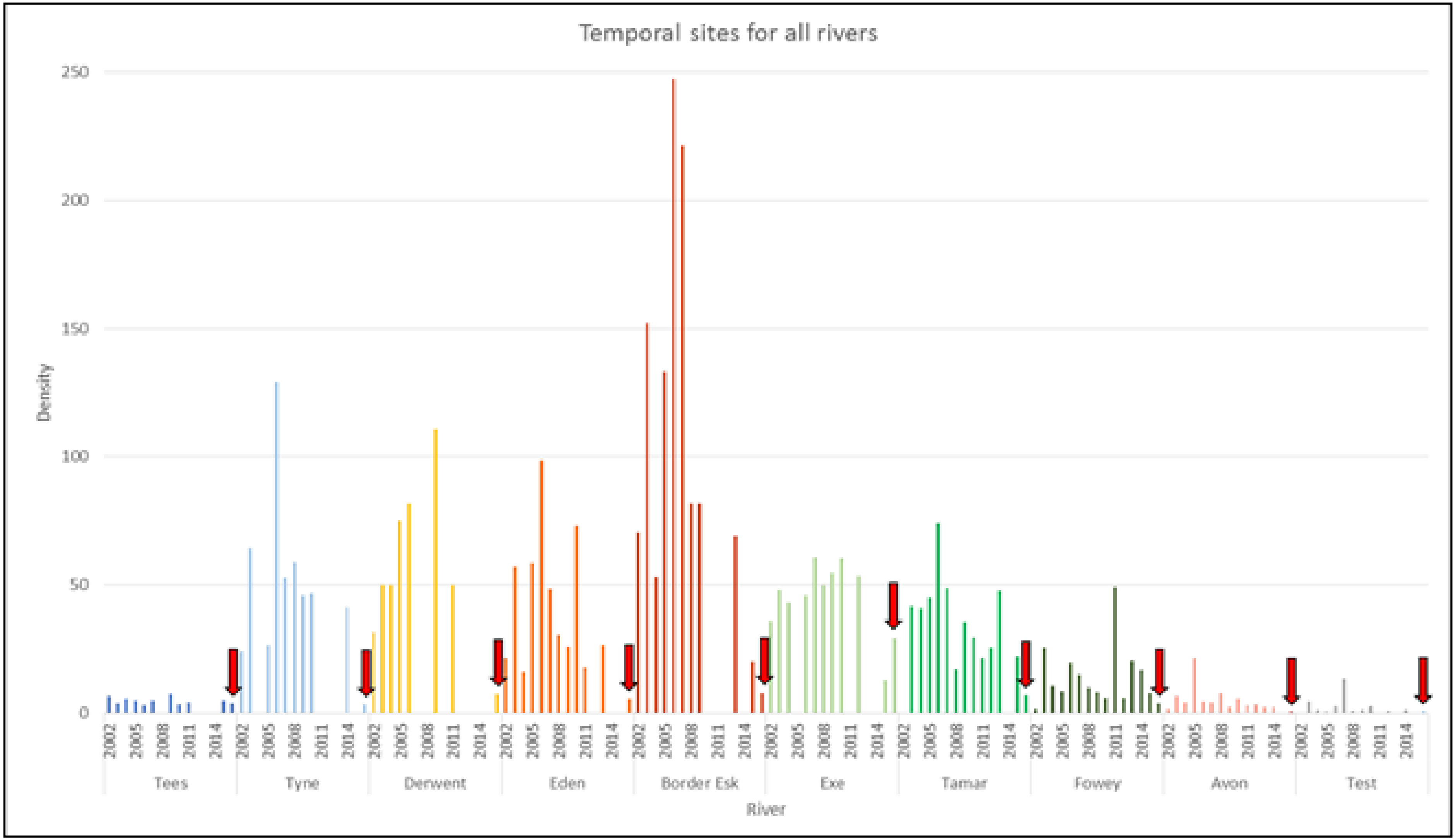
5.8 The widespread nature of the 2016 low juvenile salmon abundance suggest common factors operating at a broad geographic scale and appear to be linked, at least in part, to climate change. These low abundances were also seen in Welsh juvenile salmon data from 2016. Possible causes were investigated and it was concluded that the low abundance of juvenile salmon in 2016 was most likely influenced by a combination of factors including:

- low numbers of spawners
- loss of adults as a consequence of disease outbreaks
- very high winter flows associated with storm Desmond
- unusually high winter water temperatures

With different factors having greater influence in different catchments.

5.9 In summary, the latest assessments indicate low levels of juvenile abundance across the country. For the period 2011-2016, the majority (68%) of sites surveyed fell in the lowest two abundance classes (Classes E or F). The proportion of sites surveyed that fell within Classes A to C varied between geographic regions from 6% to 30%. In addition, there are particular concerns about the very low numbers of juveniles (in particular fry) recorded in many catchments in 2016. The reduction in fry abundance is likely to result in reduced smolt numbers in 2018. There is already evidence of reduced smolt output for the River Frome in 2017, where the majority of smolts migrate after just one year in freshwater. The effects are therefore likely to result in reduced numbers of returning adults in subsequent years.

Figure 12: Juvenile densities (fish per 100m^2) for selected rivers over the period 2002 to 2016. (N.B. Figure only includes rivers where the same sites have been sampled consistently over the period).



6.0 National salmon stock assessment

6.1 There are 49 rivers in England that regularly support salmon, although some of the stocks are very small and support minimal catches; of these, 42 rivers have been designated ‘principal salmon rivers’. The status of stocks in the principal salmon rivers in England is assessed annually against the Conservation Limits[1] and Management Targets[2] for these rivers, with the results used as a basis for assessing the need for management and conservation measures. The methods which are used are described in detail in Annex 7 of the Assessment of Salmon Stocks in England and Wales and are reproduced in Appendix 2 of the consultation document. The data used to calculate a rivers compliance with its Conservation Limit and Management Target comes from both angler catch returns (adjusted by an appropriate exploitation rate), included in Section 8, and where appropriate, electronic fish counter data as summarised in Section 4.

6.2 In summary, this method involves estimating the numbers of salmon returning to spawn in a river each year, and hence the number of eggs deposited, against the Conservation Limit. The Conservation Limit is considered to be the **minimum safe level of spawning salmon** (described as the number of salmon eggs deposited) for each river. By regularly failing to reach this limit, the risk of that river’s salmon stock suffering serious decline greatly increases.

6.3 Because salmon stocks naturally vary from year to year, the Environment Agency aims to ensure that **stocks meet the Conservation Limit in four out of five years on average**; this is the Management Objective. To meet this, the average level of a stock typically needs to be around 40% above the conservation limit (this higher level is termed the Management Target).

6.4 It is also important to look at the trend for a particular stock, whether it is stable, improving or deteriorating. Stocks are therefore classified according to whether, on the basis of the trend over the past 10 years, they are **likely to meet** the Management Objective in five years’ time. This system is used because it gives an early warning of where a river’s salmon stock will be if current trends are maintained. On the basis of this annual compliance assessment stocks are allocated to one of four categories based on the likelihood of meeting the Management Objective, these are set out in Table 1.

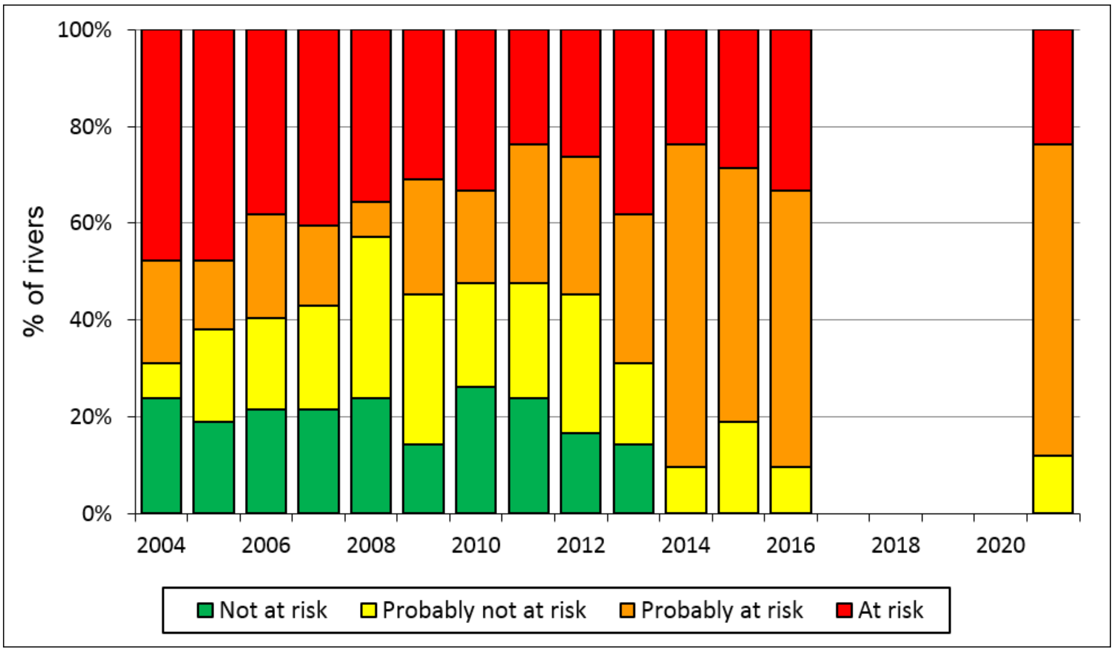
Table 1: Likelihood of meeting the Management Objective and the associated category title.

Likelihood of meeting the Management Objective	Less than 5%	Between 5% and less than 50%	Between 50% and less than 95%	95% and greater
Category name	At Risk (AR)	Probably at Risk (PaR)	Probably Not at Risk (PNaR)	Not at Risk (NaR)

6.5 Figure 13 shows trends over the available time series in the compliance of England’s principal salmon rivers against the Management Objective, along with predicted compliance rates for 2021. A numerical breakdown of the 2016 figures is given in Table 2 and a river by river breakdown is presented in Table 3.

[1]The Conservation Limit (CL) is the minimum spawning stock level below which stocks should not be allowed to fall. The CL for each river is set at a stock size (defined in terms of eggs deposited) 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.
[2] The Management target (MT) is a spawning stock level for managers to aim at in order to meet the management objective. The ‘management objective’ used for each river in England is that the stock should be meeting or exceeding its CL in at least four years out of five (i.e. >80% of the time), on average.

Figure 13: Percentage of England's 42 principal salmon rivers in each risk category assessed against the management objective, for 2004-2016 and as predicted for 2021



6.6 Table 2 presents the number and percentage of England's principal salmon rivers falling into each of the 4 risk categories in 2016, along with the predicted numbers for 2021.

Table 2: Number and percentage of England's 42 principal salmon rivers in each risk category assessed against the management target for 2016, and as predicted for 2021

Risk category	Number of rivers in 2016	% of rivers in 2016	Number of rivers predicted for 2021	% of rivers predicted for 2021
At risk	14	33	10	24
Probably at risk	24	57	27	64
Probably not at risk	4	10	5	12
Not at risk	0	0	0	0

6.7 From this data and that presented in Figure 13 the following trends can be seen in the four different risk categories:

At Risk:

- there has been an overall decrease in the number of rivers classified 'At Risk' in the past 13 years
- the last 3 years have seen numbers slightly increase from a low of point of 11 in 2014 to 14 rivers (33%) in 2016
- the number of rivers in this category are predicted to reduce to 10 (24%) in 2021

Probably at Risk:

- there has been a large increase in the percentage of rivers in this category since 2004, partly as a result of the rivers improving from the At Risk category and partly by rivers deteriorating from 'Probably Not at Risk'
- in 2016 the majority, 24 (57%), of the English principal salmon rivers were 'Probably at Risk'
- the number of rivers 'Probably at Risk' is predicted to continue to increase to 27 (64%) in 2021

Probably Not at Risk:

- numbers initially increased to a peak of 15 rivers (36%) in 2008
- subsequently numbers have fallen to 4 rivers (10%) in 2016 due to rivers deteriorating in classification
- the number of rivers in this category is predicted to increase slightly to 5 (12%) in 2021

Not at Risk:

- the percentage of rivers classified as 'Not at Risk' remained relatively stable around 10 rivers (20%) until 2011
- since 2011 there has been a decline in the rivers in this category, significantly none have been assessed as 'Not at Risk' in the last three years
- this is not predicted to improve, no English principal salmon rivers are predicted to be 'Not at Risk' in 2021

6.8 This data indicates that the majority of salmon rivers in England have declined in classification since 2004 and are generally not predicted to improve in the next five years. Conversely, some of the worst performing rivers have improved and are predicted to continue to do so, although this will still leave almost a quarter of principal salmon rivers in the lowest classification.

6.9 A topographical representation of this data is given in Figure 14 and 15 below. It can be seen that there is no geographical pattern in the distribution of the different risk categories, pointing to wide spread pressures effecting all salmon populations in the country, as indicated by the data presented in earlier sections of this report.

Figure 14: Risk category assessed against the management objective, for England's 42 principal salmon rivers in 2016.

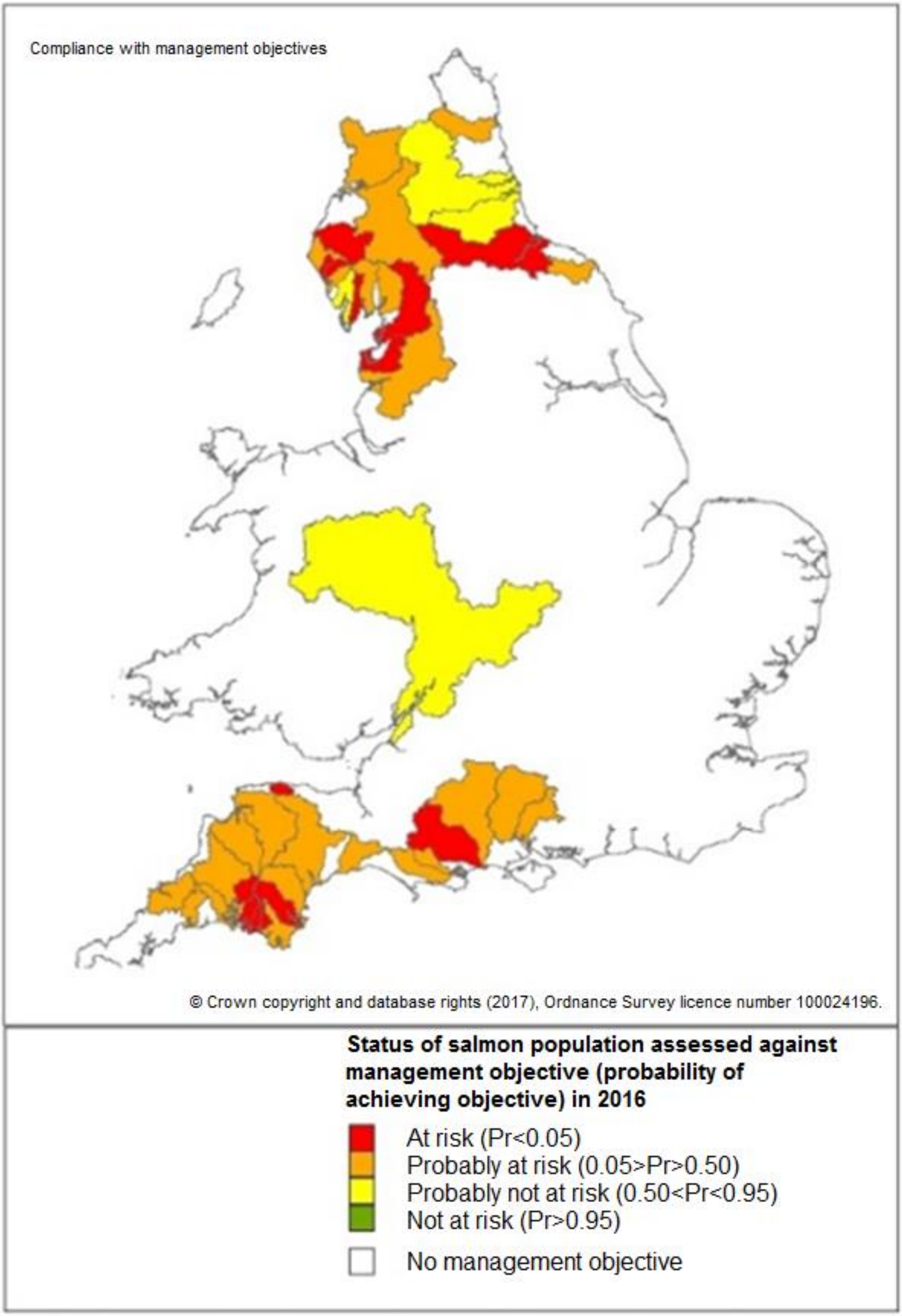
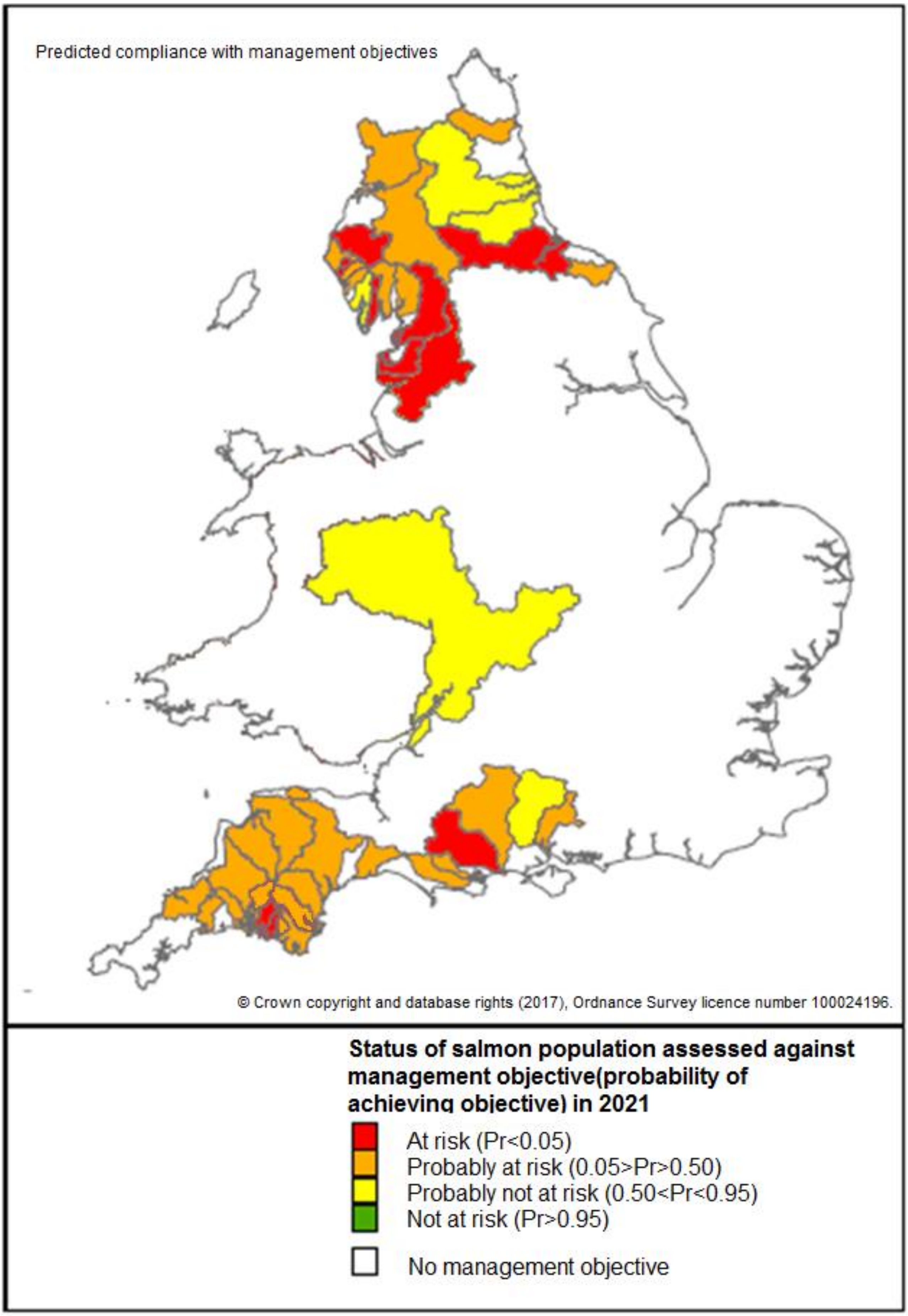


Figure 15: Predicted risk category assessed against the management objective, for England's 42 principal salmon rivers in 2021.



6.10 Table 3 (pages 18, 19 & 20) gives a detailed breakdown of the annual classification categories of the 42 English principal salmon rivers, along with the Rivers Wye and Usk.

Based on the 2016 classification, since 2008:

- 24 rivers have declined in classification
- 10 rivers have improved in classification
- 10 rivers currently have the same classification as in 2008, although many of them have changed classification over the period
- Some of the declines have been severe, for example both the River Lune and Derwent declined from Not at Risk to At Risk in four years

In 2021:

- 5 rivers, the River Dart, Erme, Irt, Tavy and Lyn are predicted to improve from At Risk to Probably at Risk
- the River Test is predicted to improve from Probably at Risk to Probably Not at Risk
- the River Ribble is predicted to drop in classification from Probably at Risk to At Risk

6.11 In summary, although some of the worst performing rivers have improved and are predicted to continue to do so, most salmon populations have declined, in some cases severely, and are generally not predicted to improve in the next five years. Only 4 of the principal salmon rivers (projected to be 5 in 2021) currently fall within the Probably Not at Risk category and none fall in the Not at Risk category, therefore there are no salmon stocks that we are very certain will meet their management objective. The majority of salmon stocks in England fall into the At Risk and Probably at Risk categories and thus remain in a depleted state.

An additional consideration is the very low numbers of salmon fry in English rivers in 2016 (Section 5). The predicted 2021 classification does not take account of this drop in recruitment rates, as it is based on the trends and variability of returning adult numbers for the years up to, and including, the current year (in this case 2016). Therefore, unless there is a compensatory improvement in salmon survival during a later life stage, it is likely that this will lead to lower management target compliance than the data is currently predicting in 2021.

Table 3: The 42 English principal salmon rivers and their provisional annual compliance with the management objective as reported in the annual ICES report since 2008, along with their predicted compliance in 2021. The Rivers Wye and Usk are also included as they feed into the Severn Estuary.

	River	Compliance 2008	Compliance 2009	Compliance 2010	Compliance 2011	Compliance 2012	Compliance 2013	Compliance 2014	Compliance 2015	Compliance 2016	Predicted compliance 2021
NE	Coquet	Not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Tyne	Not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk
	Wear	Not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk
	Tees	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk
	Esk (Yorks)	Probably not at risk	Probably at risk	At risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
Southern	Test	At risk	Probably at risk	At risk	Probably at risk	At risk	At risk	Probably at risk	Probably at risk	Probably at risk	Probably not at risk
	Itchen	At risk	At risk	At risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably not at risk	Probably at risk	Probably at risk
SW	Avon (Hants)	At risk	At risk	At risk	At risk	At risk	At risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Stour	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk
	Piddle	At risk	At risk	At risk	Probably at risk	At risk	At risk	At risk	Probably at risk	Probably at risk	Probably at risk
	Frome	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Axe	At risk	At risk	At risk	At risk	At risk	At risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Exe	Probably not at risk	Probably not at risk	Probably not at risk	Not at risk	Not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk

	Teign	Probably not at risk	Probably at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Dart	At risk	At risk	At risk	Probably at risk	Probably at risk	At risk	At risk	At risk	At risk	Probably at risk
	Avon (Devon)	Not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	At risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Erme	At risk	At risk	At risk	At risk	At risk	At risk	Probably at risk	At risk	At risk	Probably at risk
	Yealm	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk
	Plym	At risk	At risk	At risk	At risk	At risk	At risk	Probably at risk	At risk	At risk	At risk
	Tavy	At risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	At risk	At risk	Probably at risk	At risk	Probably at risk
	Tamar*	At risk	Probably at risk	Probably at risk	Probably at risk	At risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Lynher	Probably not at risk	Probably not at risk	Not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably at risk	Probably not at risk	Probably at risk	Probably at risk
	Fowey	Not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk
	Camel	Not at risk	Not at risk	Not at risk	Not at risk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Taw	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Torridge	Probably at risk	Probably at risk	Probably at risk	At risk	Probably at risk	At risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Lyn	Probably not at risk	Probably at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	At risk	Probably at risk
Midlands / Wales	Severn	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably not at risk	Probably not at risk	Probably not at risk
	Wye	At risk	At risk	At risk	At risk	At risk	At risk	At risk	Probably at risk	Probably at risk	Probably not at risk

	Usk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably not at risk	Probably not at risk
NW	Ribble	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably at risk	At risk	At risk	Probably at risk	Probably at risk	At risk
	Wyre	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk	At risk
	Lune	Not at risk	Not at risk	Not at risk	Probably not at risk	Probably not at risk	Probably at risk	At risk	At risk	At risk	At risk
	Kent	Not at risk	Probably not at risk	Not at risk	Not at risk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Leven	Probably at risk	At risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably not at risk	Probably at risk	Probably at risk
	Crake	At risk	At risk	At risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	At risk	At risk	At risk
	Duddon (& Lickle)	Not at risk	Probably not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Probably at risk	Probably not at risk	Probably not at risk	Probably not at risk
	Esk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk
	Irt	Probably not at risk	Probably at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably at risk	At risk	At risk	Probably at risk
	Ehen	Probably not at risk	Probably not at risk	Not at risk	Not at risk	Not at risk	Not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk
	Calder	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably not at risk	Probably at risk	Probably at risk	At risk	At risk	At risk
	Derwent	Not at risk	Probably not at risk	Not at risk	Not at risk	Probably not at risk	Probably not at risk	Probably at risk	At risk	At risk	At risk
	Eden	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably at risk	At risk	At risk	Probably at risk	Probably at risk	Probably at risk
	Esk (Border)	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably not at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk	Probably at risk

*Note: * High river flows on the River Tamar in 2007, 2008, 2009 & 2012 lead to poor counter data.. Due to this the classification for the River Tamar in these years should be treated with some caution.*

7.0 Net and fixed engine salmon catch data

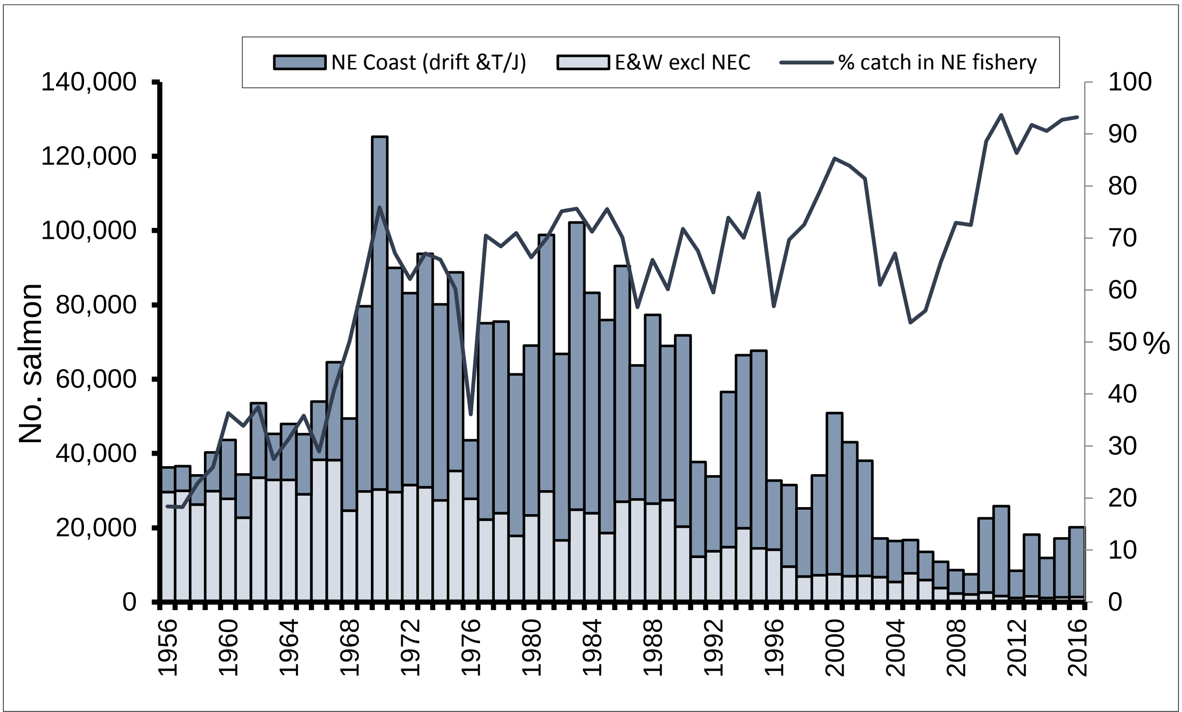
7.1 In 2016, 196 net and fixed engine licences were issued by the Environment Agency in England, these covered a number of differing methods such as seine, lave, haaf, fixed nets, putchers, traps and drift nets.

7.2 Most salmon net fisheries are based in estuaries and so primarily target fish returning to the river catchment(s) discharging into that estuary. However, the North East Coast Net Fishery exploits salmon returning to a number of English and Scottish rivers. The Anglian Coastal Fishery, although primarily targeting sea trout, can catch salmon from a number of rivers (0 in 2016, 5 year average of 4 fish). The different English stocks exploited by the various salmon net and fixed engine fisheries are presented in Table 4. All salmon net and fixed engine fisheries are covered under the existing National Salmon Byelaws that protect spring salmon stocks, this prevents them from fishing before 1 June (Section 9). A number of fisheries have dispensation to allow them to fish for sea trout prior to 1 June (provided any salmon caught are released alive), these are the Dart, Teign, Fowey and all beach nets in districts 1 – 7 of North East Coast Net Fishery.

7.3 The declared salmon catch by nets and fixed engines in 2016 was 20,071 in England, with a total of 20,312 fish for England and Wales, these include 185 fish that were released alive.

7.4 Figure 16 shows the reported annual net catch of salmon in England and Wales since 1956. The total catch is split between those fish caught in the North East Coast Net Fishery and those caught in the rest of England and Wales. A secondary axis gives the percentage of the catch attributed to the North East Coast Net Fishery.

Figure 16: Declared number of salmon caught by nets and fixed engines in England and Wales and the percentage of the catch taken in the North East Coast Net Fishery, 1956-2016.



7.5 Overall, it is evident that there has been a marked decline in net catches in England and Wales over the past 15 – 20 years. This is mostly due to increased regulatory controls and the continuing phasing out of mixed stock fisheries.

7.6 The total declared catch by nets and fixed engines in 2016 increased by 19% on the catch recorded in 2015, and was above the average of the previous five years. The declared catch in the North East Coast Net Fishery fell to 5395 fish in 2009, but has increased in more recent years; catches have remained over 10,000 fish since this date, apart from in 2012, and have averaged almost 14,000 fish in the last 5 years. The North East Coast Net Fishery accounted for the majority of the England and Wales net catch (93%; 18,824 fish) in 2016.

Table 4: Declared number of salmon caught by English net and fixed engine fisheries, along with the principal river stocks which these fisheries are likely to exploit, and the current classification status of these stocks.

Net fishery	2011 – 2015 Average net catch.	2016 net catch	The main English & Welsh stocks exploited by the net fisheries	2016 compliance	2021 predicted compliance
North East Drift and Beach*	14959	18824	Coquet	Probably at risk	Probably at risk
			Tyne	Probably not at risk	Probably not at risk
			Wear	Probably not at risk	Probably not at risk
			Tees	At risk	At risk
			Esk (Yorks)	Probably at risk	Probably at risk
Christchurch Harbour*	8	0	Avon (Hants)	Probably at risk	Probably at risk
			Stour	At risk	At risk
Poole Harbour*	0	0	Piddle	Probably at risk	Probably at risk
			Frome	Probably at risk	Probably at risk
Exe	120	128	Exe	Probably at risk	Probably at risk
Teign	58	71	Teign	Probably at risk	Probably at risk
Dart*	30	0	Dart	At risk	Probably at risk
Tavy*	2	5	Tavy	At risk	Probably at risk
Tamar*	28	68	Tamar	Probably at risk	Probably at risk
Lynher*	0	0	Lynher	Probably at risk	Probably at risk
Fowey*	0	0	Fowey	Probably at risk	Probably at risk
Camel	27	15	Camel	Probably at risk	Probably at risk
Rivers Taw and Torridge*	47	44	Taw	Probably at risk	Probably at risk
			Torridge	Probably at risk	Probably at risk
Severn*	165	155	Severn	Probably not at risk	Probably not at risk
			Wye	Probably at risk	Probably not at risk
			Usk	Probably not at risk	Probably not at risk
Ribble*	68	52	Ribble	Probably at risk	At risk
Lune	230	322	Lune	At risk	At risk
Kent	7	1	Kent	Probably at risk	Probably at risk
Leven	2	1	Leven	Probably at risk	Probably at risk
Solway (England)	371	301	Eden	Probably at risk	Probably at risk
			Esk (Border)	Probably at risk	Probably at risk

7.7 Table 4 shows the declared number of salmon caught by salmon nets and fixed engines in England, along with the main river stock(s) exploited by each fishery and the 2016 national salmon stock assessment classifications for each river.

7.8 All public salmon net and fixed engine fisheries are subject to Net Limitation Orders which stipulate the numbers of net licences that are available to be issued in each fishery. A small number of trap fisheries are privately owned and are not subject to these orders; these fisheries are now referred to as 'historical installations' and their use must be licensed by the Environment Agency. In combination with these provisions, a number of fisheries are also subject to additional controls such as catch limits. A list of the Net Limitation Orders covering the fisheries in Table 4 is provided in Table 5.

7.9 Those rivers marked with * in Table 4 are subject to a reducing Net Limitation Order, this means that as existing fishermen leave the fishery their licence is not allocated to a new fishermen.

7.10 In addition, the net fisheries in Christchurch Harbour and the Rivers Dart, Fowey and Lynher are subject to net buy outs and there is therefore no catch reported for these fisheries.

Table 5: Net Limitation Orders applying to salmon net fisheries in England.

EA Region / NRW	Area	Net Limitation Order	End date	NLO licence provision	
				Type	Number
Anglian	Coastal	Anglian Coast 2015	2022	Drift net & non-drift net	0
North East	Coastal	North East Coast 2012	2022	T and J nets	0
				Drift net - Northumbria and Yorkshire	0
North West	North	River Lune Estuary 2009	2019	Drift	7
North West	North	River Lune Estuary 2009	2019	Haaf	12
North West	North	River Ribble Estuary 2017	2027	Drift (hang or whammel) nets	1
North West	North	River Kent Estuary 2013	2023	Lave net	6
North West	North	River Leven Estuary 2013	2023	Lave net	2
North West	North	Solway Firth 2007	2017	Heave or Haaf net	105
Southern	Solent & S Downs	Southern Region 2008	2018	Seine	1
South West	Cornwall	River Camel 2013	2018	Draft, seine, drift or hang net	6
South West	South Wessex	Christchurch Harbour 2012 (Hants Avon & Stour)	2022	Draft or seine net	0
South West	South Wessex	Poole Harbour 2017 (Piddle & Frome)	2027	Seine net	1
South West	Devon	River Dart 2015	2025	Draft or seine net	0
South West	Devon	Exe Estuary 2011	2021	Draft nets	3
South West	Cornwall	River Fowey 2007	2017	Draft or seine net	1
South West	Cornwall	River Lynher 2014	2024	Draft or seine net	0
South West	Cornwall	River Tamar 2014	2024	Draft or seine net	0
South West	Cornwall	River Tavy 2014	2024	Draft or seine net	0
South West	Cornwall	Rivers Taw and Torridge 2012	2022	Draft or seine net	1
South West	Devon	River Teign 2015	2020	Draft or seine net	3
Midlands		River Severn 2014	2019	Draft or seine net	0
Midlands		River Severn 2014	2019	Lave net	15

Note: Table does not include historical installations which operate under Certificates of Privilege.

7.11 Since catch levels are influenced strongly by the level of fishing effort, catch per unit effort (CPUE) data are commonly used as well as the declared catch in order to help evaluate the status of stocks. However, it should be noted that the relationship between catch per unit effort and abundance can be influenced by a number of confounding factors such as; run timing, sea age composition of stock and the weather. Table 6 shows the mean catch per unit effort (CPUE) for the salmon net fisheries in England and Wales.

Table 6: Mean catch per unit of effort (CPUE) for salmon net fisheries, 1997-2016.

Year	Environment Agency Region					NRW	England & Wales total
	NE Drift nets (June-August)	NE	SW	Midlands	NW	Wales	
1997	6.48	4.40	0.70	0.23	0.63	0.07	1.23
1998	5.92	3.81	1.25	0.24	0.46	0.08	1.17
1999	8.06	4.88	0.79	0.31	0.52	0.20	1.35
2000	13.06	8.11	1.01	0.33	1.05	0.18	2.19
2001	10.34	6.83	0.71	0.33	0.71	0.16	1.77
2002	8.55	5.59	1.03	0.53	0.90	0.23	1.66
2003	7.13	4.82	1.24	0.60	0.62	0.11	1.43
2004	8.17	5.88	1.17	0.36	0.69	0.11	1.65
2005	7.23	4.13	0.60	0.60	1.28	0.09	1.35
2006	5.60	3.20	0.66	0.51	0.82	0.09	1.04
2007	7.24	4.17	0.33	0.51	0.75	0.05	1.14
2008	5.41	3.59	0.63	0.64	0.34	0.06	0.96
2009	4.76	3.08	0.53	0.64	0.51	0.04	0.89
2010	17.03	8.56	0.99	0.26	0.47	0.09	2.08
2011	19.25	9.93	0.63	0.14	0.34	0.10	2.25
2012	6.80	5.35	0.69		0.31	0.21	1.36
2013	11.06	8.22	0.54		0.39	0.08	1.89
2014	10.30	6.12	0.43		0.31	0.07	1.42
2015	12.93	7.22	0.64		0.39	0.08	1.71
2016	10.95	9.98	0.78		0.38	0.10	2.26
Mean (2011-2015)	12.07	7.37	0.59	0.14	0.35	0.11	1.73
No. fisheries	2	4	3	1	6	6	19
% change (2016 on 5-year mean)	-9	+35	+34		+9	-4	+31

Note: Fisheries were selected on the basis that they were fished consistently during the period. Data are expressed as catch per licence-tide, except for the North East, for which data are recorded as catch per licence-day From 2012, the fishery operating in the Severn (Midlands Region) has been limited by a catch limit (cap); the Midlands data have therefore been removed from the combined E&W total for the whole time series. Data for 2016 are provisional.

7.12 Table 6 shows that the overall catch per unit effort (CPUE) for nets and fixed engines in 2016 increased on 2015, and was higher (31%) than the previous 5-year mean (2011 – 2015). CPUE in 2016 was below the 5-year average for the drift nets in the North East Coast Net Fishery, but above the 5-year mean elsewhere.

7.13 An earlier analysis of net CPUE and river flow suggests below average flows in July (when a high proportion of the net catch typically occurs) tend to result in higher CPUE values. One reason for the recently increased net catch per unit effort may be down to a number of dry summers, meaning that more fish have been waiting at sea to enter rivers. The increase in the multi sea winter stock would also be expected to have a positive effect on catch per unit effort. The increase in catch per unit effort combined with the drop in the numbers of grilse means that net fisheries are now potentially having a greater impact on stock sustainability than they were prior to 2012, as they are targeting the run component (i.e. multi sea winter salmon) that is principally supporting salmon stock sustainability.

7.14 In summary, there has been a marked decline in net catches in England and Wales over the last 15 – 20 years. This is likely a consequence of increased regulatory controls, such as reducing net limitation orders, and licence buy outs along with the reduction in salmon stocks (Figure 1). However the catch by nets and fixed engines in England increased by almost 4000 fish in 2016 and was 24% above the average of the previous five years. This was largely due to an increase in the catch in the North East Coast Net Fishery, which also saw a large increase in the catch rate of the beach nets in 2016. This, combined with the falling catch in other parts of the country, meant that the North East Coast Net Fishery catch comprised 93% of the total net catch in England and Wales in 2016.

8.0 Salmon rod catch data

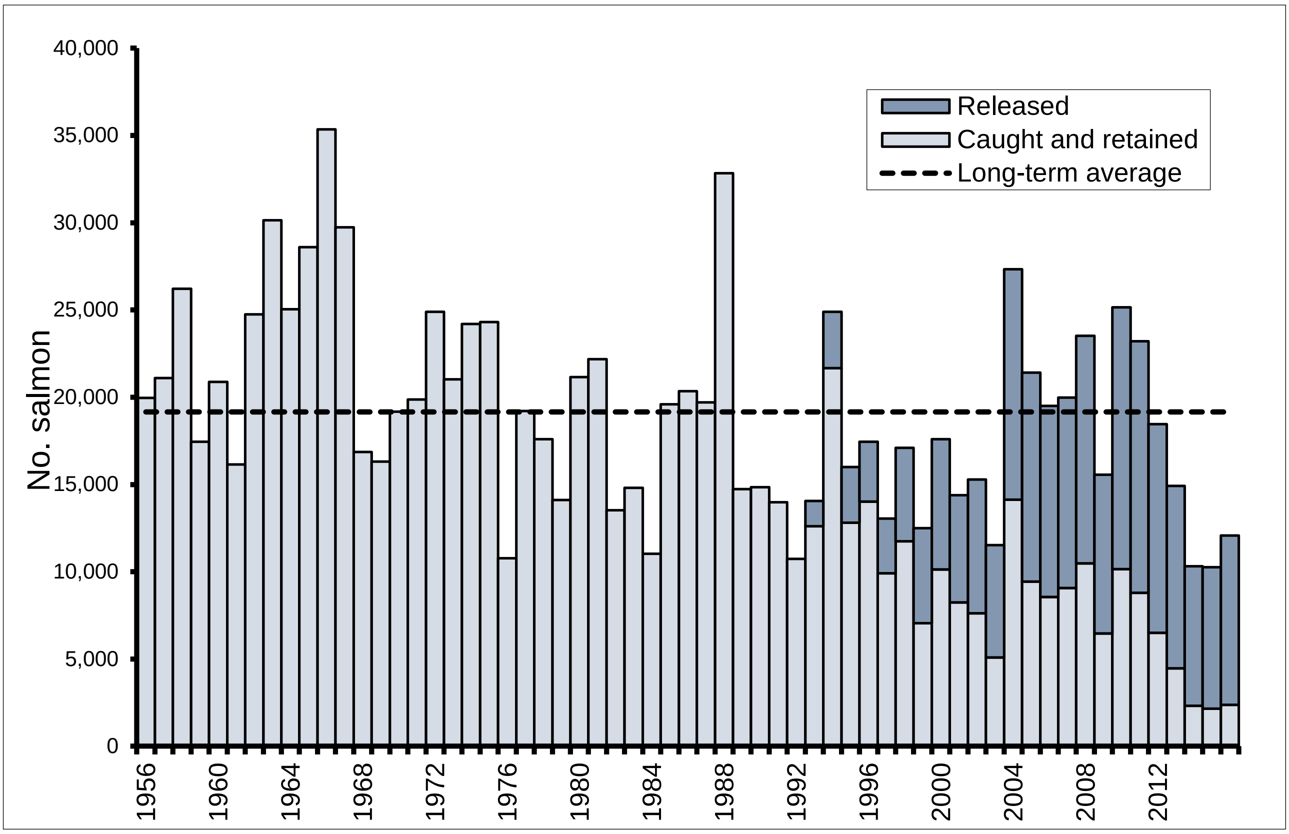
8.1 In 2016 29487 migratory salmonid rod licences were issued by the Environment Agency in England (this includes all 1 day, 8 day and full annual licences). The following section analyses the data declared by anglers in their catch returns to investigate trends in rod catch in the England.

8.2 In 2016, the final declared catch was 8,930 fish in England and a total of 12,068 fish in England and Wales; these figures include 7,090 fish that were released alive in England and a total of 9,701 in England and Wales. It is calculated from declared caches that 80% of rod caught fish were released in England and Wales during 2016, this figure includes the mandatory release of all salmon caught prior to 16 June that has been required as part of the existing National Salmon Byelaws since 1999.

8.3 Figure 17 shows the total reported numbers of salmon caught by anglers in England and Wales since 1956. From 1993 onwards this data is sub-divided into those fish that were caught and retained or caught and released. These data do not take account of catch reporting rates (believed to be substantially lower at the start of the time series) or the possible repeat capture of fish following the implementation of catch and release. The data shows:

- provisional estimated rod catch in 2016 (including released fish) increased by 12% on 2015, but remained 22% below the average of the past 5 years
- long-term trends in rod catch indicate a progressive decline from the peak in the mid-1960s to the early 2000s
- between 2004 and 2011 there was an improvement in the rod catch, when catches were typically above the long-term average of 19,158, suggesting some degree of reversal in the declining trend
- after 2011 numbers of salmon caught by anglers declined rapidly falling to an all-time low of 10,263 in 2015
- there was a small increase in the 2016 catch over that in 2015 but this remained among the lowest recorded
- the percentage of rod caught fish released by anglers has increased progressively since such data were first recorded in 1993

Figure 17: Declared number of salmon caught by rods in England and Wales, 1956-2016. (Fish caught and released not reported prior to 1993).



8.4 It should also be noted that rod catch trends on individual rivers, have varied from much more severe declines to substantial recoveries. This data, along with catch and release rates, which also vary considerably between rivers, is given for the 42 English principal salmon rivers in Table 7.

Table 7: 2016 declared catch by anglers on English principal salmon rivers, also including, 5 year average catches, catch and release rates, and provisional 2016 & 2021 risk category.

Principal salmon river	2011 – 2015 average rod catch	2016 rod catch	2016 total % catch and release	2016 voluntary (post 16 June) % catch and release	2016 compliance	2021 predicted compliance
Coquet	503	289	74	67	Probably at risk	Probably at risk
Tyne	3613	3113	75	74	Probably not at risk	Probably not at risk
Wear	1223	715	81	80	Probably not at risk	Probably not at risk
Tees	89	46	93	93	At risk	At risk
Esk (Yorks)	108	98	87	85	Probably at risk	Probably at risk
Test	170	167	99	99	Probably at risk	Probably not at risk
Itchen	195	200	99	99	Probably at risk	Probably at risk
Avon (Hants)	103	193	99	100	Probably at risk	Probably at risk
Stour	<1	1	100	100	At risk	At risk
Piddle	1	0	N/A	N/A	Probably at risk	Probably at risk
Frome	77	71	97	96	Probably at risk	Probably at risk
Axe	12	9	67	63	Probably at risk	Probably at risk
Exe	289	126	79	77	Probably at risk	Probably at risk
Teign	82	32	69	64	Probably at risk	Probably at risk
Dart	54	28	96	96	At risk	Probably at risk
Avon (Devon)	20	11	73	70	Probably at risk	Probably at risk
Erme	5	2	100	100	At risk	Probably at risk
Yealm	5	2	100	100	At risk	At risk
Plym	14	2	50	50	At risk	At risk

Tavy	58	20	80	82	At risk	Probably at risk
Tamar	223	215	83	80	Probably at risk	Probably at risk
Lynher	70	65	94	93	Probably at risk	Probably at risk
Fowey	105	88	74	74	Probably at risk	Probably at risk
Camel	159	99	67	67	Probably at risk	Probably at risk
Taw	195	146	79	77	Probably at risk	Probably at risk
Torridge	60	58	83	79	Probably at risk	Probably at risk
Lyn	48	9	100	100	At risk	Probably at risk
Severn	324	334	78	61	Probably not at risk	Probably not at risk
Ribble	735	432	89	88	Probably at risk	At risk
Wyre	9	1	0	0	At risk	At risk
Lune	570	383	69	69	At risk	At risk
Kent	215	140	68	67	Probably at risk	Probably at risk
Leven	60	21	100	100	Probably at risk	Probably at risk
Crake	21	3	100	100	At risk	At risk
Duddon (& Lickle)	51	52	85	85	Probably not at risk	Probably not at risk
Esk	44	61	72	71	Probably at risk	Probably at risk
Irt	76	26	65	65	At risk	Probably at risk
Ehen	240	115	47	48	Probably at risk	Probably at risk
Calder	29	2	0	0	At risk	At risk
Derwent	498	216	79	79	At risk	At risk
Eden	767	753	87	79	Probably at risk	Probably at risk
Esk (Border)	572	378	72	71	Probably at risk	Probably at risk

8.5 Table 6 shows the wide range of reported catches and catch and release rates across English principal salmon rivers.

Catch numbers:

- one river, the River Piddle reported no catch in 2016
- reported catches on the other rivers ranged between 1, on the Rivers Wyre and Stour, and 3113 on the River Tyne
- only 5 rivers, the Severn, Esk, Duddon, Hampshire Avon and Itchen reported catches above their 5-year average in 2016
- on 15 rivers reported catches in 2016 were less than 50% of their 5 year average

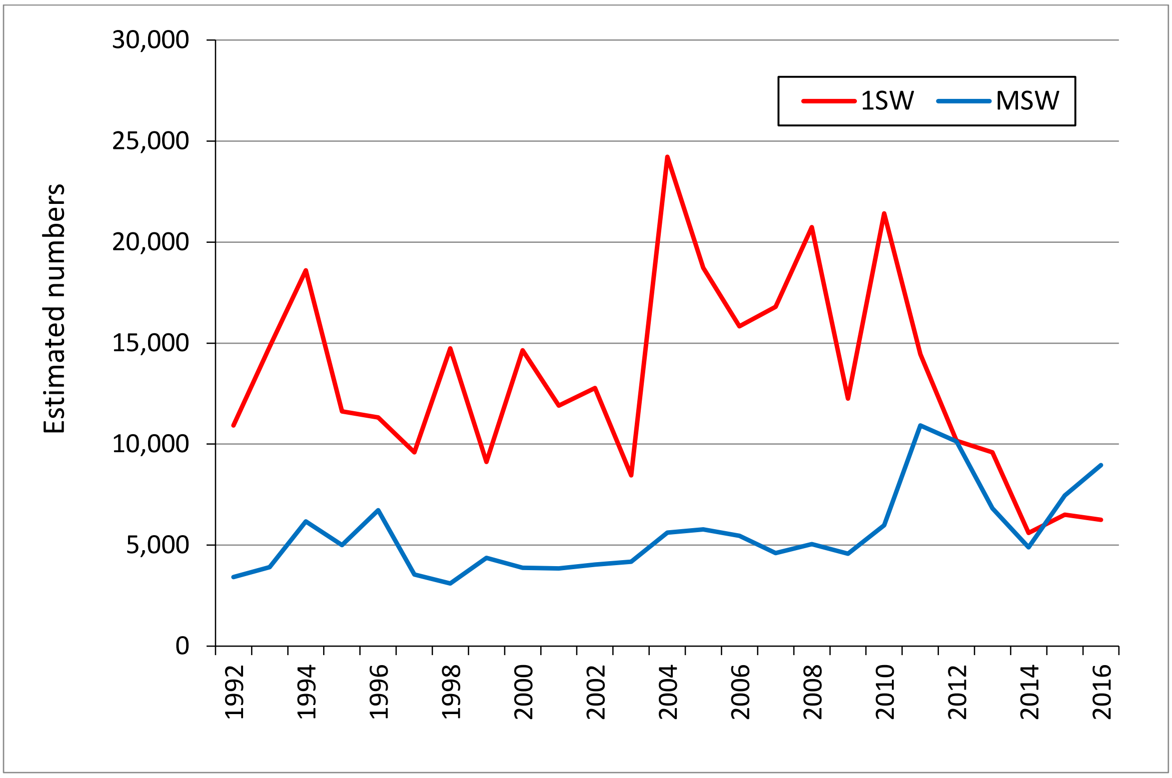
Catch and release rate trends are expanded on later in this document (Page 44 - 47), however 2016 data shows:

- although the catch and release rate continues to improve overall, there is large variation from river to river
- the lowest total catch and release rate of 0% was recorded on the Rivers Wyre and Calder, a total of three fish were caught and retained on these rivers
- on the 40 other principal salmon rivers, the total catch and release rate ranged from 47 – 100%, this equates to 6903 fish released and 1819 fish retained
- salmon continue to be retained in the majority of catchments in the lowest risk category ("At Risk")
- the average difference between total and voluntary (post 16 June) catch and release in 2016 was 1.5%
- the largest difference between total and voluntary (post 16 June) catch and release in 2016 was 17%, on the River Severn

8.6 Further to the catches on principal salmon rivers, reported in Table 6, an additional 208 salmon were caught on non-principal salmon rivers throughout England, these rivers had a combined catch and release rate of 90%.

8.7 Figure 18 shows how the fall in total rod catch numbers, shown in Figure 17, is distributed between grilse and multi-sea winter salmon.

Figure 18: Estimated total number (corrected for under-reporting) of grilse (1SW) and multi sea winter (MSW) salmon caught by rod fisheries in England and Wales (including fish caught and released), 1992-2016.



8.8 There are marked differences in the trends in catch numbers shown for grilse and multi sea winter fish.

Grilse:

- rod catches of grilse (1SW) show substantially greater year to year variability than those of multi sea winter fish in numerical terms
- since the early 1990s, catches of grilse have ranged between a high of over 24,000 in 2004 to 5,610 in 2014
- catches of grilse in the period 2004 to 2011 were generally higher than those in the early part of the time series
- from 2011 to 2016 there was a sharp downturn in the grilse rod catch which appears to have stabilised at a low level
- the provisional corrected grilse catch in 2016 was the second lowest in the time series, the lowest being in 2014

Multi sea winter:

- in contrast to grilse, rod catches of multi sea winter salmon have demonstrated comparatively smaller numerical changes (range 3,100 to 10,900)
- catches of multi sea winter salmon stock show a positive trend in over the period
- catches of multi sea winter salmon in 2016 were among the highest in the time series
- multi sea winter salmon have comprised 50% of the total rod catch, on average, over the last five years, compared with an average of 25% in the preceding period back to 1992
- the observed increase in multi sea winter fish has however not offset the much more substantial decline in grilse abundance

8.9 In addition to differences in total annual catches between grilse and multi sea winter fish, there are changes in both the number and sizes of salmon caught thorough out the year. This is explored in

Table 8 and 9. An average of the previous 5 years data has been used to even out individual yearly variations in catches.

Table 8: Size distribution and average numbers of multi sea winter salmon (> 8 lb) caught in England by month. Based on five years data (2012 – 2016).

Month	Average weight (lb)	Maximum weight (lb)	Minimum weight (lb)	Average number caught
January	14.1	32	8.5	1
February	12.5	27.0	8.0	22
March	13.6	33.0	8.0	88
April	12.8	32.0	8.0	190
May	12.1	31.3	8.0	375
June	11.6	32.4	8.0	574
July	11.3	29.5	8.0	657
August	11.4	40.0	8.0	964
September	11.7	37.0	8.0	1293
October	12.0	37.0	8.0	1937
November	10.4	18.5	8.0	32
December	10.7	21.0	8.0	9

Table 9: Size distribution and average numbers of grilse (< 8 lb) caught in England by month. Based on five years data (2012 – 2016).

Month	Average weight (lb)	Maximum weight (lb)	Minimum weight (lb)	Average number caught
January	5.5	7.4	4.0	1
February	5.6	7.4	3.0	6
March	5.6	7.6	2.5	11
April	6.0	7.5	2.0	24
May	6.0	7.6	1.0	63
June	5.8	7.9	1.0	139
July	5.4	7.9	0.9	325
August	5.4	7.9	1.0	803
September	5.4	7.9	1.0	1080
October	5.5	7.9	1.0	1303
November	5.4	7.5	2.5	44
December	5.3	7.5	2.5	15

8.10 Table 8 and 9 show how both the numbers and size of salmon caught vary throughout the year. When comparing the different size classes it can be seen that fewer grilse than multi sea winter fish were caught in the spring, with a higher percentage of grilse caught later in the year. This matches the typical run timing of multi sea winter salmon and grilse. Despite this the broad pattern is similar in both size classes, with fewer fish caught early in the year and then catch numbers increasing through the late spring and summer to a peak in the autumn. This pattern leads to both more grilse, and more multi sea winter fish being caught in September and October than the rest of the year combined. Between 2012 and 2016 there was not a large difference in the monthly average size of multi sea winter salmon or grilse caught by anglers throughout the year. The largest individual fish however were caught were caught later in the year, in August, September and October.

8.11 In summary, long-term trends in rod catch indicate a progressive decline from the peak in the mid-1960s to the early 2000s and although 2016 saw some improvement the catch remained 25% below the 5 year average.

The percentage of rod caught fish released by anglers has increased progressively since such data were first recorded in 1993 to the current high of 80%. This does however mask a large amount of variation between rivers. This figure includes the mandatory release of all salmon caught prior to 16 June that has been required as part of the existing National Salmon Byelaws since 1999.

The provisional corrected grilse catch in 2016 was the second lowest in the time series and this combined with rising multi sea winter fish catch has led to multi sea winter fish making up the majority of the catch in the last two years.

Catches of both 1 SW salmon (fish <8lb) and multi sea winter salmon (fish >8lb) peak in the autumn. Over the five years investigated there was not a large difference in the average monthly size of grilse or multi sea winter salmon caught throughout the year. The largest individual fish were caught later on in the season, in August, September and October.

9.0 Data to support review of measures to protect spring salmon stocks

9.1 In response to the widespread decline in stocks of early-running multi sea winter salmon, national measures, in the form of National Salmon Byelaws, were introduced in 1999 to reduce the levels of exploitation of this stock component.

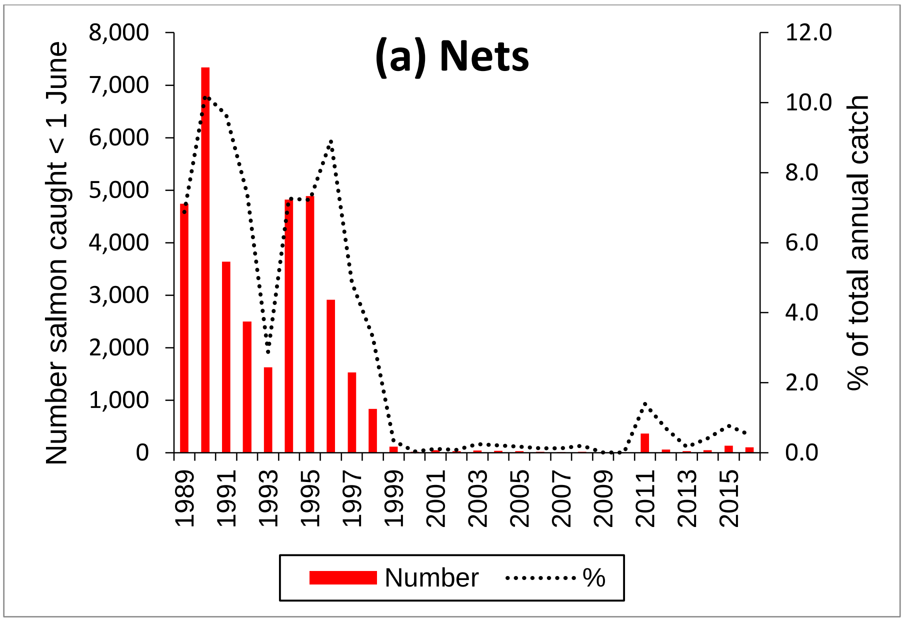
9.2 Most nets and fixed engine fisheries were prohibited from fishing for salmon before 1 June. A small number of fisheries were allowed to continue where the catch was predominantly sea trout and the salmon catch was traditionally very low. Any salmon caught by these fisheries were required to be immediately returned to the water with the least possible injury.

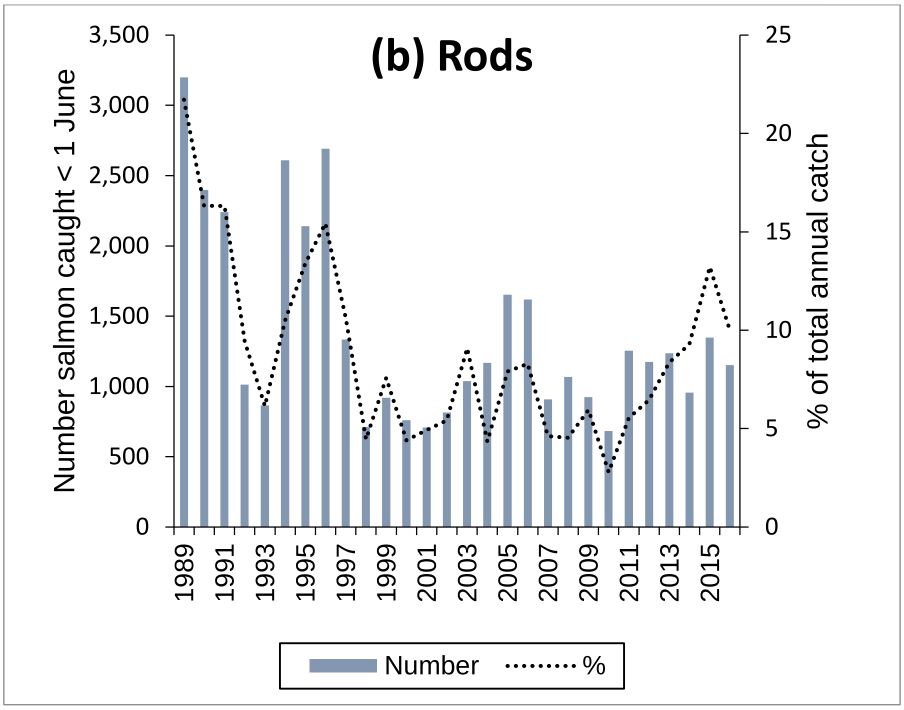
9.3 The National Salmon Byelaws also introduced mandatory catch and release of salmon by rod fishermen prior to 16 June and imposed other method restrictions. In addition to the National Salmon Byelaws some rivers have local byelaws in place, these are listed in Table 10 at the end of this section.

9.4 Following review and consultation, the National Salmon Byelaws were renewed for a further 10 years in December 2008.

9.5 The effect the National Salmon Byelaws has had on numbers of fish caught early in the year can be seen in Figure 19a and 19b.

Figure 19: (a) nets and (b) rods before 1 June, 1989-2016.





9.6 The restrictions imposed as a result of the National Salmon Byelaws, since 1999, have affected both net and rod fisheries. Figure 19a (nets) and 19b (rods) show the effect on both the number and percentage of fish caught before June.

Nets:

- Before the introduction of the National Salmon Byelaws both the number and percentage of salmon caught before June was highly variable.
- Both numbers and percent caught fell consistently in the years running up to the National Salmon Byelaws being implemented.
- After the implementation of the National Salmon Byelaws, the proportion of the catch taken by nets before June has fallen from a 5-year average of 6.7%, immediately before the measures were implemented, to 0.3%, on average, since. These fish remaining represent salmon caught in fisheries with exemptions to fish for sea trout before the 1 June, with any salmon caught being released.

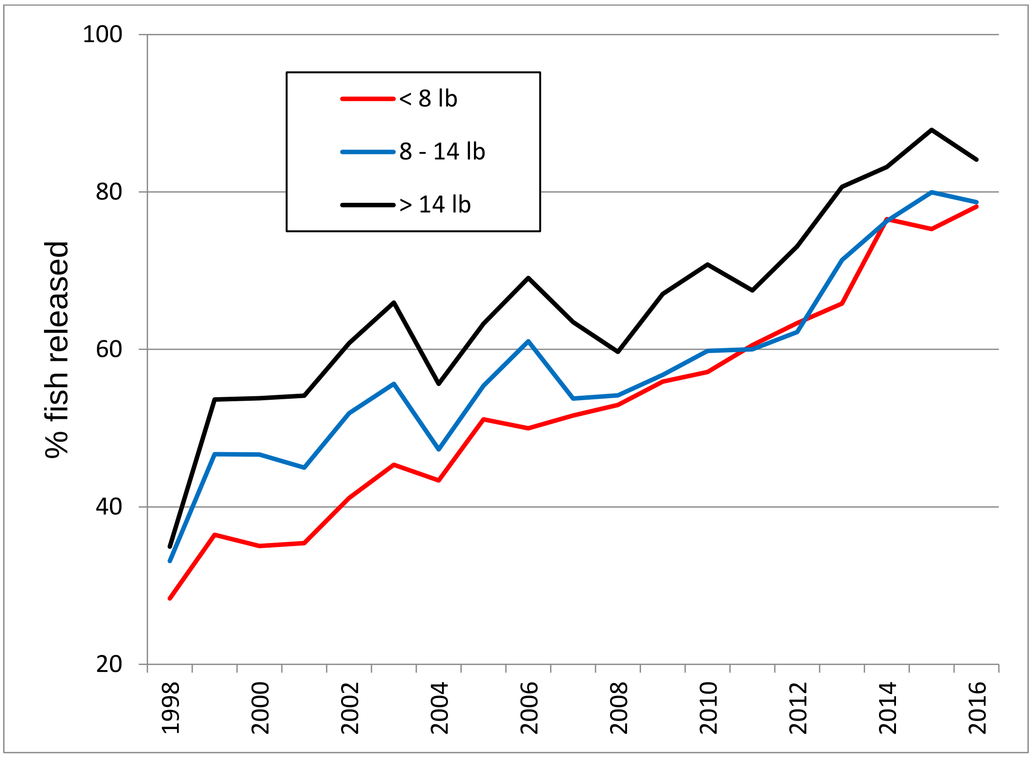
Rods:

- The proportion of the catch taken by rods before June has fallen from a 5-year average, immediately before the measures were implemented, of 10.9% to 6.3%, on average, since.
- Over 1000 salmon are caught by anglers before June, these fish must be released.
- To be an effective conservation measure the National Salmon Byelaws relies on fish surviving, so good fish handing is paramount.

9.7 As well as changing the numbers of salmon caught the National Salmon Byelaw has a notable effect on overall angling catch and release rates. This is explored in the following figures.

9.8 Figure 20 shows the changing catch and release rates for three different size classes of salmon, grilse (< 8 lb), small multi sea winter salmon (8 – 14 lb) and large multi sea winter salmon (> 14 lb).

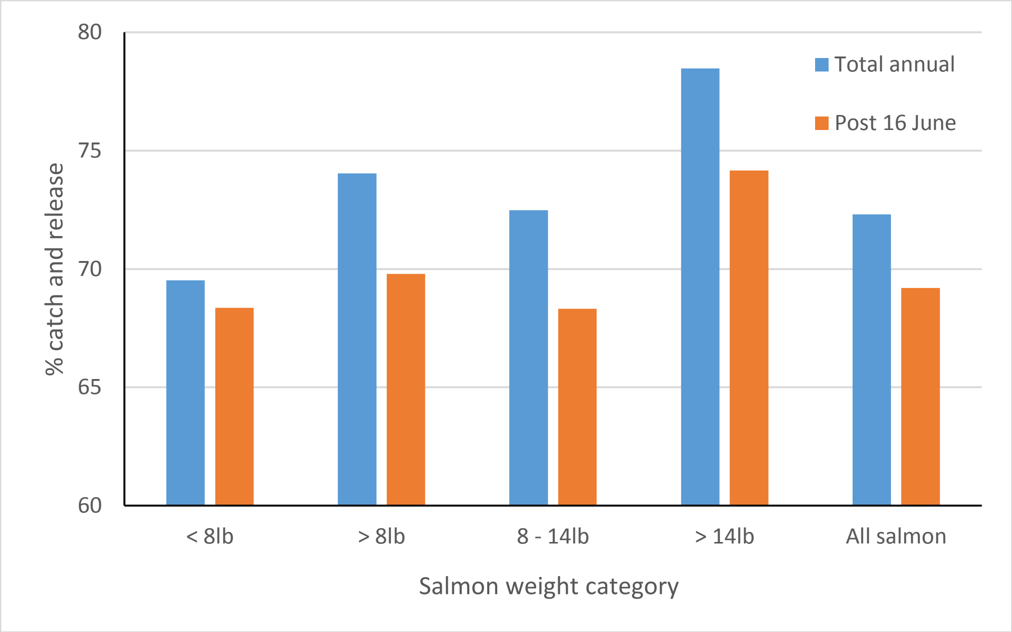
Figure 20: Percentage of rod caught fish released by anglers by weight category, 1998-2016.



9.9 Catch and release rates have improved in all weight categories since 1998, though there has been some variation shown by each of the three weight categories. It is worth noting:

- large multi sea winter salmon (> 14 lbs) have consistently had the highest annual catch and release rate, although in 1998 this was very close to that of small multi sea winter salmon (8 – 14 lb)
- there was a step change in all catch and release rates between 1998 and 1999, this coincides with the implementation of the National Salmon Byelaws
- the increase between 1998 and 1999 was greatest (19%) for large multi sea winter salmon (> 14 lbs)
- since 2007 the catch and release rates of small multi sea winter fish and grilse have been broadly similar

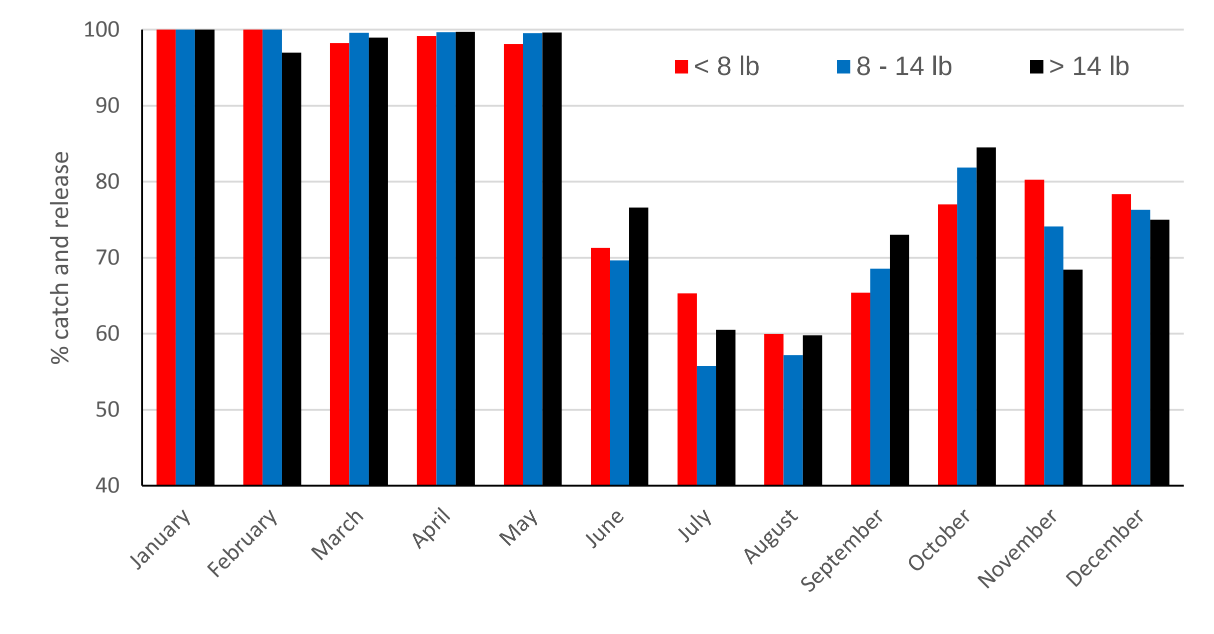
Figure 21: Total annual, and post 16 June, declared rod catch and release rates for England by weight category. Based on five years data (2012 – 2016).



9.10 As seen in Table 7 the difference between the total annual catch and release rate and the catch and release rate post 16 June, (when the existing National Salmon Byelaws are not in place) varies from river to river. Figure 21 shows the differences between these two sets of data for three different size classes of salmon, based on 5 years data (2012 to 2016) for all English rivers. The Figure shows:

- statistically significant differences between total annual and post 16 June catch and release rates, both in each individual size class and when data from all salmon sizes is combined
- there is no difference in catch and release rates between grilse (< 8 lb) and small multi sea winter salmon (8 – 14 lb) after 16 June

Figure 22: Percentage catch and release rates for England for different weight classes by month, based on five years data (2012 – 2016).



9.12 Figure 22 breaks down the data from Figure 21, into monthly catch and release rates for the three weight categories of salmon. It shows that:

- catch and release rates for all three weight classes follow a similar pattern over the year
- small multi sea winter salmon have the lowest monthly catch and release rate of any size class during June (69.6%), July (55.8%) and August (57.2%)

9.13 As part of the 2008 review of the National Salmon Byelaws, criteria for relaxing them in the future were provided. It was suggested that for those rivers not meeting these criteria there should be no additional exploitation on the early running component of the run. The criteria stated:

> If relaxation of the regulations was under consideration, this could be considered if the stock met the following criteria:
>
> - It is currently meeting its management objective of passing its conservation limit four years out of five and predicted to do so in five years' time.
> - There is a significant fishery for early run salmon (defined as ≥ than 10% of the total catch being taken before 16 June).
> - There has been a significant increase in the pre-June stock of salmon. On most rivers this will have to be based on a comparison of catches between 1994-98 and the current five-year mean. Alternatively it may be acceptable to make the comparison using catch per unit of effort with a baseline of 2002-06 (our first five years of collected effort data). As such, the first comparison could not be undertaken until 2011 (when we would have a second set of five years data with which to compare). However, for those rivers that have been fully compliant since 1994, a significant difference in spring catch might not be expected as it would be difficult to separate out improvements in the spring run from the whole stock which is generally performing well.

9.14 Criteria for a tightening of the regulations was also provided:

- There has been a significant decrease in the pre-June stock of salmon. On most rivers this will have to be based on a comparison of catches between 1994-98 and the current five-year mean. Alternatively it may be acceptable to make the comparison using catch per unit of effort with a baseline of 2002-06 as such the first comparison could not be undertaken until 2011.

9.15 No rivers in England currently meet the criteria for relaxing the regulation.

- As shown in Table 3, no rivers are currently meeting their management objectives with a high degree of certainty.
- Figure 19(b) shows the percentage of salmon caught before the 1 June increased every year between 2011 (5.5%) and 2015 (13.2%) before dropping slightly to 10% in 2016. However, the Figure also shows that numbers caught before the first of June remained relatively stable between 2011 and 2016. This indicates that the pre 1 June increase in percentage has not been due to an improvement in the spring catch, but rather a drop in the numbers caught later in the year. This is consistent with the decrease in the numbers of grilse caught by anglers, as shown in Figure 18 and the generally later capture date of grilse, as shown in Table 9.
- National figures point to a drop in the 5 year average pre-June catch, from 1609 between 1994 and 1998 to 1173 between 2012 and 2016.

9.16 In summary, it can be seen that the restrictions imposed as a result of the National Salmon Byelaws, since 1999, have affected the number of early running fish caught in both net and rod fisheries, as shown in Figures 19(a) and 19(b).

Rod catch and release rates have improved for all sizes of salmon since 1998 (Figure 20). Also, as shown in Figure 21, the National Salmon Byelaw produces a statistically significant difference between voluntary and total catch and release rates. By applying the post 16 June catch and release rate to the whole year and comparing this to the current total catch and release rate, it is estimated that the National Salmon Byelaw has directly led to an extra 1750 salmon being released by anglers in last 5 years.

Anglers are most likely to release large multi sea winter salmon (> 14 lb), however on average 344 fish of this size are retained every year.

Although there is a difference in the annual rod catch and release rates between grilse (< 8 lb) and small multi sea winter salmon (8 – 14 lb), once catch and release is voluntary (post 16 June) the release rates are identical (68%). Small multi sea winter salmon also have the lowest monthly catch and release rate of any size class during June (69.6%), July (55.8%) and August (57.2%).

Small multi sea winter salmon (8 – 14 lb) are the most numerous size category and the majority fish in this size class are caught after 16 June (Table 8). A greater number of small multi sea winter salmon (8 – 14 lb) are retained than any other size category by anglers (average of 1252 per year vs 1161 for grilse (< 8 lb) and 344 for large multi sea winter salmon (> 14 lb), between 2012 and 2016).

This is significant as multi sea winter fish are highly important to the salmon stock, both in terms of the greater number of eggs they lay and in the increasing percentage of the population that they make up as grilse have declined.

9.17 Overall, although the National Salmon Byelaw is decreasing the exploitation pressure on early running salmon this report has highlighted that:

- both nets and rods are taking fish from stocks at the lowest classification status
- the declining number and size of grilse make multi sea winter fish increasingly valuable to stocks

- there is evidence from the River Tamar of a reducing trend in the percentage of multi sea winter fish running early in the year, reducing the proportion of the stock that is protected by the National Salmon Byelaws
- the majority of multi sea winter fish are caught after 16 June and are not therefore afforded the same level of protection as provided by current National Salmon Byelaws, leaving them reliant on voluntary catch and release rates
- there is not a large difference in the monthly average size of multi sea winter salmon caught by anglers throughout the year
- there is no difference in voluntary catch and release rates between grilse and smaller multi sea winter salmon
- a greater number of small multi-winter salmon (8 – 14 lb) are retained by anglers than either grilse (< 8 lb) or large multi sea winter salmon (> 14 lb)
- no rivers meet all the criteria for future relaxation of the National Salmon Byelaws suggested during the 2008 renewal process

Table 10: Rod Fishing Seasons for Salmon and Sea Trout including method restrictions and bag limits.

EA Region	River	Salmon Season (inclusive dates)	*Method Restrictions	*Bag limits/Catch and Release etc.	Effective from (date); expires (date)
NE	Aln	1.2 -31.10			
	Coquet	1.2 -31.10			
	Tyne	1.2 -31.10			
	Wear	1.2 -31.10			
	Tees	1.2 -31.10			
	Esk (Yorks.)	6.4 -31.10			
	Ouse (Yorks.)	6.4 -31.10			
Anglian	Region	1.3 -28.9			
Thames	Thames	1.4 -30.9		2 salmon bag limit a day	
SW	Avon (Hants.)	1.2 -31.8	Artificial fly only before 15/5		
	Piddle	1.3 -31.8	Artificial fly only before 15/5		
	Frome	1.3 -31.8	Artificial fly only before 15/5		
	Axe	15.3 -31.10	No shrimp, prawn, worm or maggot. Fly only after 31/7 below Axbridge		
	Exe	14.2 -30.9 (trial extension to 14.10)	No worm or maggot	Fly only and mandatory catch and release during trial extension period.	
	Teign	1.2 -30.9	No worm or maggot before 1/6		
	Dart	1.2 -30.9	No worm or maggot. No shrimp/prawn etc. below Staverton Bridge.		
	Avon (Devon)	15.4 -30.11	No worm or maggot		
	Plym	1.4 -15.12	No worm, maggot, shrimp or prawn after 31/8		
	Tavy	1.3 -14.10	No worm, maggot, shrimp or prawn after 31/8		
	Tamar	1.3 -14.10	No worm, maggot, shrimp or prawn after 31/8		
	Lynher	1.3 -14.10	No worm, maggot, shrimp or prawn after 31/8		
	Fowey	1.4 -15.12			
	Camel	1.4 -15.12			
	Taw	1.3 -30.9	No shrimp, prawn, worm or maggot. Fly only 1/4 to 31/5	Numbers for Taw, Torridge in brackets: 2 (2) salmon a day, 3 (2) a week and 10 (7) a season, (2 salmon limit before June 1st) & return of all salmon > 70 cm after Aug 1st.	
	Torridge	1.3 -30.9	No shrimp, prawn, worm or maggot. Fly only 1/4 to 31/5		
	Lyn	1.2 -31.10	No worm or maggot before 1/6		
	Yealm	1.4 -15.12	No worm, maggot, shrimp or prawn after 31/8		

Midlands	Severn	1.2 -7.10	No float fishing with lure or bait		
NW	Ribble	1.2 -31.10		Byelaw, no more than two salmon may be killed between 16.6 and 31.10	21.06.2017 – 20.06.2023
	Wyre	1.2 -31.10			
	Lune	1.2 -31.10		Byelaw (NW-14/02/00) no more than four salmon may be killed during the season.	26.11.2009 – 26.11.2019
	Kent	1.2 -31.10			
	Leven	1.2 -31.10		Byelaw requires the release of all salmon after capture. Derogation allows anglers to take some fish (currently 3 for the Leven catchment for the whole season) provided these are marked with a carcass tag.	10.05.2016 – 09.06.2023
	Crake	1.2 -31.10		Byelaw requires the release of all salmon after capture. Derogation allows anglers to take some fish (currently 3 for the Crake catchment for the whole season) provided these are marked with a carcass tag.	10.05.2016 – 09.06.2023
	Duddon	1.2 -31.10			
	Esk (Cumb.)	1.2 -31.10			
	Irt	1.2 -31.10			
	Calder	1.2 -31.10			
	Ehen	1.2 -31.10			
	Derwent	1.2 -31.10			
	Ellen	1.2 -31.10			
	Eden	15.1 -14.10		Byelaw (NW–13.11.07) 2 salmon bag limit a day between between 16.6 and 14.10 Byelaw (NW-13.11.07) prohibits retention of female salmon 10.9 to 14.10	13.11.2007 – 12.11.2017 13.11.2007 – 12.11.2017
	Esk (Border)	1.2 -31.10		Byelaw (NW–13.11.07) 2 salmon bag limit a day between 16.6 and 31.10 Byelaw (NW-13.11.07) prohibits retention of female salmon 10.9 to 31.10	13.11.2007 – 12.11.2017 13.11.2007 – 12.11.2017
	Others	1.2 -31.10 (a)			

Note: (a) Applies to all other watercourses in the North West not named specifically above.

10.0 Overall summary

10.1 The estimated abundance of salmon at sea that originate from stocks in England and Wales has reduced by around 50% since the early 1970s. There has also been a recent marked decline in the abundance of grilse and an increase in numbers of multi sea winter fish.

10.2 The recent increase in multi sea winter fish numbers is expected to have a disproportionate effect on egg deposition, given the substantially higher fecundity of these larger fish. However, when taken with the decline in grilse numbers and size, this poses risks to the sustainability of salmon stocks in the future. As reductions in the survival of returning multi sea winter salmon would result in proportionally greater reductions in egg deposition.

10.3 The available estimates of marine survival for stocks in the UK and Ireland show a marked decline in marine survival around 1990 and persistent low levels of marine survival since. Similar patterns of reduced levels of marine survival in the last 20-30 years are evident for stocks throughout the north-east Atlantic. The reduction in the survival rate of salmon in the north-east Atlantic means that same number of smolts leaving English rivers now will produce many fewer returning salmon than would have been the case in the 1980s.

10.4 Electronic fish counters or upstream trap data from English and Welsh rivers show variable performance between the stocks on these rivers. Some runs have varied considerably year on year without any discernible trend, and others indicate an increasing trend over recent years. However, for a number of the rivers, there have been declines in salmon numbers in recent years. Counter and trap data from the River Tamar shows a reducing trend in grilse length and weight, and therefore the number of eggs they carry. This, if seen across the whole grilse stock, will have a compounding effect on the lower egg numbers produced due to reducing grilse numbers. Data from the Tamar also shows a reduction in the percentage of two sea winter salmon that run early in the year.

10.5 The latest juvenile salmon assessments (2011-2016) indicate low levels of juvenile abundance across the country. There are concerns around the very low numbers of juveniles, in particular fry, recorded in many river catchments during 2016. The reduction in fry abundance is likely to result in reduced smolt numbers in 2018. There is already evidence of reduced smolt output for the River Frome in 2017, where the majority of smolts migrate after just one year in freshwater.

10.6 The national salmon stock assessment shows that, although some of the worst performing rivers are improving and are predicted to continue to do so, most salmon populations have declined, in some cases severely, and are generally not predicted to improve in the next five years. Only 4 of the principal salmon rivers (projected to be 5 in 2021) currently fall within the ‘Probably Not at Risk’ category and none fall in the ‘Not at Risk’ category, therefore there are no salmon stocks that we are very certain will meet their management objective. The majority of salmon stocks in England fall into the ‘At Risk’ and ‘Probably at Risk’ categories and thus remain in a depleted state.

10.7 The very low numbers of salmon fry recorded from monitoring sites in English rivers in 2016 are not taken into account by the predicted 2021 classification, as it is based on the trends and variability of returning adult numbers for the years up to, and including, the current year (in this case 2016). Therefore, unless there is an improvement in salmon survival during a later life stage, it is likely that this will lead to lower management target compliance than the data is currently predicting in 2021.

10.8 There has been a marked decline in net catches in England and Wales over the last 15 – 20 years. This is likely a consequence of increased regulatory controls, such as reducing net limitation orders and licence buy outs, along with the reduction in salmon stocks.

10.9 In 2016 the catch by nets and fixed engines in England increased by almost 4000 fish over 2015 catch and was 24% above the average of the previous five years. This was principally due to an increase in the catch in the North East Coast Net Fishery, which also saw an increase in the catch rate of the beach nets in 2016. This, combined with the falling catch in other parts of the country, meant that the North East Coast Net Fishery catch comprised 93% of the total net catch in England and Wales in 2016.

10.10 Long-term trends in rod catch show a progressive decline in catch numbers from the peak in the mid-1960s to a low in the early 2000s and although catch numbers improved between 2004 and 2011 they have subsequently fallen, and are currently amongst the lowest recorded. The 2016 catch numbers saw some improvement over those in 2015, but remain 25% below the 5 year average.

10.11 The numbers of grilse caught by anglers (6256 in 2016) has fallen. This, combined with an increase in the multi sea winter fish catch (8968 in 2016), has led to this stock component making up the majority of the rod catch in the last two years.

10.12 Catches of both grilse (fish <8lb) and multi sea winter salmon (fish >8lb) peak in the autumn. Over the five years investigated (2012 – 2016) the largest fish were also caught later on in the season, in August, September and October.

10.13 The percentage of rod caught fish of all sizes released by anglers has increased progressively since such data were first recorded in 1993 to the current high of 80%. This does however mask a large amount of variation between rivers and sizes of fish, and it includes the mandatory release of all salmon caught prior to 16 June that has been required as part of the existing National Salmon Byelaws since 1999.

10.15 The restrictions imposed as a result of the National Salmon Byelaws, since 1999, have reduced the number of early running fish caught and killed in both net and rod fisheries across England. This has led to a direct reduction in the exploitation pressure on early returning (majority multi sea winter) salmon. However, this report also highlighted that:

- both nets and rods are taking fish from stocks at the lowest classification status
- the declining number and size of grilse make multi sea winter fish increasingly valuable to stocks
- there is evidence from the River Tamar of a reducing trend in the percentage of multi sea winter fish running early in the year, reducing the proportion of the stock that is protected by the National Salmon Byelaws
- the majority of multi sea winter fish are caught after 16 June and are not therefore afforded the same level of protection as provided by current National Salmon Byelaws, leaving them reliant on voluntary catch and release rates
- there is not a large difference in the monthly average size of multi sea winter salmon caught by anglers throughout the year
- after 16 June anglers are most likely to release large multi sea winter salmon (> 14 lb) (voluntary catch and release rate of 72%), however the release rates of grilse (< 8 lb) and smaller multi sea winter salmon (8 – 14 lb) are identical (68%)
- a greater number of small multi-winter salmon (8 – 14 lb) are retained by anglers than either grilse (< 8 lb) or large multi sea winter salmon (> 14 lb)
- no rivers meet all the criteria for future relaxation of the National Salmon Byelaws suggested during the 2008 renewal process

11.0 Glossary

This glossary has been extracted from various sources, but chiefly the EU SALMODEL report (Crozier *et al.*, 2003) and Environment Agency reports.

Adult - Salmon after the middle of the first winter spent at sea, after which the main categorisation is by sea-age, measured in sea-winters (e.g. grilse, or 1SW; two sea winter, or 2SW).

Anadromous fish - Fish, born in freshwater, that migrates to sea, to grow and mature, and then returns to freshwater as an adult to spawn (e.g. salmon, sea trout).

Catchment - The area of land drained by a river (e.g. River Tyne catchment).

Conservation Limit (CL) - The minimum spawning stock levels below which stocks should not be allowed to fall. The CL for each river is set at a stock size (defined in terms of eggs deposited) 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.

Exploitation - Removal of fish from a stock by fishing.

Fecundity – the number of eggs produced by a female salmon

Fixed engine (FE) - The term fixed engine is an ancient one used in the UK as a general descriptor of stationary fishing gears.

Fork length - The length of a fish from the tip of its snout to the centre of the fork in its caudal fin (tail).

Fry - Young salmon that have hatched out in the current year, normally in May at the stage from independence of the yolk sac as the primary source of nutrition up to dispersal from spawning areas (redds).

Grilse - An adult salmon that has spent only one winter feeding at sea before returning to freshwater to spawn; normally only applied to salmon in homewaters (see also one sea-winter salmon).

Management target (MT) - A spawning stock level for managers to aim at in order to meet the management objective. The 'management objective' used for each river in England and Wales is that the stock should be meeting or exceeding its CL in at least four years out of five (i.e. >80% of the time), on average.

Mixed stock fishery (MSF) - A fishery that predominantly exploits mixed river stocks of salmon. The policy in England and Wales is to move to close coastal net fisheries that exploit predominantly mixed stocks where the capacity to manage individual stocks is compromised. Fisheries, including MSFs, operating within estuary limits are assumed to exploit predominantly fish that originated from waters upstream of the fishery; these fisheries are carefully managed to protect the weakest of the exploited stocks, guided by the decision structure and taking into account socio-economic factors and European conservation status where applicable.

Multi-Sea-Winter (MSW) salmon - An adult salmon that has spent two or more winters at sea.

Net Limitation (Order NLO) - Mechanism within the Salmon and Freshwater Fisheries Act 1975 whereby the competent authority may apply to limit the number of nets or traps fishing a particular area.

One-Sea-Winter (1SW) salmon - An adult salmon that has spent one winter at sea (see also grilse).

Parr - Juvenile salmon in the stage following fry until its migration as a smolt, Salmon parr are typically <16 cm long and have parr-marks (dark vertical bars) on the sides of the body.

Post-smolt - Young salmon, at the stage from leaving the river (as smolts) until the middle of its first winter in the sea.

Pre-fishery abundance (PFA) - The PFA of salmon from England and Wales is defined as the number of fish alive in the sea on January 1 in their first sea winter. This is split between maturing (potential 1SW) and non-maturing (potential MSW) fish.

Production - The assimilation of nutrients to produce growth in a population over a given period.

Reference point - An estimated value derived from an agreed scientific procedure and/or model which corresponds to a state of the resource and/or of the fishery and can be used to assess stock status or inform management decisions.

Run - The number of adult salmon ascending, or smolts descending, a river in a given year. The main smolt run takes place in spring, whereas adult salmon runs may occur in spring, summer, autumn or winter.

Special Area of Conservation (SAC) - An area designated under the EU Habitats Directive (92/43/EEC) giving added protection to identified species and habitats. Where salmon is a "qualifying species", additional protection measures are required specifically for salmon.

Salmonid - A fish belonging to the family *Salmonidae*, which includes the Atlantic salmon (*Salmo salar*), brown trout / sea trout (*Salmo trutta*), charr (*Salvelinus alpinus*) and rainbow trout (*Oncorhynchus mykiss*).

Sea age - The number of winters that a salmon has remained at sea.

Sea trout - Anadromous form of the trout (*Salmo trutta*) from the post-smolt stage; the brown trout remains in freshwater throughout its life.

Site of Special Scientific Interest (SSSI) - An area of land notified under the Wildlife and Countryside Act 1981 by the appropriate nature conservation body as being of special interest by virtue of its flora and fauna, geological or physiographical features.

Smolt - The stage in the life cycle of a salmon when the parr undergo physiological changes, become silver in appearance and migrate to sea. Salmon smolts are typically 12–16 cm long and migrate to sea in spring.

Smolt age - The number of winters, after hatching, that a juvenile salmon remains in freshwater prior to emigration as a smolt (this does not, therefore, include the winter in which the egg was laid).

Spring salmon - Multi-sea-winter salmon which return to freshwater early in the year, usually before the end of May.

Stock - A management unit comprising one or more salmon populations, which may be used to describe those salmon either originating from or occurring in a particular area. Thus, salmon from separate rivers are referred to as "river stocks". (N.B. Very large management units, such as the salmon exploited at West Greenland, which originate from many rivers, are often referred to as 'stock complexes').

Two sea winter salmon (2SW) - An adult salmon that has spent two winters at sea.

12.0 References

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